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中国生成式人工智能应用与实践展望

中国联通研究院 | 中国联通国际公司 · 2024年9月

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前 言

生成式人工智能（Generative AI）是一种基于学习大规模数据集生成新的原创内容的新型人工智能，其通过大量学习数据或语料库，生成全新的、或与原始内容相似但不限于原始数据的文本、图片、视频、代码等内容。生成式人工智能逐渐成为科技行业的焦点，重塑着各行各业的未来，在全球范围内引领一场深刻的产业革新浪潮，为中国乃至金砖国家的智能化发展提供了前所未有的机遇。

本白皮书聚焦生成式人工智能产业发展前瞻趋势，深度洞察中国在生成式人工领域的应用与实践。在应用方面，白皮书将从居民生活场景和行业应用场景两个维度，精选中国典型实践经验进行介绍。在居民生活场景中，分析日常、办公、娱乐等细分场景需求，探索如何满足个性化需求和提高生活质量的方式；在行业应用场景中，洞察电信、医疗、金融和工业等重点行业应用情况，深入解读相关行业的业务痛点、发展成效、应用经验。希望中国在生成式人工智能行业应用的探索和实践可为金砖国家未来的发展提供参考，中国愿与全球各国共同合作，探索新的发展模式，让数字文明造福各国人民，推动构建人类命运共同体。

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一、生成式人工智能发展迎来爆发期

生成式人工智能的爆发式增长为数字经济的繁荣奠定坚实基础。生成式人工智能以内容生产模式变革催动生产力革新，引领数实融合浪潮下的产业变革，激活数据要素潜能，拓展数实融合空间，促进数字经济与实体经济的深度融合，改善实体经济对于数据资源的应用模式与利用效率，推动实体经济实现数智化转型，保障了数字经济运行的稳定性和可持续性。

（一）生成式人工智能开辟数字经济发展新空间

数字经济的高速发展为人工智能发展创造了良好的经济与技术环境，而人工智能作为关键性的新型信息基础设施，也被视为拉动服务业、工业的新动能。生成式人工智能的价值赋能将主要作用于工业和服务业，农业由于是劳动力密集型行业，以人工程式化作业为主，与生成式人工智能优势相关性暂时较低。[1]

1. 生成式人工智能引领产业数字化创新革命

生成式人工智能在研发设计、生产制造、运营管理等环节发挥重要作用，推动了工业企业智慧化转型。生成式人工智能通过其高度自动化的设计和制造流程，正在重塑工业生产方式，它能够优化生产计划，预测设备故障，提高效率和降低成本。此外，生成式人工智能还通过模拟和虚拟测试减少物理原型的需求，缩短研发时间，辅助工人决策，提供实时数据分析，提升供应链的透明度和响应速度。作为工业 4.0 和智能制造发展的核心驱动力，生成式人工智能为工业创新和转型带来了新的机遇。

生成式人工智能以个性化服务、优化客户体验和提高运营效率的方式，全面提升了服务业的面貌。在客户服务领域，生成式人工智能

[1] 来源：《通用人工智能的曙光——生成式人工智能技术的产业影响》罗兰贝格

通过自然语言处理和机器学习，实现全天候智能客服和个性化聊天机器人，快速响应客户需求，提升客户满意度。在金融、教育、医疗等服务行业中，生成式人工智能借助大数据分析，提供了精准的风险评估、个性化学习计划和健康管理方案等。生成式人工智能正推动服务业数字化转型，创新服务模式，提升服务质量。

2. 生成式人工智能推动数字产业迭代升级

生成式人工智能对算力的巨大需求促进云计算市场快速扩展。随着生成式人工智能应用的增多，对计算资源的需求也在不断攀升，这促使云计算服务提供商不断提升其基础和服务能力，以满足高性能计算的需求。生成式人工智能在云平台上的部署和应用，使企业可以按需获取计算资源，有效降低硬件投资成本，进一步促进了云计算市场的迅猛增长。

生成式人工智能驱动了大数据产业的发展和成熟。生成式人工智能利用高效算法和自动化能力，在数据清洗、数据标注和数据分析等关键环节实现了质的飞跃，极大提升数据处理的效率，降低数据处理的成本。生成式人工智能还通过对大数据的创新应用，开发出新的商业模式和产品，推动大数据产业的发展和进步。

3. 生成式人工智能助力社会数字化治理

生成式人工智能推动数字政府服务发展建设。生成式人工智能技术的广泛应用有效促进自动化政府服务平台建设，提高人机交互效率及体验，为智慧城市与智慧乡村的建设提供了强大支持。此外，生成式人工智能还助力完善了数字信息基础设施，让科技进步真正惠及广大群众，提高了社会发展水平和社会治理能力，让人们的生活更加便捷、高效和美好。

生成式人工智能助力完善多方协同治理体系。生成式人工智能技术要求在数据训练、设计、生成等各个环节中都必须遵守合规性、保障数据安全和用户隐私，从而有效促使行业协会和社会各界积极参与人工智能技术管理规范的制定，实现多方协同治理。这不仅为人工智能技术的健康发展提供了监管框架，也使其成为支撑数字经济健康、稳定发展的坚实保障。

4. 生成式人工智能充分激活数据要素潜能

生成式人工智能提升数据要素价值和利用率。生成式人工智能时代强调数据合规性和私有数据价值，促使企业更加重视数据资产管理，通过训练数据自动化生成新内容，将现有数据资源高效转化为有价值的信息，为用户和企业创造全新的价值增长点。生成式人工智能还加速推动数据治理体系的完善，企业通过建立完善的数据治理体系和严格的管控策略，确保数据在其整个生命周期中满足数据安全和合规性的要求，最大限度地发挥数据价值，为企业的持续发展提供有力支撑。

（二）全球生成式人工智能市场前景广阔

据彭博行业研究相关报告，2022 年全球生成式人工智能市场整体收入为 400 亿美元，预计到 2032 年将超过 1.3 万亿美元，2022 到 2032 年十年间的复合增长率高达 42%。生成式人工智能重塑了传统的内容生产和获取方式，简化了知识获取和创作的难度，激发了数字经济的活力与创造力，正在以创新的模式全面融入各行业各领域。

图 1：2020-2032 全球生成式人工智能应用规模
（来源：彭博行业研究）

1. 从决策式人工智能到生成式人工智能，人工智能领域实现跨越式发展

人工智能的发展可以划分为两大主要阶段，以 2012 年为显著的分界点。在 2012 年之前，是决策式人工智能的时代，这一阶段的人工智能技术侧重于分析数据中的条件概率分布，从而进行决策、分析和预测。自 2012 年起，生成式人工智能迅速崭露头角，成为人工智能领域的重要分支，基于大模型、大算力、训练方法等多方面技术突破，生成式人工智能实现了高质量、高效率、多样化的内容生产，其生成的内容形式丰富多样，包括文本、图片、音频和视频等多种格式。

图 2：人工智能技术应用发展阶段
（来源：联通研究院）

具体来看，全球范围内人工智能的发展历程主要经历了四个阶段，**第一阶段是早期萌芽阶段（1950 年代至 1980 年代）**，该阶段主要为人工智能概念的诞生和方法论构建。1950 年，艾伦·麦席森·图灵提出了著名的“图灵测试”，引发了机器产生智能的探讨。1956 年的第一次人工智能研讨会正式宣告人工智能领域的诞生。**第二阶段是技术积淀阶段（1980 年代至 2010 年）**，人工智能研究和应用逐渐深入，神经网络和深度学习技术的发展为后来的人工智能爆发奠定了基础。1986 年杰弗里·辛顿等人提出的反向传播训练算法成为神经网络研究的里程碑。2006 年深度学习技术的兴起引领了人工智能技术的新浪潮。**第三阶段是快速发展阶段（2011 年至 2016 年）**，人工智能技术的实际应用和影响力开始迅速扩大。2014 年对抗式神经网络（GAN）技术的提出以及 2015 年谷歌的 AlphaGo 机器人战胜围棋世界冠军，不仅展示了人工智能在特定领域超越人类的能力，也推动了人工智能技术的广泛关注和研究。**第四阶段是爆发阶段（2017 年至今）**，2017 年 Transformer 架构的提出标志着人工智能进入了大模型时代。2022 年被认为是“生成式人工智能元年”，随着 ChatGPT、Dall-E 2、Midjourney、Stable Diffusion 等生成式 AI 应用的兴起，人工智能在文本、图像生成方面展现出巨大潜力，开启了多模态融合的新篇章。

2. 有为政府和有效市场的有机统一，推动美国在生成式 AI 领域全球领先

美国生成式人工智能发展战略布局呈现出稳定型、渐进性特征，行政治理为先，软法约束为主。在生成式人工智能的发展与治理两方面，美国政府始终坚持发展战略的稳定性和治理策略的渐进性，旨在实现生成式人工智能领域的长远发展和有效管理。2023 年 10 月美国

政府推出首部关于生成式人工智能的监管规定，标志着美国在生成式人工智能领域从过去以观望和探索为主，向积极的引导和规范方向转变，为生成式人工智能的创新应用提供了清晰的发展方向和规范标准，促进技术的健康成长，同时确保伦理和安全标准得到妥善维护。

美国高度重视人工智能技术发展，始终走在生成式人工智能产业浪潮前列，鼓励私营部门积极参与，持续推动技术创新和应用实践。美国在生成式人工智能浪潮中独占鳌头，得益于其强大的产业基础、卓越的创新能力、雄厚的资本支持。美国拥有众多全球领先的人工智能技术供应商和模型开发商，如英伟达等基础层技术供应商通过不断的技术创新，为生成式人工智能技术的发展提供了强大的硬件支持，Open AI 等模型开发商通过开发先进的生成式人工智能模型，推动了 AI 技术在各个领域的广泛应用。此外，美国生成式 AI 企业获得了资本市场的大力支持，数据显示，在全球生成式人工智能的投资流向中，美国初创公司独揽 89% 的资金份额，这一资本优势为美国在该领域的快速发展提供了强劲动力。

美国政府致力于推动数据开放，以增强生成式人工智能大模型的技术和应用。鉴于生成式人工智能对高质量模型数据的极高要求，2024 年 1 月美国政府启动了一项为期六年的国家人工智能研究资源（NAIRR）计划，旨在为美国研究人员和教育工作者提供更丰富的算力和数据资源，从而巩固其在全球生成式人工智能领域的领先地位。联邦政府通过建立数据资源服务平台，整合了来自政府与社会各界的开源数据资源，建立统一的数据汇聚标准，规范数据描述格式，促进不同来源和类型数据的有效融合，为生成式 AI 大模型的优化和迭代提供支持。

3. 其他多国加速生成式人工智能战略布局，发展路径与业务布局各有侧重

欧盟注重生成式人工智能的合规应用，着重强调数据安全和用户隐私保护。欧盟机构在遵循所适用法律的前提下，原则上被允许开发、部署和利用生成式人工智能系统以提供公共服务，但同时必须要注重保护用户的数据安全。2024年6月3日，欧洲数据保护监督机构（EDPS）发布了《生成式人工智能与 EUDPR》[2] 指南，这是首份适用于欧盟机构的人工智能与数据安全指南，为欧盟机构负责任地使用生成式人工智能系统提供了重要参考，指南重点强调数据最小化、数据准确性和数据安全性等原则，并突出了透明度、问责性以及在整个人工智能系统生命周期内维护个人权利的重要性。

英国充分挖掘生成式人工智能潜力，推动生成式人工智能在教育领域的创新发展。2024 年 2 月，英国教育部发布《教育中的生成式人工智能》报告，积极倡导在创建教学资源、辅助学生学习等教育实践中广泛应用生成式 AI 技术，旨在提高教学效率和教育质量。报告同时指出，在引入生成式 AI 技术时需要审慎考虑其可能带来的风险和挑战，包括学术不端行为的风险、数据安全和隐私问题、技术依赖增加以及对教育公平性的潜在影响等，强调必须通过制定相关政策、加强教育部门的监管以及合理应用技术等措施，确保生成式人工智能技术在教育领域的健康发展。

印度积极与全球科技巨头开展合作，对生成式人工智能发展寄予厚望。2023 年 8 月，谷歌在印度推出生成式人工智能搜索服务 SGE，这项服务不仅提供传统的搜索结果链接，还通过智能整合向用户展示更为全面和直观的答案。同年 9 月，印度 IT 服务公司印孚瑟斯宣布与

[2] 注：EUDPR 指的是《欧盟 2018/1725 号条例》

微软合作开展生成式人工智能项目，结合双方各自的人工智能技术优势，共同开发行业领先的解决方案。2024 年 4 月，印孚瑟斯进一步扩大了与美国芯片巨头英特尔的战略合作，采用基于英特尔技术的解决方案，助力客户将生成式人工智能技术融入其业务流程，推动业务优化和创新发展。

（三）中国在生成式人工智能领域加速突破

目前，中国的生成式人工智能市场规模正在不断扩大，根据艾瑞咨询预测，2023 年中国生成式人工智能产业规模约为 143 亿元，预计到 2028 年中国生成式人工智能产业规模将达到 7202 亿元，中国生成式人工智能产业生态日益稳固，完成重点领域、关键场景的技术价值兑现，逐步建立完善模型即服务产业生态，2030 年中国生成式人工智能产业规模有望突破万亿元大关。

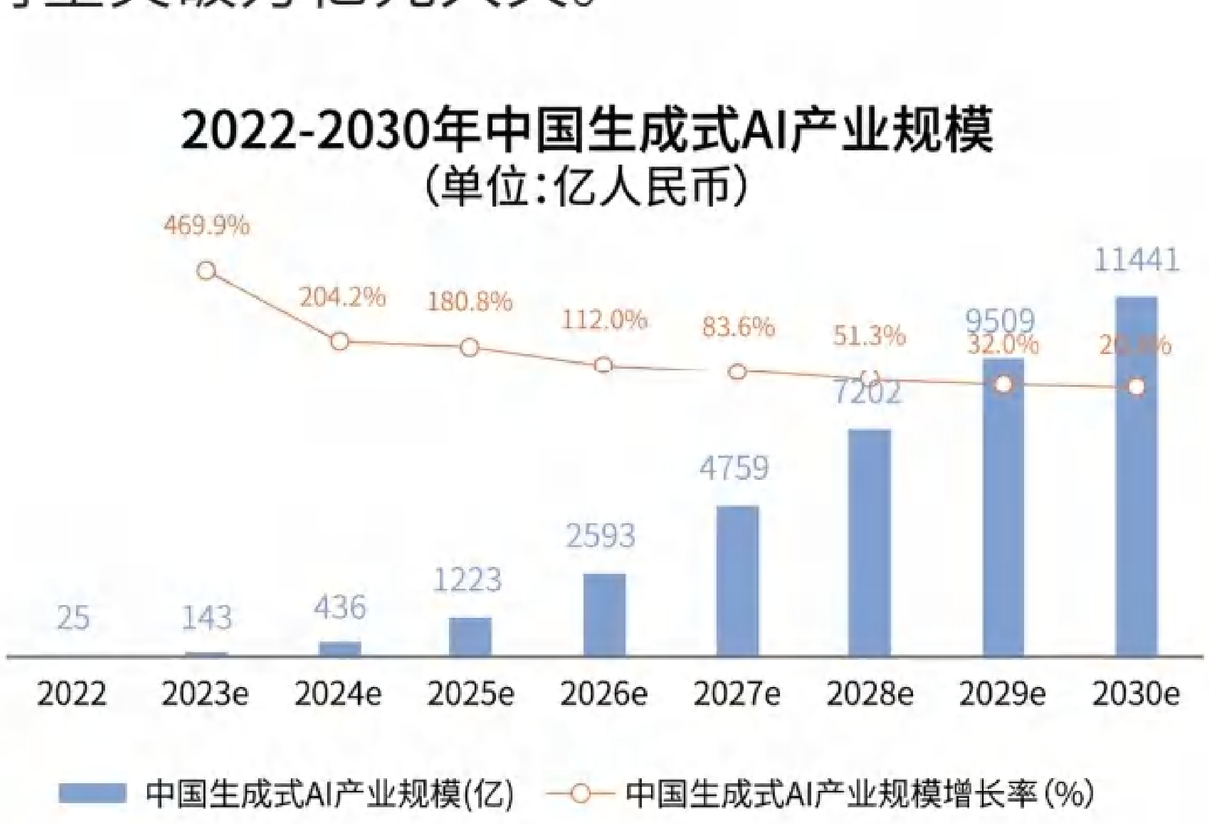


图 3：2020-2030 年中国生成式人工智能产业规模

（来源：艾瑞咨询）

1. 中国生成式人工智能起步较晚，但发展势头强劲

相较于国际人工智能的发展历程，中国人工智能产业起步较晚，最早可以追溯到 1978 年。随着互联网的快速发展和技术的迭代更新，中国人工智能产业在过去近四十年间经历了从初步探索到加速成长，

再到快速发展的多个阶段。自 2022 年以来，随着一系列国产大模型的推出，中国正式迈入生成式人工智能的黄金发展期，展现出前所未有的活力和潜力。

图 4：中国生成式人工智能发展历程

（来源：中国联通研究院）

中国生成式人工智能产业发展可以总结为五个阶段。**第一阶段是萌芽与起步期（1978-2000 年）**，以 1987 年出版的《人工智能及其应用》为标志，人工智能开始在国内进行理论探索和初步实验，但尚未得到广泛推广和应用。**第二阶段是初步探索期（2001-2012 年）**，进入 21 世纪后，人工智能研究获得国家自然科学基金、工信部重大项目基金等各种国家基金计划的大力支持，出现了视觉与听觉的认知计算、中文智能搜索引擎关键技术、虹膜识别、语音识别、基于仿生机器人的人机交互与合作等研究成果。**第三阶段是加速成长期（2013-2015 年）**，得益于大数据、云计算等新兴技术的推动，人工智能在自然语言处理、机器视觉、智能交互等领域取得突破性进展，行业迎来发展机遇。企业开始积极探索人工智能技术在各个领域的应用，推动了行业的快速发展，如百度推出了将深度学习技术应用到病毒查杀客户端的慧眼杀毒引擎，并组建了全球最大的深度机器学习开源平台，

中国科学院与阿里巴巴成立了量子计算实验室，进一步推动了人工智能技术的发展。**第四阶段是快速发展期（2016 年 -2021 年）**，随着国家政策的持续出台，中国人工智能行业进入了政策驱动期。2016 年国务院发布《“十三五”国家科技创新规划》中明确将人工智能列为国家战略层面的重大科技项目。2020 年，“十四五规划”将人工智能定位为“新基建”建设的重要一环，被视为新一轮产业变革的核心驱动力，人工智能迎来新的发展春天。**第五阶段是爆发增长期（2022 年至今）**，生成式人工智能快速崛起，逐渐成为人工智能领域的“顶流”，国内企业纷纷投身于这一创新领域，催生了众多国产生成式 AI 大模型的诞生，截至 2024 年 3 月，共有 117 个大模型成功完成“双备案”[3]。企业致力于将生成式人工智能大模型技术与实际应用场景深度融合，更加聚焦于商业模式的创新和变现，以实现技术的实际价值和商业潜力。

2. 中国积极推动技术革新与应用拓展

伴随着技术革新与产业深度融合，中国生成式人工智能行业正迅速扩张，市场规模已位居全球前列。得益于政府的政策支持、资本市场的积极参与以及应用场景的不断丰富，中国生成式人工智能产业呈现出迅猛的发展势头。

中国生成式人工智能政策环境持续优化，为生成式人工智能发展提供有力支持。2022 年 11 月，国家网信办等三部门联合发布了《互联网信息服务深度合成管理规定》，这是中国首个合成内容管理政策，旨在依法、合理、有效地使用深度合成技术，并积极防范和化解相关风险。2023 年 7 月，国家网信办等七部门共同发布《生成式人工智能服务管理暂行办法》，这是我国首个生成式人工智能监管文件，标志着“发展”正逐渐成为中国生成式人工智能治理的第一视角，确立了

[3] 双备案：“境内深度合成服务算法备案”和“生成式人工智能服务备案”

包容审慎、分级分类的监管基调，提出安全评估、备案以及对生成内容进行标识等要求，有助于推动生成式人工智能技术的规范化应用，并促进整个产业的高质量发展。

中国生成式人工智能投资规模加速增长，推动生成式人工智能企业快速发展。中国生成式人工智能领域正迎来投资的快速增长期，从风险投资到产业资本，各类投资者纷纷布局。据 IDC 报告，2022 年中国生成式人工智能投资额占整个人工智能市场投资总额的 4.6%，预计到 2027 年这一投资比例将达到 33.0%，投资规模有望超过 130 亿美元，五年复合增长率达到为 86.2%。中国庞大的市场规模和丰富的应用场景为生成式 AI 企业提供了广阔的发展空间，吸引了更多的资本关注和投入，形成了一个良性互动的投资与创新生态。

中国生成式人工智能应用场景不断丰富，集中于商业化发展成熟的优势产业。国内企业利用本土市场垂直场景的优势，将生成式人工智能技术优先应用于商业化基础设施较完善的新兴行业中，特别是在电商、传媒、娱乐和游戏等领域，例如，电商行业通过数字虚拟人和视频营销提升品牌营销效果，游戏行业则利用生成式人工智能技术开发 AI 陪玩和竞技机器人，并通过自然语言处理技术丰富游戏角色的互动性，增强玩家体验。

二、生成式人工智能产业发展前瞻

生成式人工智能产业大致可分为三个层次，基础设施层、模型层和应用层。基础设施层是生成式人工智能产业发展的关键资源引擎，大算力需求将推动数字基础设施建设。模型层是产业技术变革的原生驱动力，大模型的落地将赋能千行百业，推动传统产业数字化转型，带来新一轮人工智能产业化扩散，MaaS 模式将会持续作为大模型落地的关键业务模式，重构产业链价值流通和技术传递路径。应用层是生成式人工智能产业技术价值传递的实际落位，将通过对内容生产方式和人机交互方式的改变，深刻影响消费与生产生活。

生成式人工智能未来发展分为三波次，**第一波次是探索与初步应用**，未来两到三年，行业发展重点在于算力基础设施和数据基础设施建设，应用场景仍在探索中，C 端应用主要聚焦以聊天助手为代表的通用应用，B 端应用主要应用于金融、法律、教育等行业的知识辅助、客服营销等场景，以语言文字为载体。**第二波次是技术成熟与行业深化，**未来三到五年，C 端应用更加丰富，B 端应用向先进制造业、医疗行业核心场景环节渗透，重点是视觉技术以及动态数据分析管理的应用。**第三波次是普及与创新爆发，**未来五到十年，生成式人工智能与物理世界更紧密地结合，使其能够通过感知和行动来学习和交互，开拓全新的应用领域；同时，在产业侧，成为企业应用的标准必备工具。

图 5：生成式人工智能产业图谱

（来源：中国联通研究院）

（一）基础设施层：智算设施将是产业发展的基石

基础设施层主要包含算力基础层和数据基础两大层面。基础设施层是生成式人工智能产业的底层架构，提供计算资源和数据资源，支撑上层的模型开发和应用。算力层指的是用于训练和运行生成式 AI 模型的硬件和软件资源，包括 GPU、TPU、高性能计算集群、云计算平台等。数据层涉及数据的收集、存储、管理和处理。数据是训练生成式 AI 模型的关键原材料，数据层包括数据仓库、数据湖、数据标注和预处理工具等。

在算力基础层面，中国在高性能计算和云计算领域取得了显著进展。阿里云、腾讯云和华为云等国内领先的云服务提供商正在大力投

资建设大型数据中心，提供强大的算力资源。中国的超级计算机在全球排名中也名列前茅。**在数据基础层面，**得益于在大力推进数字中国建设中的成效，在产业数据方面，目前中国拥有较为丰富的高质量产业数据资源，尤其是在交通运输、能源、智能制造等领域；在公共数据资源方面，政府和企业也在积极推动数据共享和数据治理，颁布了《“数据要素 X”三年行动计划（2024-2026 年）》，明确支持人工智能大模型发展。

在基础设施层面，数据训练和推理需求对数据中心能力提出更高要求，同时，巨量算力训练推理需求将促进新型数字基础设施建设。行业发展趋势如下：

趋势一：数据训练和推理需求对数据中心能力提出更高要求，算力供需结构承压

自 2017 年谷歌提出 Transformer 架构后人工智能发展逐步迈入预训练大模型时代。2018 年 Open AI 的 GPT 模型参数量已经达到 117 亿模型参数量开始实现亿级基底的飞跃发展，平均每三四个月即呈现翻倍态势作为数智化时代的资源引擎，随着生成式人工智能时代大模型参数的量级提升，算力供需结构承压持续加大。另外，随着数据量与计算量的飞涨，数据中心的网络带宽也亟待优化，来实现数据在节点内与节点间的高吞吐低延迟的传输与连接。面对算力层的供需结构矛盾，各国需要加快发展算力层基础设施建设，目前部分国家也在积极行动，在 2023 年全球计算力指数排名中，美国排名第一，

算力指数 82，拥有最多的数据中心，算力总规模达 270EFLOPS，其中智能算力规模约 180EFLOPS，基础设施支持全球领先；中国排名第二，算力指数 71，算力总规模达 230EFLOPS，其中智能算力达 70EFLOPS，目前中国各地正加快智算建设，持续优化算力资源，满足未来高速发展的大算力需求。

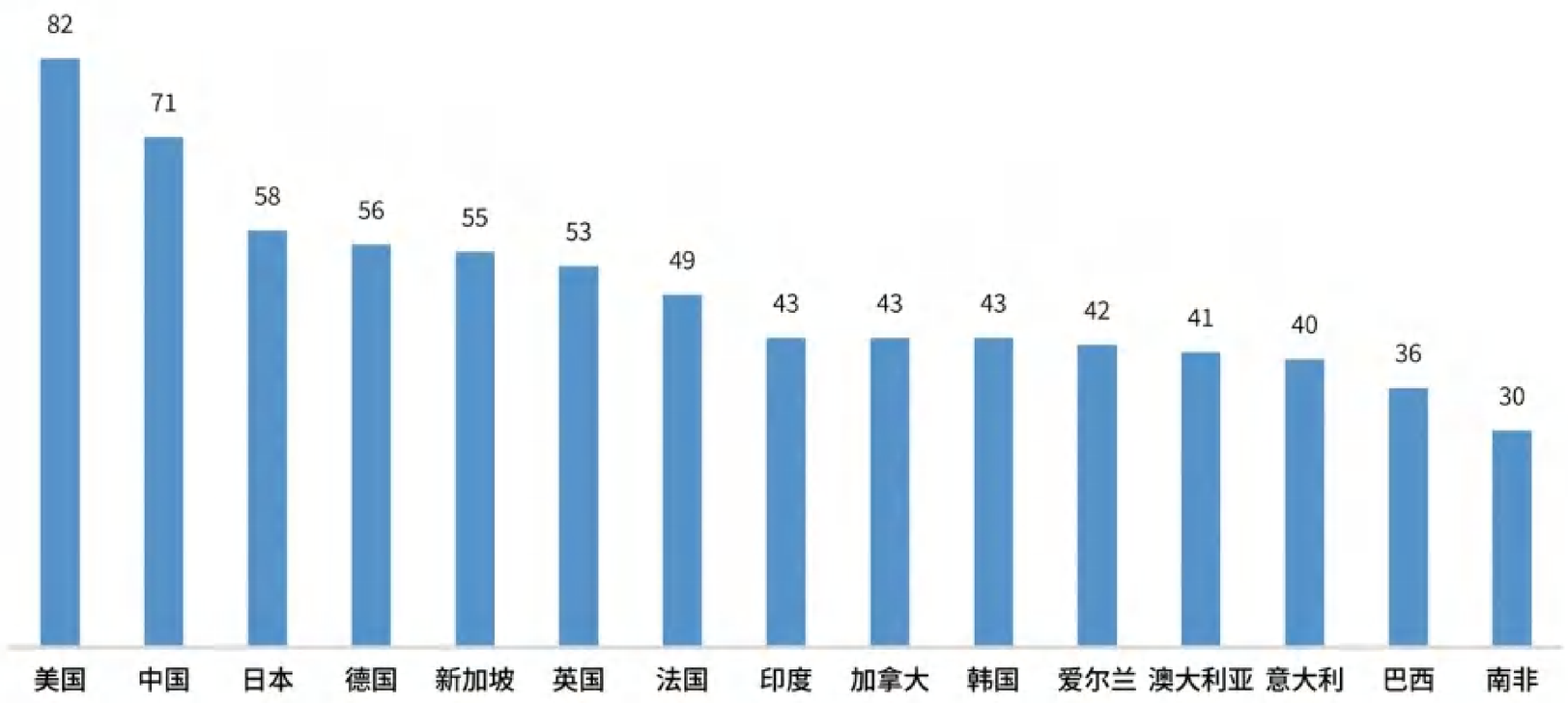


图 6：各国计算力指数及排名

（来源：IDC）

趋势二：数据在生成式人工智能的发展中扮演日益重要的作用

生成式人工智能能力的提升主要依赖于高质量的数据集，未来将更加注重数据的准确性和数据来源的多样化。在多模态数据方面，未来越来越多的应用需要结合文本、图像、音频和视频等多种类型的数据。这要求数据收集和生成涵盖更广泛的内容形式，以支持多模态模型的训练和应用。在实时数据方面，物联网设备和传感器的发展使得未被大规模开发利用的实时数据收集成为可能，IoT 设备可以提供实时的传感器数据，如温度、湿度、运动等。这些数据可以用于实时监测和

预测系统中，支持生成式人工智能在智能家居、智能城市等领域的应用。同时提供了更加丰富和动态的数据源，能够实现实时更新和反馈。在合成数据方面，生成式人工智能技术可以用于生成高质量的合成数据，未来可以用于模型训练、测试和验证，减少对真实数据的依赖。

（二）模型层：大模型商业模式将逐渐贴近一线用户

在生成式人工智能中，“模型层”是构成生成式人工智能系统的核心部分，负责处理和生成数据。大语言模型的核心任务是根据提示词和已有文本，不断预测下一个“合理”的字符。大模型底层是深度学习网络，可以像海绵一样吸收知识，并对知识进行无损压缩。

模型层分为通用大模型和行业大模型两大类，其中通用大模型主要包括闭源模型和开源模型；行业大模型主要包括金融、医疗、法律等领域专业模型。算力规模决定模型的升级迭代效率，大模型训练时长与总算力呈反比，因此具有更高资本优势和算力资源的公司，越有机会领先发布模型更新。目前美国是大模型领域的领跑者，中国起步略慢于美国，目前持续追赶海外进程。

在模型层，大模型发展行业将继续朝着多模态方向进化，MaaS重构了生成式人工智能产业的商业生态，激发新的产业链分工和模式不断涌现，模型层将更贴近应用层。模型层具体发展主要趋势如下：

趋势三：MaaS 重构人工智能产业链价值流通和技术传递路径

MaaS[4] 模式降低了应用开发门槛，重构生成式人工智能产业的商业化结构生态，激发新的产业链分工和商业模式不断涌现。未来，

[4][MaaS（Model as a Service）：是指云计算、智能算力、模型能力等资源做高度融合，客户可以直接在云端调用、开发与部署模型]

MaaS 将成为大模型的主流商业模式。目前，MaaS 模式已成为云厂商的第一战略优先级，将模型作为重要的生产元素。依托于既有 IaaS 设施与 PaaS 平台架构，为下游客户提供以大模型为核心的数据处理、特征工程、模型训练、模型调优、推理部署等服务。未来，顺应大模型开源趋势，MaaS 服务上将着力打造大模型商店平台，发力大模型生态建设，纳入更多允许商用的开源模型，提升平台的基模类型及能力，并丰富工具链产品服务，通过数据回流、模型迭代逐步形成壁垒，形成厂商核心竞争力。

另外，MaaS 模式在 B/G 端和 C 端的商业化落地有所区别。B/G 端需要针对行业领域和业务场景进行大量工程工作，尤其是传统行业的知识获取和积累需要较长时间；即使是同一个行业下，细分场景的痛点不同，AI 大模型渗透率也有明显差异。应用场景碎片化的特点导致低成本、泛化能力较强的能力平台构建需较长周期。C 端用户量巨大，工具使用门槛较低，应用落地以及未来成长速度更快，“应用商店”等创新商业模式不断涌现；通过“对话 + 插件”形式将大模型单点工具接入厂商自有或第三方应用，将打造新的用户交互界面和入口。

趋势四：AI Agent 将为千行百业注入新生产力

AI Agent 是可感知环境及需求、进行决策和执行动作的智能体。相较于大模型底座，靠近应用层的 AI Agent 更具自主性，是提示工程的进化体，可拆解客户指令并自主执行任务。AI Agent 相对语言大模型最大的改进是增加自主行动能力，在实现目标过程中无需人类干预。

目前趋势是 Al 正从简单的工具，进化为复杂的助手乃至 Agent。这一转变的拐点在于 AI 技术在深度学习和自主决策能力的突破，然后将行业垂类数据与业务理解集成到 Agent 框架中，保证大模型应用能够准确理解复杂的任务需求、自主选择最合适的解决方案，并有效控制任务进度，届时就能在各行各业实现智能化转型，推动生产力的指数级增长。未来，AI Agent 可能集成到组织机构的各个层面，与人类员工形成一个互联互通的生态系统，这种深度整合不仅优化了组织结构和提升了运营效率，也将为企业创造前所未有的价值。

（三）应用层：内容、场景、生态将是应用发展关键

应用层是生成式人工智能技术的具体落地和商业化场景，其包含软件和硬件两大应用场景。生成式人工智能技术在软件层面应用主要分为生产力和泛娱乐两个场景，在硬件层面，终端将逐渐从手机和电脑拓展至可穿戴设备，从自动驾驶的汽车延展至机器人。应用层具体发展主要趋势如下：

趋势五：内容和生态是未来生成式人工智能应用的基石

“内容”和“生态”将会决定生成式人工智能应用的发展，“场景化体验”是用户价值的最终体现。内容赋能模型、场景驱动落地，两者相辅相成。生成式人工智能的能力主要源自于学习和训练数据，因此拥有高质量、多样化的内容资源将是应用发展的关键基础，应用背后高质量的内容生态将是决定能力的核心要素。强大的内容生态不仅为模型训练提供动力，也为定制化应用奠定知识基础，拥有领先内容优势的企业，将在应用拓展上占据先机。在内容基础之上，如何为用

户提供无缝智能体验，是生成式人工智能真正落地的关键。生成式人工智能需要完全嵌入应用场景，高度智能化、自然化地服务用户，最终达到“无感”的体验效果。企业需要“内容生态”、“场景化体验”这两个维度同步布局，才能在激烈竞争中引领生成式人工智能的应用革新。

趋势六：端侧部署应用带来广阔应用场景，推动终端智能化

端侧人工智能的应用将大模型降低参数到百亿级规模，极大降低了边际推理成本，相比公有云，本地部署具备低成本、低时延、高隐私、无地域网络限制等优势。人工智能推理将在手机、便携电脑、汽车等终端上运行。端侧人工智能具有一些独特优势，如本地数据处理效率更高，节省云端服务器带宽和算力成本，对用户数据更好的隐私保护。其中，端侧人工智能应用将为用户带来流畅、便捷和贴心的全新使用体验，成为促进用户消费升级的主要动力。作为新技术应用的风向标，汽车和手机将优先落地端侧大模型技术。在移动设备上，手机端的 AI 助手则提供跨应用的系统级服务，允许用户通过语音输入或其他交互方式与助手沟通。在汽车端侧，用户可以在车载系统中与人工智能助手进行直接对话，享受包括衣食住行在内的全方位服务。

三、中国生成式人工智能的典型实践与应用

随着近年来生成式人工智能的高速发展，人工智能基础设施逐步完善，深度学习技术不断进步，生成式人工智能的应用场景也逐渐增多。在人工智能时代，数据成为推动其发展的关键基石，而大模型则有效地承载了这些数据。凭借大模型的通用性和可定制性，生成式人工智能得以建立稳固的基础，进而推动其能够在更广泛的领域中进行创新和突破。

生成式人工智能的渗透路径可遵循数字产业的基本发展逻辑，分为 C 端与 B 端 /G 端两大领域。一方面，生成式人工智能在 C 端的应用已逐步走向成熟。各类面向公众用户的 C 端产品通过灵活调用通用大模型 API 形成各种 AI 创作工具，以内容和工具形式触达用户，提供了诸如文本生成、图片生成、音视频生成和代码生成等多种功能，极大地丰富了用户的日常生活和工作体验。另一方面，以 C 端带动 B 端 /G 端的发展模式将成为生成式人工智能的重要演进趋势。得益于生成式人工智能真实性、多样性、可控性及组合性等显著特性，结合大模型能力，生成式人工智能有望逐步替代或补充传统算法小模型和软件功能，实现对各行业的深度渗透。这将助力企业提升生产与办公效率，提供定制化解决方案，如精准营销、客户服务优化等。同时，在高数字化和高内容需求的行业，如医疗、金融和教育等领域，生成式人工智能将持续推动创新发展，引领行业变革。

大模型技术的崛起带动了生成式人工智能的蓬勃发展。在供给侧，

大模型的基础能力将进一步牵引上层应用的开发、开发者工具生态的形成和底层硬件的技术路线；在需求侧，大模型极大提高了聊天对话、文本翻译、搜索引擎以及内容生成方面的用户体验，促进下一代生成式人工智能原生应用在多元场景中爆发。本章节将深入探讨中国生成式人工智能的应用实践，从产品矩阵、服务模式、关键场景应用等多个维度进行全面分析，分享中国生成式人工智能的成功应用经验，为金砖国家提供清晰且深入的了解视角，共同迎接生成式人工智能新时代的到来。

（一）生成式人工智能深入生活场景，重塑智能生活新篇章

生成式人工智能正在深度渗透至人们生活和生产环节中，在需求侧，C 端用户对于生成式人工智能的需求呈现出多元化和个性化的特点。无论是智能交互的便捷性、文档制作的效率性，还是代码生成的准确性、决策辅助的智能性，用户都在寻求更加贴合自身场景的应用解决方案。而在供给侧，大模型厂商们正不断深耕细作，基于文本和图像、音频等核心功能，拓展出更加丰富的应用能力。对于大模型厂商和行业参与者而言，如何更好地洞察用户需求、降低大模型使用门槛、把握新兴技术趋势、推动生态共建共享将是未来发展的关键所在。

在日常场景中，以智谱清言、文心一言、Kimi 等为代表的大模型应用，依托自身过往技术积累与高校科研资源，以文本生成与图像生成为核心，展开了一系列开放服务，通过智能体搭建等技术，降低了用户使用门槛，进一步挖掘了生成式人工智能的潜在应用场景，实现

了与大模型外部工具、服务的无缝对接，从而加速了整个应用生态的良性循环与发展。

在办公场景中，生成式人工智能已经涵盖了智能交互、文档制作、代码生成等多个细分市场，为用户提供了全方位的支持。商汤科技的日日新代码小浣熊具备出色的代码生成与修改能力，为用户带来的编码能效提升达到 20%~78%；而金山 WPS AI 等则在多个维度实现了办公效率与质量的飞跃，使用户仅需几十秒就能完成过去要花费几小时的机械性任务，降低了办公领域生成式人工智能的使用门槛。

在娱乐场景中，从图片设计到视频生成，再到虚拟人和 3D 模型生成等前沿技术，每一次技术的突破都为用户带来了全新的视觉体验。以 Pixverse 为代表的视频生成应用凭借其优秀的视频生成能力，可生成高质量、连续性强且风格一致的视频内容，降低了创作门槛，使更多用户能够参与到视频创作中来；而筑梦岛聚焦虚拟人的创新与发展，依托阅文版权小说为主的语料库，使用户可以和自己喜欢的虚拟人物角色深度沟通，满足了用户情感陪伴需求。

1.Gen AI+ 日常：融入生活细节，提升智能体验

生成式人工智能搜索问答功能已在日常生活中发挥重要作用。该功能通过深入学习和分析海量数据，结合全网搜索能力，实现对各类问题的理解与响应，覆盖常识、学术、技术等多元领域。它能够根据用户的查询进行推理和逻辑分析，相较于传统搜索引擎，提供了更为精确且高效的解答。生成式人工智能搜索问答功能的应用范围广泛，

不仅助力学生解决学业疑惑，还为医生提供医疗咨询，协助投资者分析市场动态，以及协助用户应对日常生活中的问题等。此外，该功能具备显著的可扩展性与智能化特性，能够基于用户反馈和数据持续学习、优化，从而缩减用户的搜索时长，提升搜索质量与效率。

生成式人工智能在文学创作领域得到普遍应用。依托自动化、智能化和自适应的文本生成技术，该功能显著提升内容创作的效率与质量。**在激发创作灵感方面，**生成式人工智能写作工具能够自动生成吸引人的文章标题和摘要，提供贴合语境的写作建议，以及基于关键词或主题的内容创意生成，助力创作者突破思维局限，迅速捕捉创作灵感。**在确保文章质量方面，**生成式人工智能纠错工具通过细致的语法检查、拼写检查、标点符号检查以及风格和用词建议，帮助创作者避免常见错误，提升文章的专业性和可读性。**在拓宽创作领域方面，**生成式人工智能协同创作工具实现跨领域知识融合，人机协作，推动创作走向更深层次的创新与探索。此外，生成式人工智能写作功能的应用场景极为丰富，覆盖创意文案、小说创作、旅游指南、科研文献等多个领域，不仅减轻了人力负担，还降低了创作成本，为创作者带来了前所未有的便捷性与可能性。

长文本阅读与处理能力已成为生成式人工智能市场的差异化竞争优势。用户对于文本方面的需求已从短文本获取扩展至超长文本生成、超长文本理解与分析和具备超长记忆的个性化对话等方面，这些需求与实际生活和工作中所面临的问题密切相关。优秀的长文本处理能力

使生成式人工智能系统能够深入理解书籍、研究报告、法律文件和商务材料等复杂信息，为知识密集型工作者提供显著的实用价值。在知识摘要、长篇内容提取、文档分析和语义理解等领域，该功能有效解决用户的迫切需求。鉴于此，中国的生成式人工智能厂商敏锐地捕捉到了这一关键需求，竞相致力于提升大模型在长文本处理方面的能力，以此作为市场竞争的新优势。

典型案例一 —— 智谱清言

智谱清言是基于参数规模超千亿的 GLM-4 打造的智能助手，可在日常生活中为用户解答各类问题。除了在多模态交互上有着杰出表现外，智谱清言还推出了智能体定制功能，用户只需用简单提示词指令即能创建属于自己的 GLM 智能体，进而实现大模型开发的大众化。截至 2024 年 4 月，智谱清言上已有超过千万用户，以及 30 万个活跃智能体。通用问答方面，智谱清言可以实时、准确地回答用户涉及各领域的疑问，为决策提供信息支持。在创意写作辅助方面，智谱清言可激发用户创作灵感，构建文章框架，生成高质量文案，提升写作效率与质量。图像生成与解读方面，智谱清言不仅支持文本生成图片，用户还可以通过输入图像及文本信息，得到视觉描述、图像标注、视觉问答以及视觉定位等多项功能服务。联网增强方面，智谱清言可自动检索网络资源，提供参考链接。文档处理方面，智谱清言可对 PDF 文件进行深度解析，提供检索、总结、改写、翻译等服务，并可对文档结构进行梳理，生成摘要、大纲、关键词分析等，便于用户快速理

解和利用。此外，在视频生成方面，最新发布了清影功能，用户只需输入一段指令或图片，智谱清言即可理解并且生成对应的高品质视频画面。

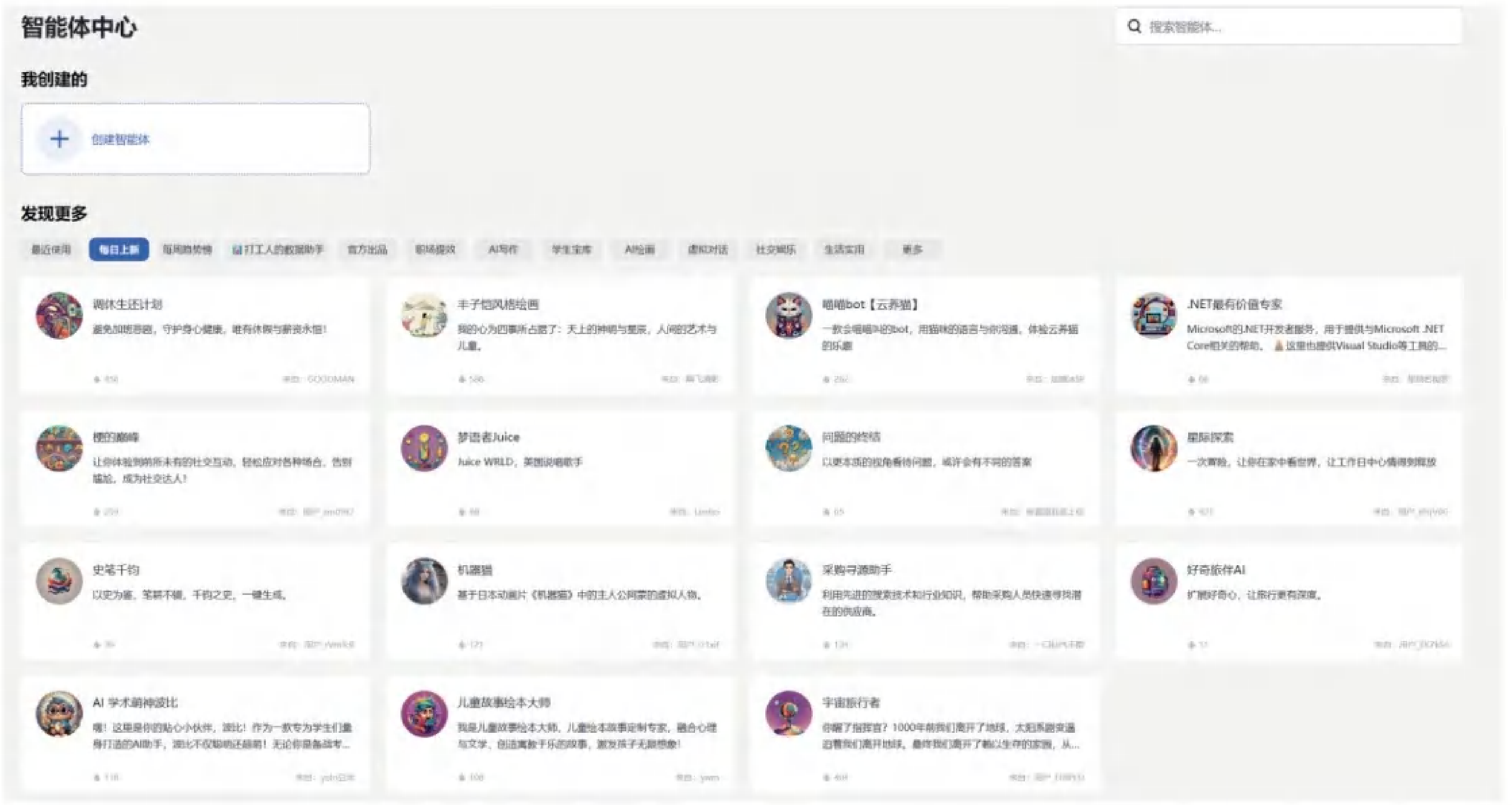


图 7：“智谱清言”智能体中心

（来源：智谱清言）

典型案例二 —— 文心一言

基于文心大模型 4.0 为底座的文心一言是百度全新一代知识增强大语言模型，具备跨模态、跨语言的深度语义理解与生成能力。相较于其他同类型产品，文心一言在提供多种实用插件和易用性方面表现优秀，适合在拓展性要求较高的应用场景使用，为用户提供更加便捷、高效的解决方案。文学创作方面，文心一言可以清晰地表达观点、传递情感，激发创意思维，为用户提供新的灵感和想法，因此可以应用于小说、散文、诗歌等文学作品的创作中。搜索问答方面，文心一言

的聊天机器人可以与用户进行自然语言交互，理解用户的意图和需求，并提供相应的回答和建议。这种应用可以广泛应用于生活服务等领域。多模态生成方面，文心一言支持图像生成和处理，可以根据用户需求生成图像或者对已有图像进行处理编辑。特色应用方面，文心一言与甲骨文信息处理教育部重点实验室共同打造“来自甲骨文的回答”互动程序，用户只需通过输入 prompt 的形式进行提问，就可以收到来自甲骨文的回答。通过调用文心一言的对话能力及对甲骨文文字的释义，让古老的甲骨文“活起来”。截至 2024 年 6 月，文心一言用户规模已超过 3 亿，日调用量已超过 5 亿次。

典型案例三 —— Kimi

Kimi 智能助手是月之暗面公司推出的一款基于自研 Kimi 大模型的应用产品。该产品以千亿级模型参数为基础，以长文本处理为核心能力，凭借其初始阶段约 20 万汉字的无损上下文处理能力，为用户解锁了众多新应用场景。相较于其他同类型产品，Kimi 在文件处理和信息检索方面具有优势，适合用于报告优化、网页内容提取和长文本信息概括等领域。目前，Kimi 已将上下文处理能力提升至 200 万汉字，能够一次性深入阅读 500 份甚至更多文件。在响应速度方面，Kimi 能够在 20 秒内完成对 30 页以内文档的迅速解析，并输出相关文本综述。在长文本概括能力上，Kimi 能够全面把握各篇文章的核心观点，并在处理多篇论文时有效比较和融合相似观点，同时确保输出的文本具备良好的可读性和层次结构。

2.Gen AI+ 办公：创新工作流程，提高生产效率

在数字化转型的浪潮中，传统的办公模式已难以满足日益增长的工作效率和个性化需求。以生成式人工智能赋能办公，正是顺应这一趋势的关键举措。通过集成先进的生成式人工智能技术，能够为各类办公场景注入智能动力，实现代码生成的自动化、数据分析的智能化以及信息管理的精准化。这不仅极大地提升了办公效率，降低了人力成本，还为员工创造了更加灵活、高效的协作环境。生成式人工智能的引入，不仅优化了办公流程，更为企业带来了创新思维和战略优势，推动办公领域迈向全新的智能时代。

生成式人工智能代码编写助手作为高效生产力工具，推动了软件和信息行业的变革。生成式人工智能（Gen AI）编程助手的价值贯穿于开发者工作的始终，从代码的编写、记录到测试，均能发挥重要作用。生成式人工智能（Gen AI）编程助手不仅能通过智能优化、错误检测及代码重构等功能大幅提升软件开发的效率与质量，还能有效减少开发者在编程任务上的时间和精力投入，自动生成代码、自动化处理繁琐的重复性任务，使开发者能够专注于更高层次的设计和创新工作。此外，生成式人工智能（Gen AI）编程助手还可以作为一个强大的学习工具，帮助开发者学习新的软件开发技能。通过 AI 辅助的教程、代码解释和调试工具，使开发者可以更快地掌握新技术和编程语言，从而推动软件开发进入一个更加高效、优质的新时代。

生成式人工智能赋能数据分析与报告生成，实现数据的高效转化

与精准呈现。凭借强大的数据处理能力，生成式人工智能能够迅速分析和解读各类数据，包括结构化的表格数据以及非结构化的文本、图像等多媒体数据。其能够高效地识别、分类和提炼出有价值的信息，从而大幅缩短数据分析周期，降低人工分析成本和出错率。基于分析结果，生成式人工智能能够自动生成清晰、直观且逻辑严密的报告。这些报告不仅包含了详细的数据分析结果，还通过图表、图像等可视化元素，使复杂数据信息易于理解。此外，生成式人工智能还能根据不同的需求和场景灵活调整报告的格式和内容，以满足不同受众的阅读习惯。

典型案例一 —— 商汤代码小浣熊

代码小浣熊是基于商汤大语言模型的软件智能研发助手，覆盖软件需求分析、架构设计、代码编写、软件测试等环节，满足用户代码编写、编程学习等各类需求。代码小浣熊支持 Python、Java、JavaScript、C++、Go、SQL 等 90+ 主流编程语言和 VS Code、IntelliJ IDEA 等主流 IDE，覆盖软件开发全生命周期，包括需求分析、架构设计、代码编写、软件测试、部署上线、系统维护等环节，助力开发者代码生成和补全、代码翻译、代码重构、代码纠错、代码问答、测试用例生成等多个应用场景。在实际应用中，代码小浣熊可帮助开发者提升编程效率超 50%。此外，代码小浣熊可以为用户提供个性化的学习路径，根据开发者的现有技能和学习进度推荐合适的资源，还可以通过分析大量的代码库来提供最佳实践和设计模式的建议，从而提高开发者的

技术能力和生产力。

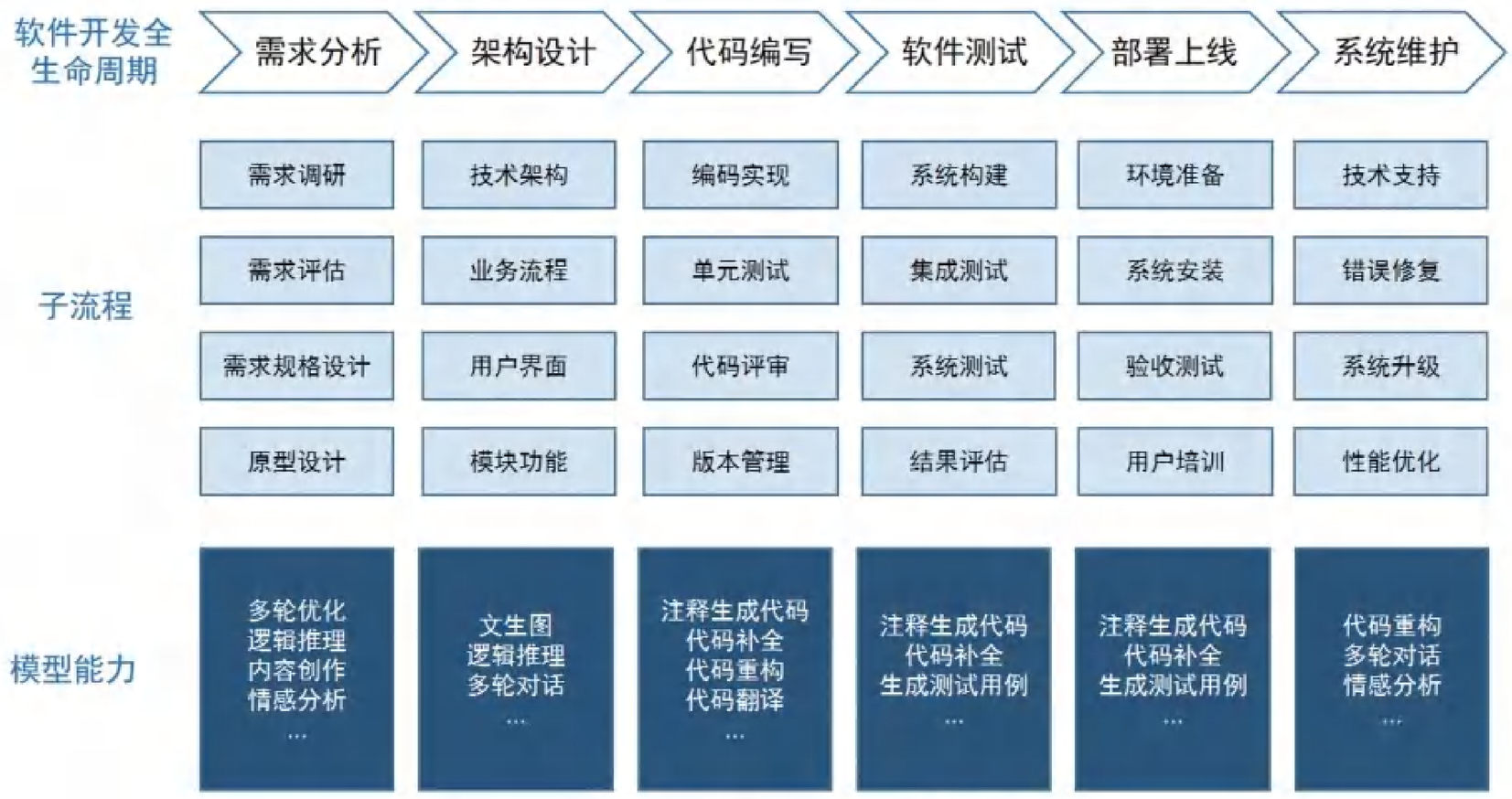


图 8：“代码小浣熊”软件开发全流程

（来源：IDC）

典型案例二 —— 金山 WPS AI

WPS AI 是金山办公旗下基于大语言模型的人工智能办公助手，在 2023 年 11 月开启公测，锚定 AIGC（内容创作）、Copilot（智慧助理）、Insight（知识洞察）三个方向发展。目前 WPS AI 2.0 已经发布，面向个人用户新增四个 AI 办公助手。在**数据分析方面**，WPS AI 数据助手可在表格中完成海量数据的 AI 计算、分析和归类，用户以自然语言提出需求，AI 可转换写出相应代码，并在表格中执行。在**报告生成方面**，WPS AI 可根据用户的需求和预设规则，自动生成各类财务报表、数据报告等文档。用户只需输入相应的指令或设置规则，WPS AI 便能自动执行复杂的公式计算、创建数据透视表，并生成格式规范、内容详实的报告。此外，WPS AI 还具备智能图表和报告功能，能够根据数据内容自动选择合适的图表类型，并生成直观易懂的图表展示数据。WPS

AI 设计助手则可对已有数据、文字和图片快速完成排版、设计风格和图片处理等方面的工作，例如自动调整文本和图片位置，从此告别繁琐格式设置，一键完成文档排版，让每一篇文档都清晰规范，使报告更具可读性和说服力。

3.Gen AI+ 娱乐：拓展娱乐领域，激发创新活力

在数字经济蓬勃发展的背景下，娱乐产业不仅构建了产品服务与消费者之间的紧密联系，还巧妙地满足了现代人对于归属感的深切需求，其重要性愈发显著。得益于生成式人工智能的强大助力，娱乐行业得以通过音频、视频、虚拟人物等多种形式，有效拓宽其影响范围，以更加亲切、易接受的方式触达消费者，从而注入新的发展活力，推动行业实现持续创新与发展。

生成式人工智能激发用户创作热情，促进音频内容行业革新。音频领域专注于运用先进的人工智能技术和复杂算法来创造声音内容。通过集成机器学习和深度学习算法，AI 音频生成技术能够模仿和再现人类的语音、音乐节奏以及各种声音效果，实现高度自然和逼真的音频产出。随着生成式人工智能技术的进步，AI 音频生成不仅能够精准模仿已知声音，还能创造全新的音频体验。从音乐创作到语音合成，再到音频处理，生成式人工智能不仅丰富了音频内容的创作方式，还提高了制作效率和质量，为音频行业带来了革命性的变化。

生成式人工智能重塑视频内容创作，打造智能技术与创意融合新篇章。在视频生成环节，用户仅需通过文字和图片输入，并设定风格、

运动及比例等参数，便可快速生成准确、一致且生动的高清视频，极大地提升了视频制作的效率和便捷性。在视频编辑环节，借助智能辅助编辑工具，用户可以删除视频特定主体、自动跟踪剪辑、视频特效生成、自动添加、视频美颜等。这些智能编辑功能进一步丰富了视频创作的可能性，使得普通用户也能轻松制作出专业级别的视频作品。

生成式人工智能正成为人类的情感寄托，虚拟社交正在成为互联网新的流量入口。伴随生成式人工智能技术的突破，AI 智能体不仅具有了人格特征，而且逐渐赢得了人们的接纳、喜爱与信任。这为在传统“人 - 人”社交网络基础上，开辟了“人 -AI 角色”颠覆式创新交互模式。通过模拟人类的情感反应，AI 角色能够深入理解并回应人类复杂的情绪，进而极大地丰富了用户的社交体验。在当今各类 ToC 的大模型应用中，访问量排名第一的是主打 AI 虚拟角色聊天机器人的 Character.AI，这个 2021 年创立的 AI 平台上共有 1800 万个聊天机器人。在 2023 年底它的月访问量超过 2 亿次，比同期 ChatGPT 高出 300%，可见年轻网民们对 AI 虚拟角色的喜爱程度。

典型案例一 —— “出门问问”魔音工坊

出门问问旗下的“魔音工坊”是一款集文案、配音、剪辑全流程一站式 AI 软件。其具有六大核心功能，即软件配音、文字转语音、真人配音、声音商店、效率工具、声音克隆及视频编辑，并拥有有声音克隆、声音搜索、情感合成 / 角色迁移以及声音合成四方面声音黑科技。依托序列猴子大模型，“魔音工坊”可通过 3-10 秒的短音频，快速地实

现声音克隆，并支持跨语言迁移、情感语气生成。其海外版 DupDub 还支持多语音音频生成，目前已涵盖英语、法语、日语、西班牙语、葡萄牙语、泰语等。

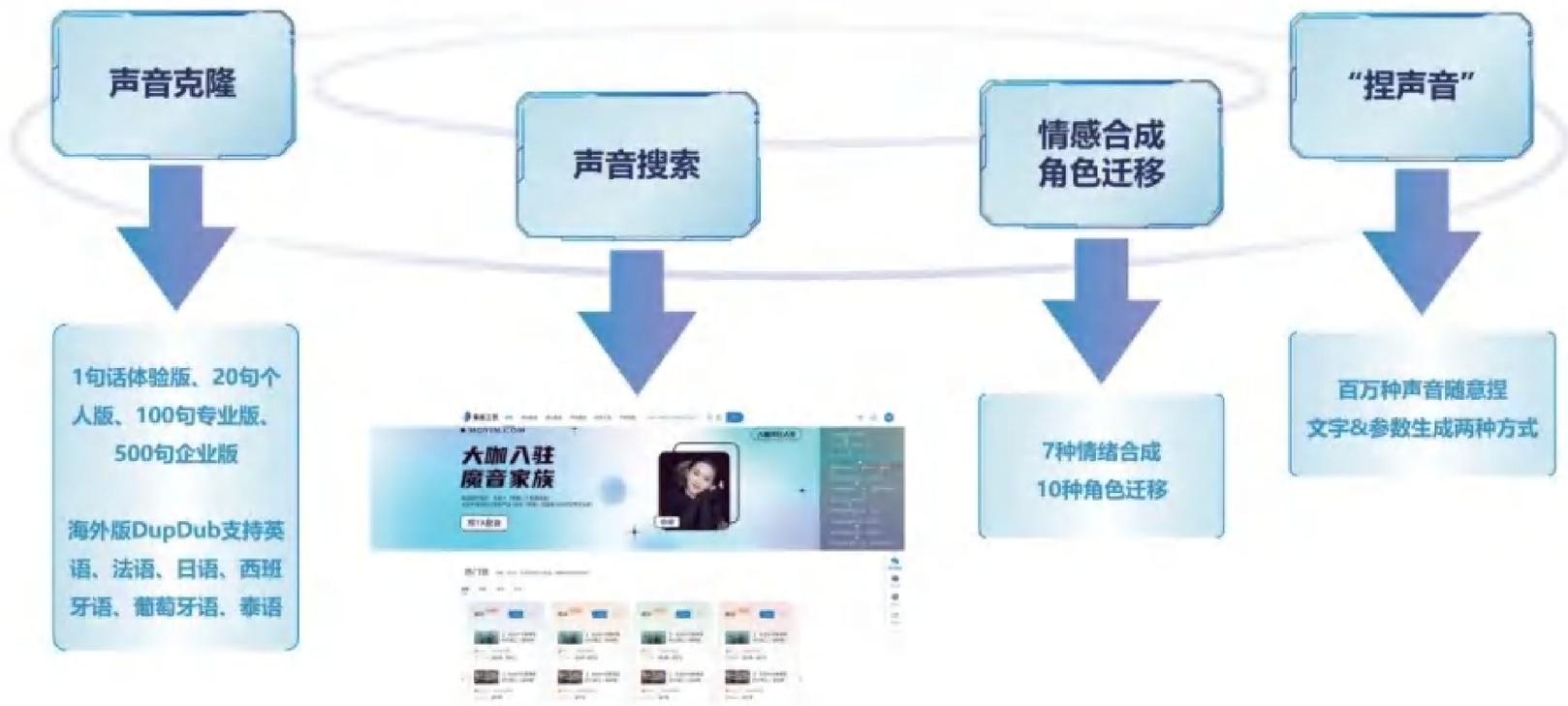


图 9：“魔音工坊”的四大声音黑科技

（来源：魔音工坊）

典型案例二 —— 爱诗科技 PixVerse

爱诗科技旗下的 PixVerse 是一个在线 AI 视频生成平台。该平台以其简洁直观的用户界面和强大的后端技术著称，使得用户无需复杂的操作或专业的视频制作知识即可快速上手。其主要应用场景包括文生视频、图生视频和角色生视频三种模式。在文生视频模式下，用户只需输入提示词、选择风格和设置参数，就能一键生成视频。而在图生视频模式下，则可以将已有的图片或视频素材转化为新的内容，并可运用 Magic Brush 运动笔刷功能，对画面的局部区域进行运动控制，包括方向、运动幅度、角度等，实现更精细的视频编辑。角色生视频 C2V（Character to Video）为全球首创特色功能，用户可以创建属于

自己的“角色库”，选用特定角色连续进行视频生成，根据创作需求将其融入不同场景和故事线。此功能初步解决了 AI 视频创作中的一致性难题，为创作者解锁了更高效、灵活的工作流。

典型案例三 —— 筑梦岛

阅文集团 2023 年发布的筑梦岛 APP 是一款原生虚拟社交生态平台，该平台以商汤科技的“日日新 • 商量 - 拟人大模型为基座打造，为用户提供和虚拟人物单聊、小剧场情景对话、围观他人群聊动态、世界观故事模式等有趣易上手的社交体验。该平台从技术角度考虑大众喜爱的 AI 角色，按照“人设”、“形象”、“声音”三个方向深度开发，人设基于商量拟人语言大模型开发出具有记忆、经验、世界观、真实感受的虚拟角色，形象通过商汤秒画文生图大模型生成高质感、多风格的人物外貌图片，声音则依靠语音大模型产生低延迟、高质量的语音对话。截至 2024 年 4 月底，筑梦岛 APP 上共有 15 万个 AI 虚拟角色“梦中人”，即包括影视综艺、网文小说、动漫、游戏、历史人物，也包括 UGC 原创人物、AI 工具助手，其中最受欢迎的热门 IP 角色数量为 300 个。

图 10：“筑梦岛”IP 角色三元素
（来源：筑梦岛）

（二）生成式人工智能推动行业变革，引领转型升级新潮流

生成式人工智能在向产业渗透的过程中，各行业的接纳与受益顺序依据其信息化基础、数据资源及行业特性而有所不同。互联网与高科技、金融和专业服务行业将是首批受益的领域，这些行业凭借扎实的信息技术基础、庞大的用户数据池，推动生成式人工智能的快速部署。其次是教育、通信、医疗服务、零售和先进制造业等行业，这些行业虽然信息化投入相对较少，但生成式人工智能技术带来的价值空间广阔。此外，农业、建筑业、能源这些传统领域在生成式人工智能技术的应用上尚处于起步阶段，这些行业需要更多时间与资源来探索生成式人工智能的应用场景与价值点。

生成式人工智能在各个行业的应用场景和侧重点存在一定差异。**在通信行业**，生成式人工智能最初被应用于客服领域，旨在节约运营成本并提升服务质量。随着技术的演进，电信领域的生成式人工智能大模型正逐步向其他行业渗透，为垂直行业的数字化转型提供了强有力的支撑。**在医疗行业**，生成式人工智能已广泛应用于诊疗全流程，通过处理海量医疗数据，给出精确诊断意见，并实施个性化治疗方案，既提升了医疗信息化效率，也改善了诊疗体验。**在教育行业，**生成式人工智能正推动行业向个性化与高效化转型，其依据学生特性提供定制化资源与辅导，同时助力教师提升教学质量，促进教育公平化和普及化。**在金融行业，**生成式人工智能能迅速响应金融市场变化，提供准确的风险评估和投资建议，显著提高金融服务的智能化水平。**在工**

业领域，生成式人工智能整合生产、运营和管理数据信息，实现生产流程的自动化和智能化，从而提高生产效率并降低生产成本。

1.Gen AI+ 电信：生成式人工智能助力电信运营商转型升级

在数字化转型的大背景下，中国运营商的第二曲线增势迅猛，新兴业务收入占比持续攀升。电信行业正站在数字经济、人工智能等多领域的新赛道上，进行全面的战略升级。作为数字经济主力军，电信运营商在人工智能时代的共识日益加强。构建坚实的人工智能基础设施，提升生成式人工智能服务和运营能力，是实现智能普惠、智能泛在及智能产业高效规模化发展的基石。

生成式人工智能的应用逐渐成为电信运营商 AI 战略的核心。先进的生成式人工智能大模型能够处理和分析海量数据，提供精准的洞察和预测，从而优化网络运营、提升客户服务体验、增强网络安全，并推动业务模式的创新。通过集成大模型，电信运营商能够实现更高效的数据处理，更智能的决策支持以及更个性化的服务定制，极大地推动电信行业的数字化转型和智能化升级。

生成式人工智能大模型不仅将成为电信运营商提升运营效率和创新能力的重要工具，也将成为推动垂直行业向更高水平发展的驱动力。随着生成式人工智能技术的不断进步，电信运营商将能够更好地利用其在数据、基础设施和用户资源方面的优势，进一步深化生成式人工智能应用，为垂直行业客户实现业务流程的自动化和智能化提供更加丰富和高效的服务。

典型案例一 —— 中国联通元景大模型全面提升 10010 客户服务质量

(1) 技术介绍

中国联通推出元景“1+1+M”大模型体系。首个“1”指一套基础大模型，该基础大模型由两大基座组成。一是语言大模型，面对不同功能需求布局多参数版本，目前已完成布局 10 亿、70 亿、130 亿、340 亿、700 亿等多个参数版本。第二个“1”指一个基础模型底座 -MaaS 平台。元景大模型借鉴人类职业技能形成规律，打造选模型 - 改模型 - 用模型工具链，使能从通用能力到专业能力和“职业技能”的塑造。“M”指 M 种特定行业的大模型，目前基于元景大模型能力，已发布网络专家大模型、客服大模型、反诈大模型等多款行业大模型，应用在工业、城市、交通等多行业超 200 个场景。

图 11：中国联通元景“1+1+M”大模型体系

（来源：中国联通）

(2) 服务模式

从服务模式来看，中国联通以元景大模型为底座，研发了面向内外部业务场景的 10 个行业大模型，赋能网络、客服、终端运营等，助力政务、经济运行、医疗、服装、物流、城市治理领域示范应用。

(3) 应用情况

中国联通充分挖掘生成式人工智能价值，发挥自研大模型优势，在客服大模型基础上打造 26 项 AI 创新服务，赋能其客户联络中心 –10010，提供精准化、智能化服务保障。通过全流程、全场景数智赋能，全面提升客户感知、一线效率和管理效能，实现智能服务占比超 85%，平均通话时长压降 15%，首次问题解决率提升 1.6pp，用户满意度达 98% 以上，打造 10010“一号通解”的智能化服务，助力热线满意度跃升行业第一。

典型案例二 —— 中国移动九天大模型协助 10086 打造智慧客服

(1) 技术介绍

中国移动的九天·客服大模型，依托于客户服务行业深厚的业务知识、丰富交互数据、系统接口信息以及人工坐席的专业经验，采用了科学有效的大小模型融合策略。该模型以自然语言处理为入口，与现有系统无缝对接，实现一体化服务；通过增强意图识别和任务式对话的能力，该模型重塑了以大模型与人工客服协作为中心的客服流程，覆盖了全场景和全流程。这一创新显著提升了用户的满意度和忠诚度，并且通过闭环跟踪技术应用，智能客服系统在问题解决率上也取得了

显著进步。

(2) 服务模式

中国移动九天·客服大模型，既可以独立为用户提供服务，根据用户提供的自然语言描述，解析用户问题并调用 API 获取答案；又可以与人工客服合作，分析历史沟通内容的语义和上下文、总结和归纳对话的重点和关键信息，根据对话内容为坐席提示回复话术，以减少回答的时间和思考负担，形成“大模型—人工坐席—用户”的三方沟通场，极大的提升传统人工客服的工作效率，同时客服大模型将一定程度上重新定义客户服务的内涵和模式，带给用户全新的体验。

(3) 应用情况

依托九天大模型，中国移动成功地将客服行业的服务经验与先进技术相结合，通过“专业 + 通用大模型”结合、训练和推理计算一体化的深度学习，依托强大的算力中心保障，实现智能搜索、伴随式顾问、多轮交互等多样化的智能交互服务，初步具备了面向客户的复杂场景的识别能力和有效的响应能力。

生成式人工智能大模型应用在智能客服系统前，线上用户解决率约为 46%，通过将原有小模型替换为大模型，并通过一套科学有效的管道方案实现大模型对整个用户的贯穿服务，应用大模型增强意图识别、任务式对话能力，提升文字机器人交互体验，提高用户满意度和忠诚度。通过对客服大模型技术的闭环跟踪，自九天客服大模型上线后智能客服系统意图识别准确率由 92% 提升至 95%，解决率由 46%

提升至 65%，问题解决能力提升带来人力节约 200 人。[5]

2.Gen AI+ 医疗：生成式人工智能引领医疗行业创新发展

医疗产业面临着数据量大、数据质量差、数据隐私保护、医生资源不足、诊断效率低等痛点。生成式人工智能在医疗健康领域的应用，为提高医疗信息化效率、改善在线问诊体验、实现实时监测预警以及助力药物研发带来了革命性的变革，从而为患者提供更优质的诊疗体验与个性化管理。

得益于近年来医疗大模型的不断迭代，复杂的医疗数据分析任务可以得到更有效地处理。鉴于患者行为数据的独特性，生成式人工智能大模型通过个性化设计，满足患者“千人千面”的医疗服务需求，广泛应用于智慧影像、智慧手术、智慧健康等领域。智慧影像覆盖 CT、MR、DR、US、DSA、钼靶等多种医疗影像场景，为患者进行早期检测、诊断及健康风险评估。智慧手术功能则大幅提高患者病情评价的准确性，为术前风险评估、术中手术规划、术后预后估计奠定坚实基础。智慧健康则作为一般患者的贴身健康助手，通过小程序等便捷方式为患者提供高质量导诊服务和个性化健康建议。

典型案例一 —— 商汤大医助力新华医院打造智慧医院

(1) 技术介绍

商汤大医是由商汤科技研发的医疗健康大型语言模型，以商汤自研的千亿参数规模的生成式大型语言模型“商量”为基座 (拥有万亿 token 预训练语料)，利用超 200 亿 tokens 的高质量医学知识数据训

[5] 数据来源：《领先企业智能化转型实践白皮书》

练而成，数据范围涵盖医学教材医学指南、临床路径、药品库、疾病库、体检报告等资料，以及 4000 万真实病历、医患问答和对话等。

(2) 服务模式

在服务模式方面，“大医”聚焦智慧大健康、智慧患者服务、智慧临床以及数智建设四大应用领域，已覆盖智能自诊、体检咨询、健康问答、导诊、预问诊、用药咨询诊后随访管理、智慧病历、诊室听译机器人、智慧医助、智慧随访、影像报告结构化及病历结构化共 13 个细分医疗健康场景，实现模型功能与具体场景的精准匹配。为了满足客户差异化部署需求，商汤推出多个“大医”版本，参数量从千亿到百亿级别不等，既可以公有云服务方式为合作机构提供服务，也可帮助合作机构高效完成模型私有化部署。

(3) 应用情况

新华医院基于商汤科技研发的医疗健康大模型“大医”，实现多个医疗场景的无缝融合，通过“智慧医疗”、“智慧管理”、“智慧服务”、“智慧科研”四个板块建设智慧医院，以服务为主线持续推动公立医院的高质量发展。医疗技术与人工智能深度融合，重构了诊前、诊中、诊后三个阶段的服务体验。

在诊前阶段，基于商汤“大医”开发的“智能陪诊助手”为每一位患者推荐合适的医院科室、专病医生，解决“知症不知病”、“知病不知科”、“知科找不对医生”的困惑和诉求。大部分就诊者通常不知道应该挂哪个科，针对此类问题，患者可登录“上海新华医院”

微信服务号，进入“门诊预约 - 智能问诊”板块，就能获得“智能陪诊助手”便捷就医服务，通过文字或语音方式描述自己的症状，即可获得系统推送的相关科室、专病、专家的线上挂号链接。该 AI 助手通过完整学习海量就诊数据，拥有了“智能分诊”的工作能力，同时还“请教”了经验丰富的预检护士们，强化部分患者的常见疾病问题，使得“智能陪诊助手”能够给出智能分诊建议。

在诊中阶段，商汤科技自主研发的 SenseCare® 智慧诊疗平台能够帮助医生显著提升诊疗效率。该平台搭载丰富 AI 辅助诊疗应用，能根据各类检查影像，快速准确地识别微小病灶（如结节），并重建高精度三维器官模型，从而有效助力疾病早筛与精准化个体治疗。在传统方式中，三维重建往往需要耗费大量人工交互操作，给医生带来繁重的工作负担，也限制了精细重建的病例数量，并且在脉管等精细结构的重建效果也存在局限性。SenseCare® 肺部智能手术规划系统，能实现全自动的胸部多种组织结构的精细分割与三维重建，重建时间由传统医生手工操作的 1-2 小时大幅缩短至 3-5 分钟。助力医生高效、精准、便捷地规划设计个性化手术方案。

在诊后管理阶段，商汤“大医”助力新华医院率先建立“全院级智能随访中心”，灵活、高效、便捷地支撑起三类诊后随访需求。其一是“关怀性随访”，其二是“诊后跟随性随访”，其三是“科研随访”。“大医”随访的优势在于可根据随访表单进行提问，并根据患者回复调整问题，同时耐心解答被访者问题。此外，“大医”可以根据患者

档案以及随访信息给出智能风险评估和随访建议。

典型案例二 —— 百度灵医大模型助力固生堂全流程优化

(1) 技术介绍

灵医大模型是百度集团研发推出的中国首个“产业级”医疗大模型，其以自研国产、知识增强的文心大模型为底座，通过海量医疗健康的优质语料进行预训练和指令精调，以及循证医学对齐后获得的医疗行业大模型。**算法方面，**灵医大模型基于文心大模型，打造千亿参数的大模型，并内置了知识增强、检索增强和上下文增强等多项增强技术，提升了大模型生成的准确性和多样性。**算力方面，**灵医大模型基于万卡算力集群和全生命周期的模型开发工具链的保障，进行无标注的预训练，不断优化底层参数。**数据方面**灵医大模型使用了千亿 Token 的训练语料数据，包括海量临床脱敏数据、海量医学知识图谱、300 万 + 例多模态影像数据，6 亿 + 条健康科普内容，70 万 + 临床试验研究信息，丰富的语料数据提高了模型的全产业链服务能力。

(2) 服务模式

在服务模式方面，灵医大模型可划分为四层架构，按需为不同用户提供服务。**应用层**主要为患者、医院、企业等用户提供 AI 原生应用，目前以灵医 BOT 为助手，聚焦在智能健康管家、智能医生助手、智能企业服务三大方向，满足“医 - 患 - 药”各自的特定需要。**能力层**主要以 API 或 AI 插件的方式，为生态合作伙伴提供高质量的 AI 服务，帮助合作伙伴进行二次开发，打造 AI 原生应用。**模型层**主要根据不同

的应用需要和部署资源，提供旗舰版、Lite 版和定制版服务。**算力层**重点面向有私有化部署需求的用户，提供三个等级的软硬一体的算力支持能力。

图 12：“灵医大模型”商业化服务模式

（来源：百度灵医大模型）

(3) 应用情况

固生堂为客户提供融合线上线下的中医诊疗服务，是中国最大的中医诊疗服务机构之一。百度和固生堂基于灵医大模型，推出“智能健康助手”。这一项目通过整合灵医大模型的能力，实现了**智能分导诊**和**智能问答（客服）**两大功能。**智能分导诊系统**能够根据患者的症状和需求，智能地为其分配最合适的科室和医生，大大提升了患者的就医体验，从数据来看，提高了固生堂患者满意度 12%。**智能问答（客服）**则能自动化处理患者的基础问题如订单配送、发票开具等问题，不仅减少了人力成本，还提高了客服的响应速度和准确性。据统计，

固生堂通过应用灵医大模型，提升了运营人员的服务人效约 76%，极大地提升了整体运营效率。

灵医大模型还通过提供丰富的数据支持，帮助固生堂优化医疗资源配置和医疗服务流程。通过对患者就诊数据的分析，固生堂能够更准确地了解患者的需求和偏好，从而调整科室设置、医生排班等资源配置，提高医疗服务的针对性和效率。同时，灵医大模型还能够对医疗服务流程进行实时监控和优化，确保医疗服务的质量和效率得到持续提升。

3.Gen AI+ 教育：生成式人工智能推进教育行业个性化发展

当今教育行业的传统教学模式存在一定程度上的个性化教育与普惠教育之间的矛盾。个性化教育虽能够根据学生的特点和需求提供精准的教学方案，从而最大程度地发掘每个学生的潜能，但教育个性化的实施需要配套教师资源的持续投入，这对于具有规模化教育需求的国家而言，带来了师资稀缺、教育开支过高等问题。

如何利用前沿科技结合现代教育理论，实现规模更大、质量更高、效率更佳以及更过更优的教育，始终是当代教育研究领域探讨的核心课题。2023 年各类教育行业的生成式人工智能大模型相继发布，为教育行业迈向生成式人工智能之路敞开了大门，有助于师生大幅提升教学效率，并推动大规模因材施教的逐步实现。

典型案例一 —— abab 系列大模型助力高途教育探索教育场景创新应用

(1) 技术介绍

Abab 是由稀宇科技（MiniMax）推出的全栈自研多模态大模型，具有领先的文本和语音能力。今年 4 月，MiniMax 发布了国内首个基于 MoE 架构、包含万亿参数的 abab 6.5 系列模型，最高支持 245k tokens 的上下文长度，实现了高效处理复杂任务的能力。结合语音模型 abab-speech 的应用，MiniMax 致力于在教育领域提升教学效率和质量，促进学生个性化学习和全面发展，为教育行业降本增效注入新动能。

(2) 服务模式

在服务模式方面，MiniMax 聚焦教师与学生两大群体，在课前、课中与课后等不同教学、学习阶段提供多种数字化教学平台与学习助手，在数字化教育的创新探索中实现模型功能与教育场景的精准匹配。通过与教育机构合作调研，MiniMax 研发并提供教案生成、课件生成、课堂助手、作文批改、课堂总结等 AI 助理，辅佐教师完成高质量课堂教学。课堂预习、课堂助手和课后辅导等 AI 工具则能帮助学生群体进一步提升学习效果。

(3) 应用情况

MiniMax 与高途合作，针对不同学龄阶段学生的特点和学习规律，推出了一系列智能助手。这些助手采用先进的文本和语音大模型技术，实现了智能问答、数字课件讲解、数字讲师等数十种精细化的应用场景，为师生提供了丰富的教学交互方式。此外，双方还共同开发了数字讲师、

生涯助手等功能，实现了针对学习内容的问答、聊天、内容生成及规划指导等任务。其中，MiniMax 教师音色复刻等特色功能可根据不同场景定制特色音色，实现重点 IP 音色的高还原度复刻，并与使用者进行一对一交互。Abab-speech 语音模型技术则支持合成更自然的声音、消除机械音，从而提升了学生在高途数字讲师前的学习体验。目前，MiniMax 携手高途共同推出数字老师 30 余名，累计制作超十万分钟 AI 数字课程，辅助生成虚拟资源课件数量破万。

对于处于高考、考研等升学阶段的考生，生成式人工智能也展现出了新的创新应用价值。高途教育利用 MiniMax 大模型和 RAG 全套工具链，结合院校信息、招生信息以及初试复试参考信息等数据，推出了“生涯助手”应用场景。该场景与考生实现智能问答，帮助他们在与大模型的对话过程中逐步选定理想院校和专业，并自动生成针对每位考生的个性化回答和建议。

典型案例二 —— 讯飞星火智慧教育赋能国家开放大学英语教学

(1) 技术介绍

科大讯飞积极推进教育大模型实践落地，从教师备课、课堂教学、学生学习、心理健康、科普教学、素养培养多个应用场景阐述了生成式人工智能在教育数字化转型方面的创新探索。以讯飞星火大模型为底座打造了智慧教育板块，构建了从国家、省、市、县（区）到学校家庭的智慧教育体系。

(2) 服务模式

在服务模式方面，科大讯飞将星火大模型与智慧课堂相结合，从备课、授课、评价三个维度着手，为教师带来更高效、更智能的数字化时代课堂教学新样态。**在备课环节，**提供体系化课程资源，如课件、教学设计、学习单、说课视频、虚拟实验等，帮助老师轻松备课。**在授课环节，**为老师打造一套信息科技教学评管一体化工具，支持实验教学、项目式教学、合作式教学等场景。在评价环节，星火编程助手可以实现编程任务一键批改并给予个性化指导，此外，基于伴随式数据采集，还可以帮助老师智能生成学生学期评价。此外，科大讯飞还充分发挥其在英语教学方面的优势，开发了英语听说教考平台，打通了教、学、考全场景数据，全面分析学生的听说能力。

(3) 应用情况

国家开放大学是教育部直属、以现代信息技术为支撑、面向全国提供开放教育的新型高等学校。其英语学习者每年超过 300 万，学习需求多样，英语教学亟需充分交互、及时反馈的个性化支持服务。

基于讯飞核心人工智能技术及星火大模型能力，国家开放大学打造了个性化语言学习环境，通过英语口语智能训练系统，让每位学生都能即时获得不同维度的训练反馈。基于大模型 + 知识图谱双轮驱动，学校建设了自适应学习平台，并将《学位英语》课程打造为新型数字课程。学生可以结合自身需求开展“千人千面”的自适应学习，并通过课程知识图谱及学习画像，自主寻找知识盲点、查缺补漏，实现针对性提升。借助讯飞虚拟人技术，学校还打造了依托虚拟教师的新型

数字教学模式，帮助教师便捷定制 AI 课程资源，提升资源建设效率；为学生提供 7*24 小时的智能答疑服务，回答过程可同步展示与问题相关的知识点及学习资源，助力拓展练习。经过近万名师生的教学实践，国家开放大学智慧教学资源体系已经形成，共建设智能问答资源库 1 个、自适应课程 1 门，完成知识图谱知识点拆解 200 个、虚拟资源课件 141 个、虚拟资源 844 分钟，打造了开放教育“因材施教”的全新范式。

4.Gen AI+ 金融：生成式人工智能推动金融行业提质增效

金融产业的核心竞争力，在于持续降低金融风险与不断提高行业的服务水平。当前，中国金融服务呈现出服务智能化、业务场景化、渠道一体化、融合深度化等特点。生成式人工智能大模型凭借其强大的理解、学习、生成和推理能力，以及可观的知识容量和卓越的多任务泛化能力，将进一步推动金融服务的智能化升级。

金融行业的前、中、后台业务已全方位受益于生成式人工智能的赋能，显著提升运营效率。对话机器人、虚拟助理等生成式人工智能应用已经逐渐出现在个性化服务、客户服务、金融欺诈检测、信贷支持等服务场景中。在个性化服务方面，基于客户数据的深度分析，生成式人工智能大模型能够为客户量身定制财务和产品计划，实现精准服务。在客户服务方面，生成式人工智能大模型依据客户的行为偏好，生成个性化电子邮件与信息，并提供差异化的智慧客服服务，有效提升客户体验。在金融欺诈检测方面，生成式人工智能大模型助力专业

人员高效检索和分析大量数据，准确识别欺诈行为，保障金融安全。在信贷支持方面，生成式人工智能大模型通过分析海量生产生活和信用数据，为信贷部门人员生成高质量的信贷方案建议，减少贷款收益损失。

典型案例一 —— 腾讯云金融大模型赋能银行开发智慧客服

(1) 技术介绍

腾讯云正式发布的金融行业大模型主要包含四层架构，分别从算力层、平台层、大模型层及应用层助力金融行业提升效率。在**算力层**，该大模型基于 HCC 高性能算力集群、云原生数据湖仓和向量数据库，提供高性能算力和数据接入能力。在**平台层**，腾讯云 TI 平台已实现从数据预处理、模型训练、模型部署的一站式训练，配合训练加速套件，大幅提升模型训练效率。在**大模型层**，金融机构能根据不同细分场景的业务需求，通过模型商店 MaaS 接入腾讯混元大模型、金融行业大模型及 20 多个主流开源模型，通过灵活选择大模型类型降低使用成本。在**应用层**，腾讯云基于金融行业大模型结合金融行业前中后台多个业务场景，打造了一系列智能应用，致力于更好地服务各类金融机构。

(2) 服务模式

目前，腾讯云金融大模型已经在智能客服、智能投顾等场景落地使用。在保险展业场景中，腾讯云金融大模型已经实现较高匹配度并用于具体金融实践，保险代理人开始结合数字人应用场景进行营销展业、业务培训以及智能客服等工作。此外，对于金融行业重点关注的

合规问题，腾讯云基于自身的数据隐私、内容安全解决方案，通过模型私有化部署、权限管控和数据加密等方式，确保金融机构在使用模型的过程中安全合规。

(3) 应用情况

在银行客服场景中，银行的客服系统场景存在三大痛点。一是知识维护量大，冷启动知识配置成本 14 天到 1 个月不等，且需要持续投入运营。二是问答覆盖率低、拦截率低，由于知识边界受限，不在知识库的问题无法回复或者几轮下来往往答非所问。三是接待上限低、服务效率低，进线后坐席需要经历知识理解、搜索、组织回复的复杂流程。

银行客户基于腾讯云金融行业大模型能力，结合自身场景数据，通过腾讯云 TI 平台进行精调，构建了专属的金融客服大模型，并进行私有化部署。通过快速接入银行企业知识，直接学习企业文档库、搜索引擎现有资源，同时直接对接银行 API 进行任务式对话问答，打造了银行专属 AI 助手。银行可采用语音识别、语音合成、人脸识别等 AI 技术，在进行安全认证的基础上，对自然语言进行深度分析，并进行精准回复，让服务“看得见”、“听得见”，大幅减少人工成本的基础上，极大地提升用户交互体验。**一是智能语音导航和智能问答。**通过智能语音导航和智能问答，可以实现对客户的合理引导，将复杂的功能菜单扁平化，提升客服服务效率。**二是智能外呼和智能质检。**一方面，该银行利用腾讯云金融大模型的 NLP、情绪识别、语音识别等

技术，将人工客服的服务录音进行转写，并在此基础上进行数据分析，形成专题分析。另一方面，将外呼营销、催收等过去由人工开展的业务，交由机器人办理，并实时对数据进行深度分析，朝着定制化的客户处理方案演进。三是客服助手。客服助手可以在人工坐席服务时，为员工提供即时的话术支持，也可以根据人工坐席的需求，为其提供即时的协助，提升工作效率。

典型案例二 —— 轩辕大模型驱动度小满金融全场景智能化应用升级

(1) 技术介绍

轩辕大模型是由度小满开源的中国首个千亿级中文金融大模型，其基于庞大的 1760 亿参数的 Bloom 大模型进行训练，通过独创的 hybrid-tuning 的创新训练方式，在金融领域内容理解和生成上能力卓越。截至 2024 年 3 月，度小满轩辕系列已经有 17 款开源大模型，适配广泛场景任务，满足不同开发者需要。在解决实际金融任务的能力上，据评测结果显示，各个参数尺寸的轩辕大模型均具有“以小搏大”的实力，达到了自己 2—5 倍参数量的模型水平。轩辕大模型不仅在金融领域成绩优异，凭借融合百度文心一言的全面能力，轩辕大模型还覆盖了数学计算、场景写作、逻辑推理、文本摘要等多个通用能力维度。

(2) 服务模式

轩辕金融大模型不仅在金融产品营销、金融数据运营、金融风控管理、金融知识问答等关键金融场景中得到了广泛应用，同时也在代码研发、办公协助等多个通用应用场景中发挥着重要作用。自开源以来，

已经有上百家金融机构申请试用“轩辕”大模型。

电销、信审、客服等坐席相关场景是金融业务不可或缺的核心场景，提升坐席作业效率和业务转化率是机会也是挑战。基于轩辕大模型研发的坐席助手可对 CRM 系统客户信息进行摘要，帮助坐席人员提前了解客户，使对话更加有的放矢；开展对话中，坐席助手可实时推荐经营话术，帮助坐席人员把握时机，提升转化率；完成对话后，坐席助手可对通话过程进行摘要，帮助坐席人员复盘作业表现，提升服务能力。

(3) 应用情况

度小满基于轩辕开源模型探索大模型训练和微调技术，最终形成了自己的自研大模型技术栈。在预训练和指令微调阶段，除了通用数据，轩辕系列加入了度小满依托多年行业实践经验构建的海量金融数据，外挂实时更新业务知识库，同时定向增强摘要、逻辑、计算等金融场景核心能力，继而使大模型对金融知识的理解更专业、更精准、更可控、更安全。在此基础上，度小满通过使用人工校验的高质量指令数据对模型进行指令微调和对齐，使轩辕系列具备更加出色的金融能力。

目前，轩辕大模型技术已经应用在度小满各个业务场景，从营销、客服、风控、办公再到研发，已初见成效。在代码助手方面，度小满用轩辕大模型辅助生成的代码，采纳率能够达到 42%，帮助公司整体研发效率提升了 20%；在智能办公领域，轩辕大模型目前的意图识别准确率已达到 97%；在核心的坐席助手应用方面，轩辕大模型也已经取得了一定进展，比如电销坐席助手，目前幻觉问题解决率 96%，转

化率提升 12%；客服坐席助手，服务效率提升 25%；增信坐席助手，增信补件效率提升 37%。

5.Gen AI+ 工业：生成式人工智能推动工业智能化升级

工业发展正加速迈向智能化阶段。继机械化、电气化、自动化、信息化阶段后，工业正处于从数字化向智能化转型的关键时期。在当前阶段，中国在工业领域已积累了海量数据、基础能力和场景需求，借助生成式人工智能的能力，可对工业进行更深入的升级和改造，从而提高生产效率、降低生产成本并提升产品质量。此外，生成式人工智能技术可渗透至工业生产、运营、管理等各个领域，持续优化感知、认知和决策等关键环节，推动工业发展实现“自适应、自决策、自执行”的智能化模式。

生成式人工智能大模型有望为工业智能化开辟新的发展空间。相较于传统小模型，生成式人工智能大模型有望挖掘工业领域智能应用的新场景，提升生成式人工智能应用的普及率。例如，在研发设计阶段，生成式人工智能大模型能够深度挖掘、生成并分析海量数据，为产品设计提供更为精准且富有创新性的思路。在经营管理层面，生成式人工智能大模型可实现对生产流程、供应链管理等各个环节的监控与智能优化，进而提升企业的运营效率和市场竞争力。

典型案例 —— 中国联通元景大模型赋能杭州嘉溢制衣有限公司

（1）技术介绍

中国联通服装制造军团依托浙江联通，承接集团元景大模型在工

业领域助力服纺行业智能制造升级的使命，通过元景大模型底座，提供性能领先的衣裳云生成式人工智能能力平台，汇聚视觉合规、视觉质检、服纺AIGC 等产品能力单元。

（2）服务模式

中国联通服装军团借助元景大模型能力，已在全国服纺行业成功打造包括浙江的报喜鸟，中国巨石、嘉溢服饰等多个重点标杆项目，服务海宁经编、安徽宿松等多个产业集群平台。

（3）应用情况

中国联通与杭州嘉溢制衣有限公司联合开发定制化元景服装大模型，依托“衣影”大模型的能力，设计师只要在大模型聊天框内输入想生成的衣服款式描述，短短数秒后，穿着该样式服装的的模特便呈现在屏幕上，设计师可以用画笔等在模特衣服上进行修改调整，大模型便即时生成了修改后的最新款式。衬衣、长裙、外套，学院风、中式风等各种款式、各种风格大模型都可以生成。除根据文字实时生成款式图样外，“衣影”大模型还可以导入现有的图片，自动进行款式调整。

杭州嘉溢制衣有限公司借助元景大模型能力，从过去一个业务熟练

设计师一天最多设计 3 到 4 款服装，确定一款设计需要两天左右时间，到如今只需 3 秒钟就能生成设计图，且看到上身效果，平均只需大模型生成修改十余次就能得到较为满意的款式，大幅提升了设计师的工作效率。

四、探索“生成式人工智能”未来发展新路径

（一）重点布局算力平台，建立算力合作协同机制

未来，金砖国家在生成式人工智能方面可能面临算力不足的挑战，可支持围绕云计算建设的各类行业训练数据集和人工智能的联合训练平台，形成从理论模型创新、模型工程化到场景化服务的技术和商业闭环，构建统一、开放、有序的人工智能产业大生态。在这一过程中，可考虑从以下几个方面具体展开：

一是推动金砖国家建立区域级、国家级的算力合作调度平台，建立计算资源共享名录，实现跨区域、跨行业的算力资源调配。通过云计算和边缘计算的结合，可以在区域范围内动态分配算力资源，提高资源利用效率。例如，利用分布式计算技术，将各地的超算中心、数据中心进行联通，实现资源的弹性调度和按需分配，满足大规模生成式人工智能模型训练的需求。通过建立人工智能计算资源共享名录，支持超算中心、算力平台、行业训练数据集和人工智能训练平台等基础设施资源的开放共享，避免资源浪费和重复建设。同时，建议金砖多国开放国家级实验室的算力平台支持各类大模型训练。

二是鼓励金砖国家电信企业、互联网公司和科研机构通过合作共建高性能计算平台，形成算力合作联盟。集中已有高等级 GPU 的算力资源，提供大模型数据训练所需算力，通过联合实验室、研究院等形式，促进产学研深度融合，加速前沿技术研究成果的产业化进程。例如，联合开发专用的 AI 加速芯片和高效的计算框架，提升算力平台的性能和效率，

支持生成式人工智能的快速发展。

三是推动绿色数据中心的建设，做好算力和电力协同。采用先进的节能技术和可再生能源，优化数据中心的能源管理，提升算力基础设施的环保性和可持续性。针对地域、时间、天气等对绿电供给影响较大的问题，可通过储能、源网储荷一体化等方法应对。另外，未来金砖国家可考虑部署碳智能计算联合平台，通过获得各国与地区历史、实时或24 小时内每小时电力能源结构及碳强度，通过在时间或空间上转移计算任务，实现计算任务与低碳电力供应的最佳匹配。

（二）优化高质量数据供给，促进数据开放与共享

金砖国家大部分国家目前政府侧公开数据和产业专业数据相对缺乏，能体现金砖国家传统文化的源数据暂时不足，金砖国家需优化数据供给，聚焦打造专业数据服务。训练大模型需要优质的大数据集合，有些数据还需要人工标注。收集和清洗数据是一项耗时较长的基础性工作，其质量直接决定模型的智能程度。为此，建议加快推动数据资源的整合共享和开发利用。ChatGPT 的成功因素之一是拥有高质量语料库和丰富的基础科学数据集。金砖国家具备较为丰富的公共和行业数据。政府、企业和社会多方可综合利用多方资源，构建共享、共创的合作生态，激发数据要素活力。参考操作层面主要包括如下：

一是在政府侧制定公共数据资源开放清单，开展开放试点，对可用于生成式人工智能的公共数据鼓励“应开尽开”。优先开放高价值、低敏感、数据量大的民生公共数据，在数据开放过程中不要过多预设实景

场景，逐步开放公共数据库及行业专业数据库等。政府对于生成式人工智能相关的数据定期维护定期更新、分类、清洗、标注、结构化、并确定分级开放权限，同时为社会提供 API 数据接口，促进政府数据和行业数据“汇聚融合”。

二是在社会侧，推动共建“金砖价值取向”的源语言高质量语料库，提升优质数据供给。为了让生成式人工智能更好地理解客观世界和掌握规律，需要学习大量来自知识和价值观层的数据。金砖国家拥有源远流长的文化和历史积淀，各国合作共建金砖国家数据库，推动图书馆、出版社和科研机构国际合作，系统地将中文、西班牙文、阿拉伯文、俄文等源语言的历史典籍、主流媒体价值观数据、科研期刊数字化和开放共享，扩大反映“金砖式文化和价值取向”高质量语料数据供给，促进生成式人工智能的发展，推动“人类命运共同体”建设。

三是政府和社会力量协同合作，构建产业数据资源服务平台，创新数据交易机制，促进数据交易流通。政府通过建立数据资源服务平台，汇聚交通运输、能源等多行业数据资源，通过建立统一的数据汇聚标准，规范数据描述格式，促进多方数据融合。社会力量基于政府开放数据及海量网络数据加工形成预训练数据集，在数据流通方面，部分行业数据的非敏感部分可按照“**先使用后收益**”原则进行交易，在确认使用的情况下，大模型训练可免费使用，在取得商业收益后，按比例支付数据使用费。

（三）加大基础大模型投入，联合打造行业大模型

“大模型”是生成式人工智能的核心技术之一，其研发需要大量的资源配置，目前金砖国家的基础大模型能力仍有较大提升空间，应集中力量支持人工智能领域的头部企业和研究机构，分工合作，建设有水平、有影响力的底层大模型，赋能多行业，具体如下：

一是在通用大模型方面，政府应制定明确的支持政策，鼓励头部企业、研究机构、高等院校加大对基座大模型研发的投入。可以通过出台专项扶持政策、制定人工智能发展规划等措施，为头部企业提供政策上的保障。例如，设立专门的人工智能发展基金，对参与大模型研发的企业、科研机构、院校给予财政支持。鼓励其在大模型技术上进行探索和创新。通过设立示范项目，展示大模型的实际应用效果，推动技术在全行业的推广和应用。

二是在行业大模型方面，大模型头部企业与细分产业企业在不同领域进行分工合作，分领域联合开发大模型。各企业根据自身的优势和专长，选择不同的研究方向，联合开发有竞争力、有水平的大模型。建立跨企业、跨领域的协作网络，推动大模型的协同研发。通过定期的技术交流、联合项目、共享研发成果等方式，形成良性的合作机制。这样不仅可以加速技术突破，还能避免重复研发，节约资源。

三是金砖国家可建立跨国界的联合研发机构。多国可联合建设生成式人工智能研究中心或实验室，集中资源和科研力量，共同攻关技术难题，该机构专注于人工智能“大模型”的共同研究与开发，作为一个平台，

聚集来自成员国的顶尖科学家、工程师和技术专家，共享设备、资源和数据，协同攻关，以加快“大模型”技术的进步和应用。提高科研效率和成果质量。

（四）布局内容与生态，以应用带动整体能力发展

金砖国家在应用层面可以走差异化发展路线，通过发展内容、场景和生态，分类施策场景牵引，带动整体能力发展。生成式人工智能的未来竞争力将越来越依赖于其内容生态系统，这不仅包括数据资源和算法创新，还涵盖了广泛的应用场景和合作伙伴关系，构建一个强大的内容生态系统将是生成式人工智能发展的核心。这首先把各行各业的应用做好，C 端的大规模用户数据和 B 端的专业领域数据相结合，不断完善和强化大模型的底层能力和应用效果，通过建立 C 端超级应用培养用户认知，带动 B 端应用发展。

一是在 C 端应用方面，内容、场景和生态是整体发展的三大关键要素，需重点布局。关注用户在 C 端应用方面的共性需求，分别是内容生成与创意设计、信息提炼与专业辅助、智能交互。在内容布局方面，通过推广智能助手、内容生成工具等应用，吸引大量用户使用并产生丰富的互动数据，帮助优化模型的自然语言处理能力和内容生成能力，通过用户反馈提升模型的准确性和适用性。聚焦用户高频的应用场景，如办公助手、个性化学习辅助、情感虚拟人物陪伴等，开发定制化的解决方案，打造爆款应用，建立用户认知，同时推动行业应用的发展，形成良性循环。

二是在 B 端行业应用方面，分类施策场景牵引，“小应用，大推广”，

有序推进规模化应用。在重点行业和业务场景的选择上，遵循**“循序渐进、由易到难”**的原则。在重点行业方面，以金融、教育、法律等在客户服务和数据处理有强烈需求的重点行业为抓手，规模化落地标杆应用；在制造业等重资产行业，针对性采集专业数据集逐步进行模型训练开发，推动应用渐进发展。在重点业务场景方面，宜从目前进展最快的营销 / 服务环节向研发 / 设计和生产 / 制造等核心环节渗透，降低生成式人工智能使用门槛，让企业首先通过自有知识库的内容生成和智能对话，提升营销服务活动的效率和用户体验，进而提振信心，推动在生产制造核心环节复杂的时序分析、实时决策等场景的探索和应用。

（五）实施包容审慎的监管，推动国际合作与创新

生成式人工智能产品作为新生事物，鼓励创新和发展是主旋律。生成式人工智能应用初期可能会“犯错误”，但其自身也逐步建立了技术机制，针对内容、伦理等相关风险进行了过滤与阻断，经过用户反馈、专家机制优化迭代后逐步成熟完善。依托优良的网络环境、丰富的内容治理经验，以及完善的人工智能监管框架，中国及其他金砖成员国完全具备对生成式人工智能应用的治理能力，具体建议如下：

一是建立包容谨慎的监管规范，推动生成式人工智能技术沿着安全与性能 45 度平衡率（AI-45° Law）发展。推动可信生成式人工智能技术的发展，安全优先，同时保证生成式人工智能性能长期发展，促进生成式人工智能技术长期沿着 45 度安全与性能平衡发展，强技术驱动、全流程优化、多主体参与以及敏捷治理。例如，设立专门的人工智能伦

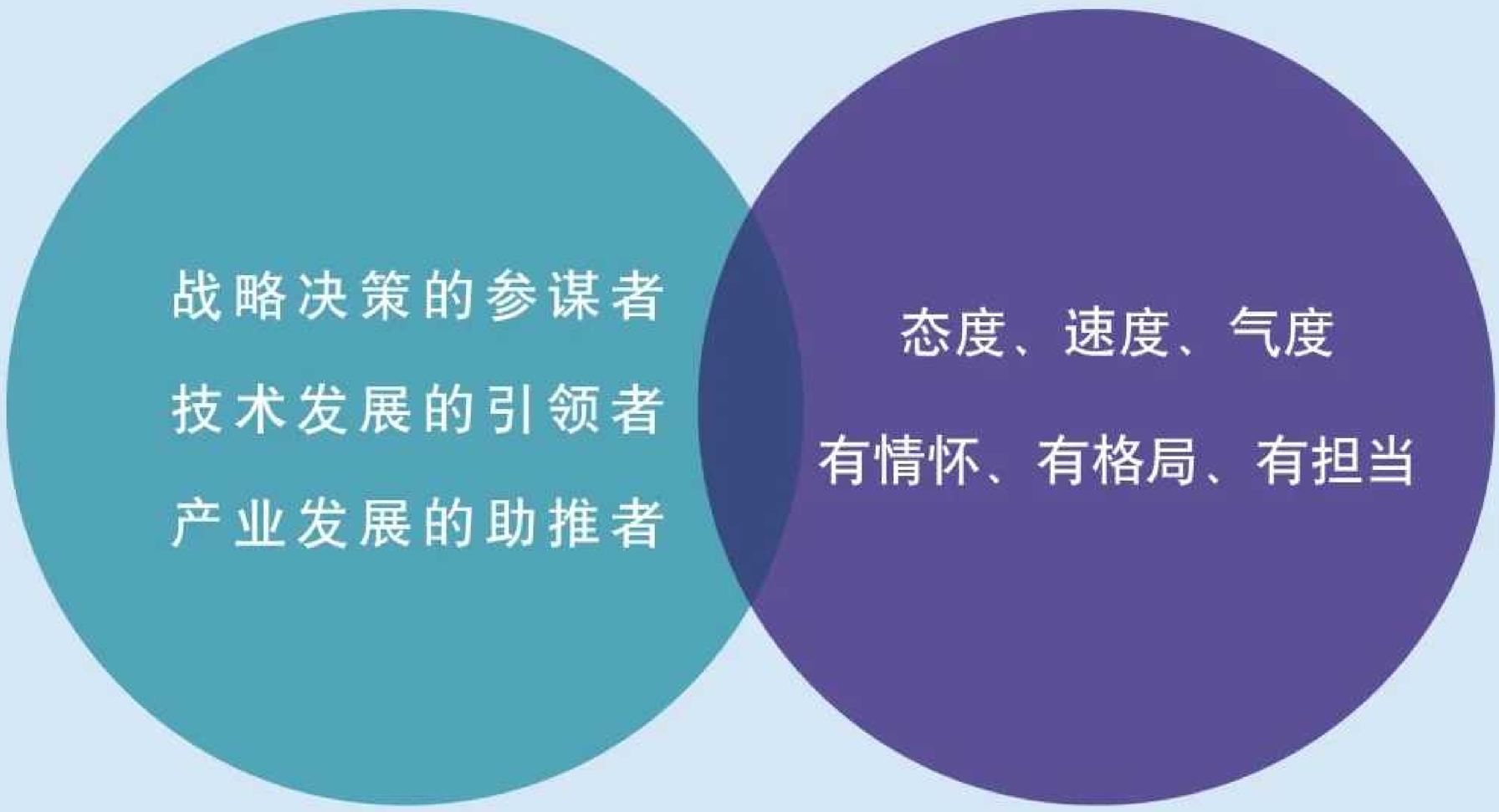
理委员会，负责审查和指导人工智能技术的伦理风险；针对生成式人工智能可能带来的个人数据隐私、内容安全等问题，建立个人数据保护和内容审查机制，保障用户权益和社会安全。

二是建立人工智能金砖合作机制。建立一个涵盖金砖国家的国际科研合作交流机制，各国的科研机构、企业和政府可以分享最新的研究成果和应用经验，促进各国在生成式人工智能技术研发和标准制定等方面的协同发展。同时，金砖国家可设立专门的跨国人才交流计划，鼓励科研人员、工程师和学生在生成式人工智能领域进行互访和联合研究，促进知识共享和技术互通。

三是建立金砖国家生成式人工智能产业联合投资基金。金砖国家可考虑联合设立投资基金，汇集各国政府、企业和资本的力量，提供充足的资金支持，助力生成式人工智能技术的研发和产业化应用。重点投资于生成式人工智能的基础研究、技术创新和产业应用项目，特别是前沿技术和具有高潜力的创新项目。通过基金的支持，可以加速技术突破和应用落地，提升金砖国家在全球生成式人工智能领域的竞争力。

中国有一句古话“合心之力，无所不克；集思之智，无所不成”，这正是我们面对挑战时所秉持的信念。中国愿与金砖各国携手努力，推动生成式人工智能在消费和产业领域应用深度和广度的突破，不断为推动建设开放型世界经济、构建人类命运共同体作出贡献，让世界更加繁荣、让人民生活更加幸福。

中国联通研究院根植于联通集团（中国联通直属二级机构），作为中国联通科技创新专业子公司，自2022年起，挂牌成立中国网络安全研究院、下一代互联网宽带业务应用国家工程研究中心及首个国家级网络安全产业知识产权运营中心，形成“两院两中心”发展格局，开创了研究院高质量发展的新局面。中国联通研究院作为服务于国家战略、行业发展、企业生产的战略决策参谋者、技术发展的引领者、产业发展的助推者，坚持以高水平科技自立自强为使命担当，聚焦网络强国、数字中国主责，拓展联网通信、算网数智业务，形成“态度、速度、气度、有情怀、有格局、有担当”的企业文化，以下一代互联网、光网络、5G-A/6G、网络安全、数智网优、低空智能网联和新型智库研究七个领域为主攻方向，坚持“四个聚焦”，开展关键核心技术攻关、科创力量建设、专业技术人才队伍建设、创新成果转化等工作，着力实现价值创造提升、战略科技力量提升、专精特新能力成色提升，争做通信行业科技创新主力军，努力建设成为“国家信赖、行业领先、集团倚重、员工自豪”现代化一流研究院。



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BRICS Business Council

China Digital Economy and Artificial Intelligence Working Group

The White Paper on the Application of Generative Artificial Intelligence in China

China Unicom Research Institute
China Unicom Global Limited
September 2024

中国联通 China unicom

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Preamble

Generative Artificial Intelligence (AI) is a new type of AI that generates new original content based on learning on a large scale. Through learning from a large amount of data or corpus, it generates text, images, videos, code, etc. that are either brand new or similar to, but not limited to, the original content. Generative AI has been gradually becoming the focus of the technology industry, reshaping the future of various industries, leading a profound wave of industrial innovation globally, and providing unprecedented opportunities for the intelligent development of China and even the BRICS countries.

This white paper focuses on the forward-looking trends in the development of the generative AI industry and provides in-depth insights into China's applications and practices in the field of generative AI. In terms of application, the white paper will introduce selected typical Chinese practices from two dimensions: the scenarios of residents' daily lives and industrial applications. For the scenarios of residents' daily lives, the needs in daily life, work, entertainment, and other segmented scenarios are analyzed, and ways to meet personalized needs and improve the quality of life are explored. For the scenarios of industry application, insights into the application of key industries such as telecommunication, healthcare, finance, and industry are provided, and in-depth explanations of the business pain points, development effectiveness, and application experience of the relevant industries are given. It is hoped that China's exploration and practice in the generative AI industry can provide a reference for the future development of BRICS countries. China is willing to collaborate with countries around the globe to explore new development models so that digital civilization can benefit the people of all countries and promote a community with a shared future for mankind.

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I.
The Development of Generative AI Enters an Exploding Phase

Generative AI promotes productivity innovation by revolutionizing the content production mode, leading the industrial transformation to ride the wave of digital-physical reality integration. It activates the potential of data elements, expands the integration space between digital and physical realities, and promotes the in-depth integration of digital and real economies, thereby improving the application modes and utilization efficiency of data resources in the real economy, supporting its digital and intelligent transformation, and ensuring the stability and sustainability of the digital economy.

1) Generative AI Creates New Space for Digital Economy Development

The rapid development of the digital economy has created a favorable economic and technological environment for the development of AI, which, as a critical new information infrastructure, is also regarded as a new driving force for the service sector and industry. Generative AI primarily empowers value in the industrial and service sectors. Meanwhile, agriculture, being a labor-intensive industry dominated by manually programmed operations, has a lower relevance to the advantages of generative AI for the time being.[1]

1. Generative AI Leads the Industrial Digital Innovation Revolution

Generative AI plays an important role in R&D, production, operation and management, promoting the intelligent transformation of industries and enterprises. Generative AI is reshaping industrial production through its highly automated design and manufacturing processes, which optimize production processes, predict equipment failures, improve efficiency, and reduce costs.

[1]*Source: "The Dawn of General Artificial Intelligence - The Industrial Impact of Generative Artificial Intelligence Technologies" Roland Berger*

Generative AI is reshaping industrial production through its highly automated design and manufacturing processes, which optimize production processes, predict equipment failures, improve efficiency, and reduce costs. Additionally, generative AI reduces the need for physical prototypes through simulation and virtual testing, shortens R&D timelines, aids workers in decision-making, provides real-time data analysis, and enhances supply chain transparency and responsiveness. As a core driver for the development of Industry 4.0 and smart manufacturing, generative AI brings new opportunities for industrial innovation and transformation.

Generative AI has improved the level of the service industry with personalized service, optimized customer experience, and improved operational efficiency. In the service sector, generative AI enables round-the-clock intelligent customer service and personalized ChatBots through natural language processing and machine learning, quickly responding to customer needs and thus improving customer satisfaction. In service industries such as finance, education, and healthcare, generative AI provides accurate risk assessment, personalized learning plans and health management programs with the help of big data analysis. Generative AI is driving the digital transformation of the service industry, innovating service models and improving service quality.

2. Generative AI Promotes Iteration and Upgrading of Digital Industries

The huge demand for computing power for generative AI contributes to the rapid expansion of the cloud computing market. As the number of generative AI applications increases, so does the demand for computing resources. This situation has encouraged cloud computing service providers to continuously upgrade their infrastructure and service capabilities to meet the demand for high-performance computing. The deployment and application of generative AI on cloud platforms enables enterprises to access computing resources on demand, effectively reducing hardware investment costs and promoting the rapid growth of the cloud computing market.

Generative AI drives the growth and maturity of the big data industry. Generative AI utilizes efficient algorithms and automation capabilities to achieve a qualitative leap in key aspects such as data cleaning, data labeling and data analysis, significantly improving the efficiency of data processing and reducing the cost of data processing. Generative AI also drives the development and progress of the big data industry by innovatively applying big data to create new business models and products.

3. Generative AI Helps Digital Governance of Society

Generative AI drives the development and implementation of digital government services. Generative AI technology has been implemented in a wide range of scenarios. It effectively promotes the development of an automated government service platform, improves the efficiency and experience of human-computer interaction, and provides strong support for constructing smart cities and villages. In addition, generative AI has contributed to the improvement of the digital information infrastructure, allowing scientific and technological progress to truly benefit the general public and improving the level of social development and capability of social governance, thus making people's lives more convenient, efficient, and better.

Generative AI helps improve multi-party collaborative governance systems. Generative AI technology requires compliance, data security, and user privacy in all aspects, including data training, design, and generation, thus encouraging industry associations and all sectors of society to actively participate in developing AI technology management specifications to foster collaboration in a multi-party governance environment. This provides a regulatory framework for the healthy development of AI technology, makes it a solid guarantee to support the healthy and stable development of the digital economy.

4. Generative AI Fully Activates the Potential of Data Elements

Generative AI enhances the value and utilization of data elements. In the generative AI era, data compliance and the value of private data receive much attention, prompting companies to pay more attention to data asset management, automate the generation of new content from training data, and efficiently transform existing data resources into valuable information, creating new value growth points for both users and companies. Generative AI also accelerates the improvement of the data governance system. Through the establishment of a sound data governance system and strict control strategies, enterprises ensure their data meets the requirements of data security and compliance throughout its life cycle, maximizing the value of data and providing strong support for their own continued development.

2) Global Generative AI Market is Promising

According to an industrial research report by Bloomberg, the overall global generative AI market is expected to generate revenues of $40 billion in 2022 and is expected to exceed $1.3 trillion by 2032, growing at a CAGR of 42% over the decade from 2022 to 2032. Generative AI has reshaped the traditional way of generating and accessing content, reduced the difficulty of acquiring and creating knowledge, stimulated the vitality and creativity of the digital economy, and is being fully integrated into all industries and fields in an innovative mode.

Scale of Global Generative AI Application, 2020-2032
(in 100 million USD)

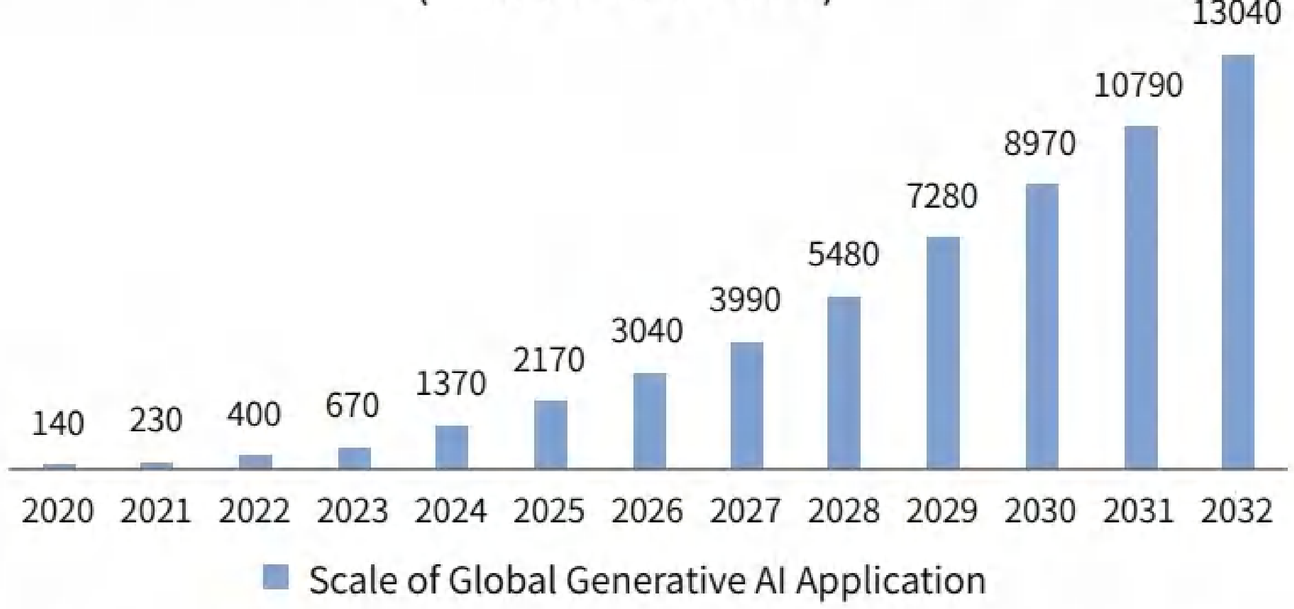


Figure 1. Scale of Global Generative AI Application, 2020-2032
(Source: industry research report by Bloomberg)

1. From Decision-making AI to Generative AI, AI Field Achieved Leapfrog Development

The development of artificial intelligence can be divided into two main phases, with 2012 as a notable turning point. Prior to 2012, it was the era of decision-making AI, a phase of AI technology that focused on analyzing conditional probability distributions in data, then, based on the results, making decisions, performing analysis, and carrying out predictions. Since 2012, generative AI has rapidly emerged as an important branch in the field of AI. Based on technological breakthroughs in various aspects, such as large language models (LLM), large computing power, and training methods, generative AI has achieved high-quality, high-efficiency, and diversified content production. It can generate a wide variety of content in various formats, including text, images, audio, and video.

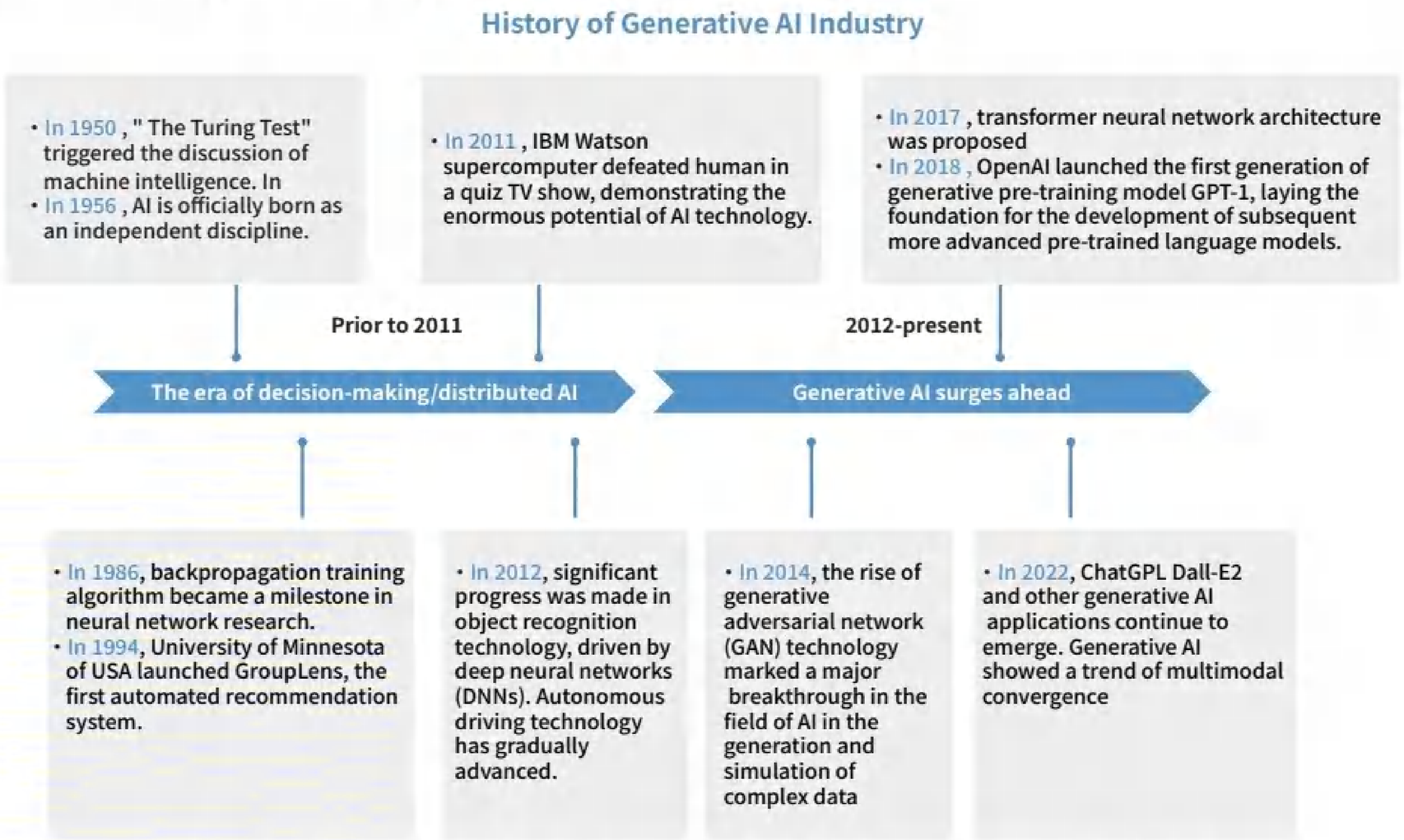


Figure 2. Stages of Development of AI Technology Applications
(Source: China Unicom Research Institute)

The history of global AI development has gone through four specific major stages: **The first is the early germination stage (1950s - 1980s),** in which the major event was the birth of the AI concept and its creation methodology. In 1950, Alan Matheson Turing's famous "Turing Test" sparked the discussion of machine-generated

intelligence. The first AI Symposium in 1956 officially announced the birth of the field of AI. **The second stage is the period of technology accumulation (1980s - 2010).** AI research and application gradually deepened, and the development of neural networks and deep learning technology laid the foundation for the subsequent AI explosion. In 1986, backpropagation training algorithm proposed by Geoffrey Hinton and his colleagues marked a milestone in neural network research. The rise of deep learning technology in 2006 led to a new wave of AI technology. **The third stage is the rapid development period (2011 - 2016),** in which the practical application and influence of AI technology began to expand rapidly. The introduction of adversarial neural network (GAN) technology in 2014 and the victory of Google's AlphaGo robot over the Go world champion in 2015 not only demonstrated the ability of AI to outperform humans in specific domains but also stimulated widespread interest and promoted research in AI technology. **The fourth phase is the explosion period (2017 - present).** The introduction of the Transformer architecture in 2017 marked AI entering the era of LLM. 2022, dubbed the first year of generative AI, saw the rise of generative AI applications such as ChatGPT, Dall-E 2, Midjourney, Stable Diffusion, and more. AI showed great potential in text and image generation, opening a new chapter in multimodal integration.

2. Organic Unity between a Capable Government and Efficient Market Secures U.S. Leadership in Generative AI Globally

The strategic planning of U.S. generative AI development is stable and progressive. It prioritizes administrative governance with a focus on soft law constraints. In both the development and governance of generative AI, the U.S. government has always insisted on the stability of the development strategy and the progressiveness of the governance strategy, aiming for long-term development and effective management in the generative AI field. In October 2023, the U.S. government introduced the first regulatory provisions on generative AI, marking a shift in the U.S. AI sector from mainly observing and exploring in the generative AI

field to an approach of active guidance and regulation. The regulatory provisions provided a clear direction for development and normal standards for the innovative application of generative AI and promoted the healthy growth of the technology while ensuring that ethical and safety standards are properly maintained.

The U.S. attaches great importance to the development of AI technology and has always been at the forefront of generative AI industry advancement. The government encourages the active participation of the private sector and continues to promote technological innovation and applications. The U.S. is leading the generative AI wave thanks to its strong industrial foundation, superior innovation capabilities, and robust capital support. The U.S. is home to many of the world's leading AI technology providers and model developers. NVIDIA and other basic layer technology providers deliver strong hardware support for the development of generative AI technology through continuous technological innovation, and OpenAI and other model developers promote the widespread application of AI technology in various fields by developing advanced generative AI models. In addition, U.S. generative AI companies have gained strong support from the capital market. Data show that U.S. startups alone accounted for 89% of the funding in global generative AI investment flows, a capital advantage that has provided a strong impetus for the rapid development of the U.S. in this field.

The U.S. government is committed to promoting open data to advance the technology and promote the applications of generative AI LLM. Given the extremely high demand for high-quality model data for generative AI, in January 2024, the U.S. government launched a six-year National Artificial Intelligence Research Resource (NAIRR) pilot aimed at providing U.S. researchers and educators with richer computational and data resources to solidify its global leadership in the field of generative AI. By establishing a data resource service platform, the federal government has integrated open-source data resources from the government and all sectors of society, established unified data aggregation standards and standardized data description formats, and facilitated the effective integration of different sources and types of data. All these efforts are to support the optimization and iteration of

generative AI LLMs.

3. Other Countries accelerate the Strategic Plan of Generative AI with Various Emphasis on Development Paths and Operation Plans

The EU focuses on compliant applications of generative AI, with a strong emphasis on data security and user privacy protection. In principle, EU institutions are permitted to develop, deploy, and utilize generative AI systems for the provision of public services in compliance with the applicable law, but at the same time must focus on the protection of users' data security. On June 3, 2024, the European Data Protection Supervisory Authority (EDPS) published the "Generative Artificial Intelligence and the EUDPR"[2] guide, the first AI and data security guide applicable to EU institutions, which provides an important reference for the responsible use of generative AI systems by EU institutions. The guide focuses on the principles of data minimization, data accuracy, and data security and highlights the importance of transparency, accountability and upholding the rights of individuals throughout the lifecycle of AI systems.

The UK fully exploits the potential of generative AI and promotes the innovative development of generative AI in education. In February 2024, the UK Department for Education released the "Generative AI in Education" report, actively advocating the widespread application of generative AI technology in educational practices such as creating teaching resources and assisting student learning. The aim is to enhance teaching efficiency and improve education quality. The report also pointed out that the introduction of generative AI technologies requires prudent consideration of the risks and challenges they may bring, including the risk of academic misconduct, data security, and privacy issues, increased technological dependence, and the potential impact on educational fairness. It also emphasized the need to ensure the healthy development of generative AI technologies in education through the development of relevant policies, strengthened regulation of the education sector, and the rational use of technology.

[2]*Note: EUDPR refers to European Union Regulation 2018/1725*

India is actively partnering with global tech giants and has high hopes for generative AI development. In August 2023, Google launched SGE, a generative AI search service, in India. SGE not only provides links to traditional search results, but also shows users more comprehensive and intuitive answers through smart integration. In September of the same year, Indian IT services company Infosys announced a collaboration with Microsoft on a generative AI program, combining the strengths of their respective AI technologies to develop industry-leading solutions. In April 2024, Infosys further expanded its strategic partnership with U.S. chip giant Intel to adopt solutions based on Intel technology to help customers integrate generative AI technologies into their business processes, helping business optimization and innovation.

3) Generative AI in China Accelerates Breakthroughs

China's generative AI market is expanding. According to iResearch's forecast, the scale of China's generative AI industry is about 14.3 billion yuan in 2023, and it is expected to reach 720.2 billion yuan in 2030. China's generative AI industry's ecology is becoming more and more solid, realizing technical value in the key fields and key scenarios, and gradually establishing and completing a model-as-a-service industrial ecosystem. The scale of China's generative AI industry is expected to exceed the 1 trillion yuan mark in 2030.

Scale of China's Generative AI Industry, 2022-2030
(in 100 million RMB)

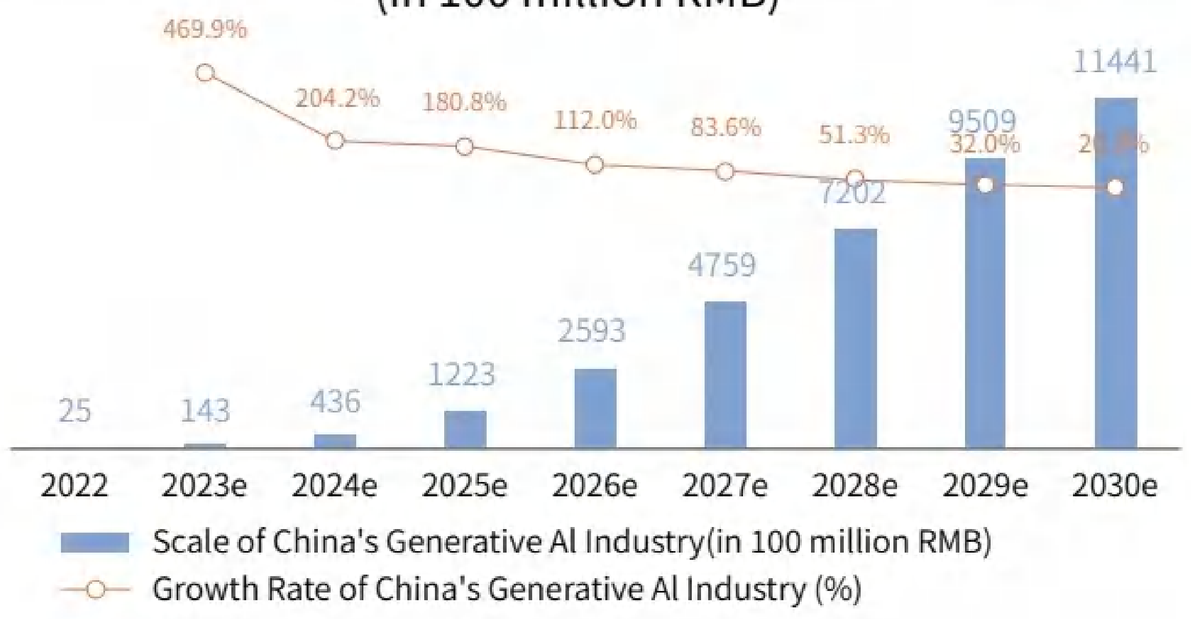


Figure 3. Scale of China's Generative AI Industry, 2022-2030
(Source: iResearch)

1. China's Generative AI Starts Late but Gains Momentum

Compared to AI development globally, China's AI industry started late, dating back to 1978. With the rapid development of the Internet and the iterative updating of technology over the past four decades, China's AI industry has experienced multiple stages of development, from initial exploration to accelerated growth to rapid development. Since 2022, with the launch of a series of home-made LLMs, China has formally stepped into the golden development period of generative AI, showing unprecedented vigor and potential.

Figure 4. Development History of Generative AI in China
(Source: China Unicom Research Institute)

Development of Generative AI in China is divided into five stages. **The first stage is the nascent and early stage (1978-2000),** marked by the publication of Artificial Intelligence and Its Applications in 1987. The theoretical exploration and preliminary experiments of AI in China took the first step, but it has not yet been widely promoted and applied. **The second stage is the initial exploration period (2001-2012).** After entering the 21st century, AI research received strong support from various national-funded programs, such as the National Natural Science Foundation of

China (NSFC) and the Ministry of Industry and Information Technology (MIIT) Major Project Fund. These efforts led to results such as cognitive computing of visual and auditory information, the key technology of the Chinese smart search engine, iris recognition, speech recognition, and human-robot interaction and cooperation based on bionic robots. **The third stage is the accelerated growth period (2013-2015).** Thanks to the advancement of emerging technologies such as big data and cloud computing, AI has made breakthroughs in the fields of natural language processing, machine vision, and smart interaction, providing the industry with development opportunities. Enterprises began to actively explore the application of artificial intelligence technology in various fields, promoting the rapid development of the industry. For example, Baidu launched the Wise Eye antivirus engine, which applies deep learning technology to client-end virus scanning and forms the world's largest open-source platform for deep machine learning. The Chinese Academy of Sciences and Alibaba jointly set up a quantum computing laboratory, which has further promoted the development of artificial intelligence technology. **The fourth stage is the rapid development period (2016-2021).** With the implementation of many national policies, China's AI industry has entered a policy-driven period. In 2016, the State Council issued the "13th Five-Year" National Science and Technology Innovation Plan, which explicitly listed AI as a major science and technology project at the national strategic level. In 2020, the "14th Five-Year Plan" stated that AI is an important part of the "new infrastructure" and is regarded as the core driving force of the new round of industrial transformation. AI ushered into the spring of development. **The fifth stage is the boom period (2022 - present),** during which generative AI is developing rapidly and gradually becoming the "star" in the AI field. Chinese enterprises devote themselves to this innovative field, giving rise to the birth of many domestic generative AI LLMs. As of March 2024, a total of 117 LLMs have been successfully completed for algorithm and service dual filing in the Cyberspace Administration of China[3]. The enterprise is committed to deeply integrating generative AI LLM technology with practical application scenarios, with a strong focus on the innovation and commercialization of business models to unlock the true

[3]*Dual filing: "filing for in-country deep synthesis service algorithm" and "filing for Generative AI service"*

value and commercial potential of the technology.

2. China Actively Promotes Technological Innovation and Application Expansion

Accompanied by technological innovation and in-depth industrial integration, China's generative AI industry is expanding rapidly, and the market size has ranked among the top in the world. Thanks to policy support, the active participation of the capital market, and the continuous expansion of application scenarios, China's generative AI industry has gained rapid development momentum.

China's generative AI policy environment continues to improve, providing strong support for this field. In November 2022, the Cyberspace Administration of China and three other departments jointly issued the Provisions on the Administration of Deep Synthesis Internet Information Services, China's first synthesized content management policy, which aims to use depth synthesis technology in accordance with the law reasonably and effectively, and to proactively guard against and resolve related risks. In July 2023, the Cyberspace Administration of China and seven other departments jointly issued the Interim Measures for the Administration of Generative AI Services, which is China's first regulatory document on generative AI. It marked the fact that "development" is gradually becoming the first perspective of China's governance of generative AI and establishing an inclusive and prudent, graded and classified regulatory tone. It establishes an inclusive, prudent, graded, and classified regulatory underlying basis and puts forward requirements such as safety assessment, filing, and labeling of generated content, which will help to promote the standardized application of generative AI technology and the high-quality development of the industry as a whole.

The investment scale of China's generative AI is growing fast, driving the rapid development of generative AI companies. China's generative AI field is ushering in a period of rapid growth in investment, attracting various kinds of investors, from venture capital to industrial capital, to set their plans. According to IDC's report, China's generative AI investment accounted for 4.6% of the total investment in the

entire AI market in 2022, which is expected to reach 33.0% by 2027, with investment expected to exceed $13 billion, a five-year CAGR of 86.2%. China's huge market scale and rich application scenarios provide a broad development space for generative AI companies, attracting more capital attention and investment and forming a benign and interactive investment and innovation ecosystem.

The application scenarios for generative AI in China are growing, with a focus on dominant industries that are mature in commercialization and development. Domestic companies take advantage of the scenarios in vertical fields in the local market and prioritize the application of generative AI technologies in emerging industries with better commercialization infrastructure, especially in the fields of e-commerce, media, entertainment, and gaming. For example, the e-commerce industry enhances brand marketing through digital avatars and video marketing, while the gaming industry utilizes generative AI technologies to develop AI accompaniment and competitive robots and natural language processing technology to enrich the interactivity of game characters and enhance the player experience.

II.
Generative AI industrial Development Forecast

The generative AI industry can be broadly categorized into three layers: the infrastructure layer, the model layer, and the application layer. The infrastructure layer is a key resource engine for the development of the generative AI industry, and the demand for big computing power will drive the construction of digital infrastructure. The model layer is the original driving force of industrial technology transformation; the implementation of LLMs will empower thousands of industries, promote the digital transformation of traditional industries, and bring a new round of fusion of AI into other industries. MaaS model will continue to serve as the key business model for the implementation of LLMs to reconfigure the value circulation of the industrial chain and the path of technology transfer. The application layer is where the technology of the generative AI industry delivers its actual value. It will profoundly affect consumption, work, and life through a change in the way content is produced and human-computer interaction.

The future development of generative AI is predicted to have three waves. **The first wave is exploration and initial application.** In the next two to three years, industry development will focus on the construction of computational infrastructure and data infrastructure, and the application scenarios are still being explored. The C-end application will mainly focus on general-purpose applications, represented by chat assistants. The B-end application will mainly be about knowledge assistance, customer service, and marketing scenarios in finance, law, education, and other industries, with text interaction as the carrier. **The second wave will be technology maturity and further deepening of industry development.** In the next three to five years, C-end applications will grow, while B-end applications will infiltrate the core scenarios and links of advanced manufacturing and healthcare industries, with an emphasis on vision technology and the use of dynamic data analysis and management. **The third wave will be the popularization and booming of innovation.** In the next five to ten years, generative AI will be more closely integrated

with the real world, so that it can learn and interact through perception and action to discover entirely new application areas; at the same time, on the industrial side, it will become a standard must-have tool for enterprise applications.

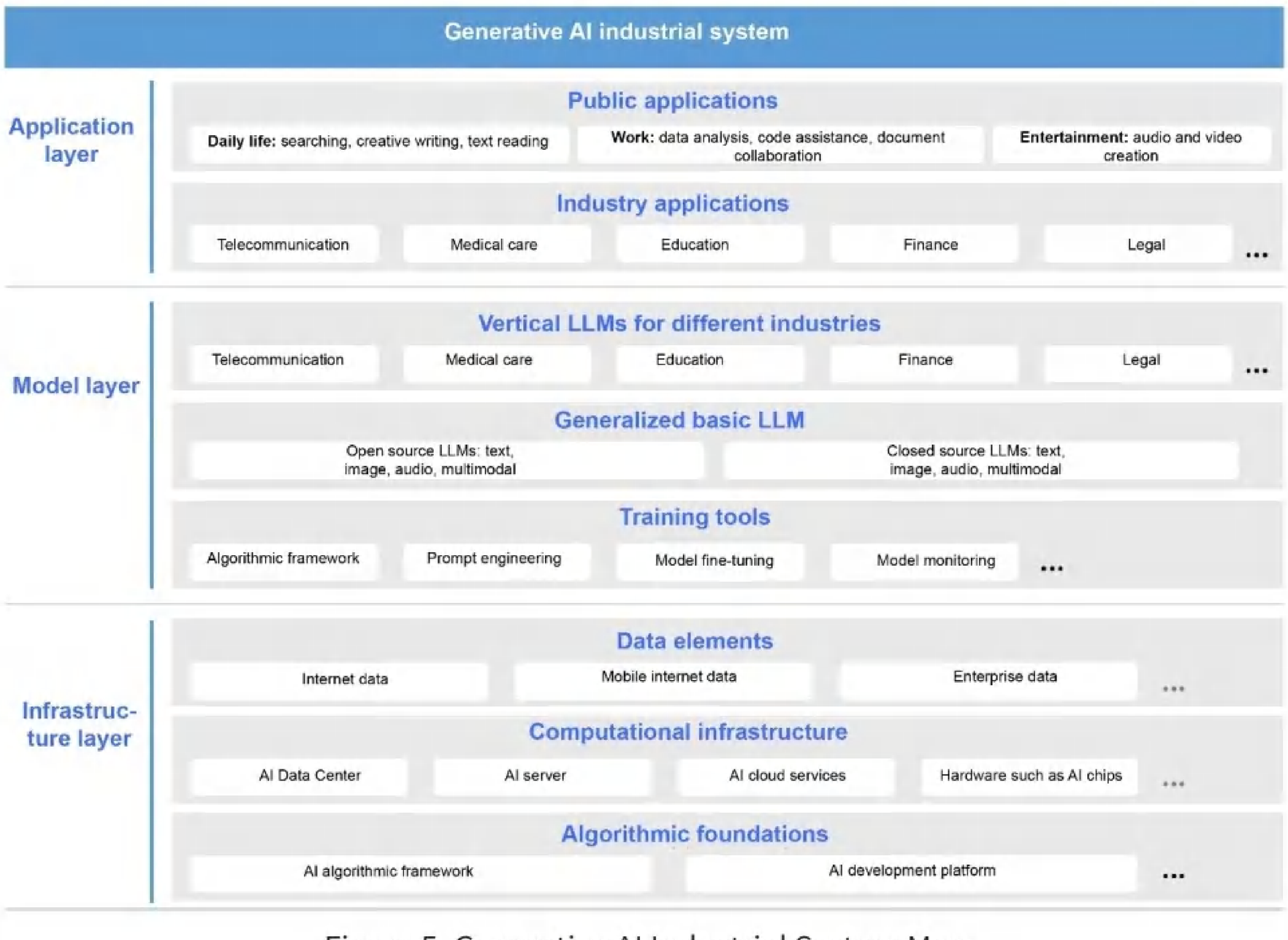


Figure 5. Generative AI Industrial System Map
(Source: China Unicom Research Institute)

1) Infrastructure Layer: AI Computing Facilities will be the Cornerstone of Industry Development

The infrastructure layer consists of two main layers: the arithmetic base layer and the database. The infrastructure layer is the underlying architecture of the generative AI industry, providing computational and data resources to support model development and applications in the upper layers. The arithmetic layer refers to the hardware and software resources used to train and run generative AI models, including GPUs, TPUs, high-performance computing clusters, and cloud computing platforms. The data layer deals with the collection, storage, management,and processing of data. Data is the key raw material for training generative AI models, and the data layer includes

data warehouses, data lakes, data labeling, and preprocessing tools.

In the area of computing infrastructure, China has made significant progress in high-performance computing and cloud computing. Leading Chinese cloud service providers such as Aliyun, Tencent Cloud, and Huawei Cloud are investing heavily in large-scale data centers to provide powerful arithmetic resources. China's supercomputers also top the global rankings. **In the area of data infrastructure,** thanks to the result of vigorously promoting the construction of Digital China, in terms of industrial data resources, the country now owns relatively abundant high-quality industrial data resources, especially in the fields of transportation, energy, and intelligent manufacturing, etc.; in terms of public data resources, the government and enterprises are also actively promoting data sharing and data governance, promulgating the "Data Elements X "Three-Year Action Plan (2024-2026)" which explicitly supports the development of AI LLMs.

The demand for data training and inference puts forward higher requirements for the capacity of data centers, and at the same time, the demand for training and the inference of huge computing power will drive the construction of new digital infrastructure. The industry trends are as follows:

Trend 1: Demand for data training and reasoning puts higher demands on data center capacity, and the supply/demand structure of arithmetic power is under pressure

Since Google proposed the Transformer architecture in 2017, the development of AI has gradually stepped into the era of pre-trained LLMs. In 2018, the number of GPT model parameters in Open AI reached 11.7 billion. The volume of model parameters has begun to achieve leapfrog development based on billions. On average, it shows a trend of doubling every three or four months. As the resource engine of the digital intelligence era, with the increasing scale of parameters in LLMs of the generative AI era, the structure of computing power supply and demand continues to face growing pressure. In addition, as the amount of data and computation skyrockets, the network bandwidth of data centers needs to be optimized to achieve high-throughput and low-latency transmission and connectivity within and between

nodes. In the face of the contradiction between supply and demand structures in the computing power layer, countries need to accelerate the development of infrastructure construction in the computation layer, and some countries are now taking active actions. In the 2023 global computing power index ranking, the United States is ranked first, with a computing power index of 82, the largest number of data centers, and a total arithmetic scale of 270 EFLOPS, of which the scale of the smart computing power is about 180 EFLOPS, and the infrastructure support is leading globally. China ranked second, with a computing power index of 71 and a total scale of 230 EFLOPS, of which the smart computing power reaches 70 EFLOPS. At present, all parts of China are accelerating the building of AI computing capabilities and continuing to optimize the computing power resources to satisfy the demand for large computing power in future high-speed development.

Computing power index and ranking of each country

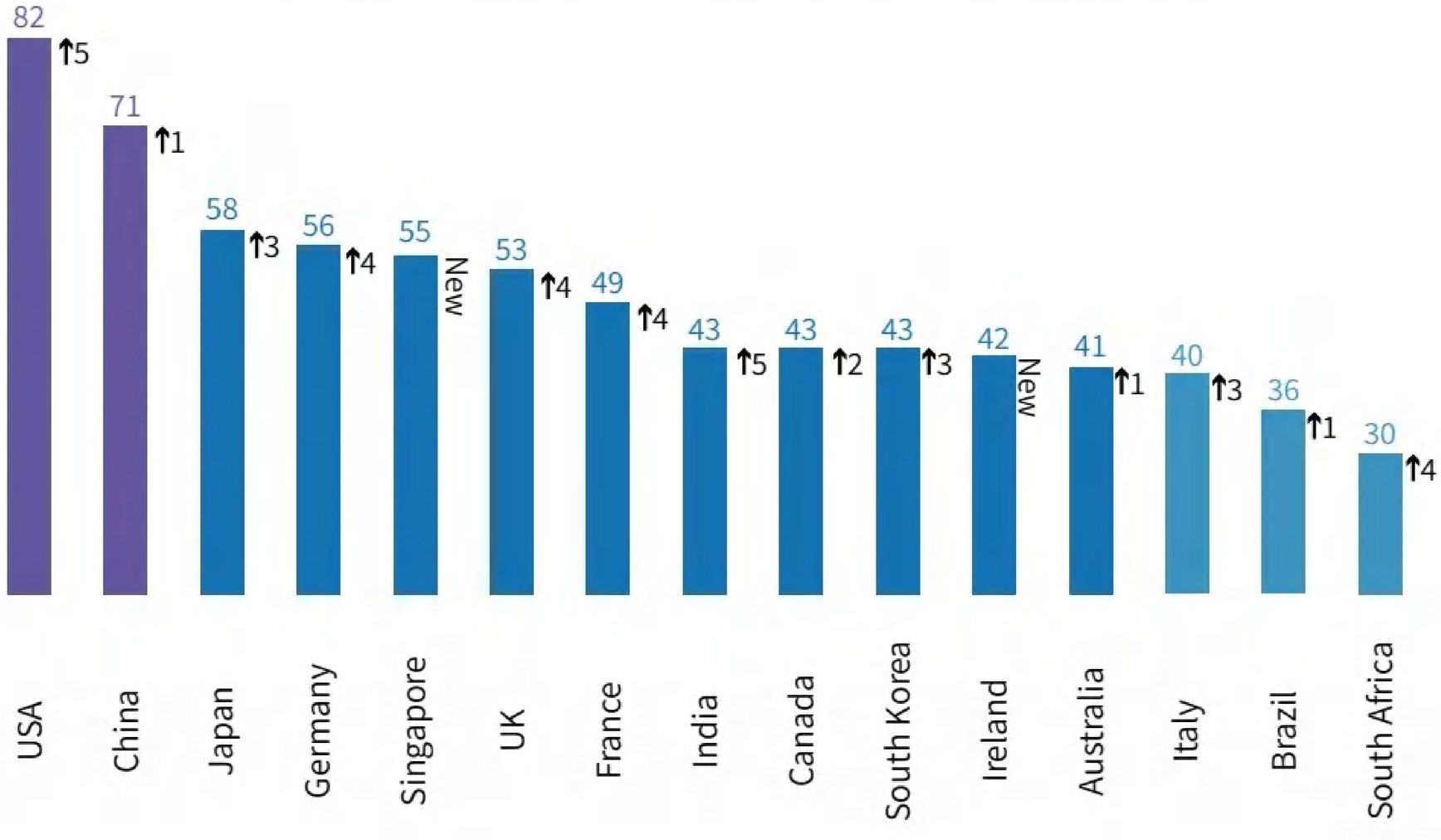


Figure 6. Computing Power Index and Ranking of Each Country
(Source: IDC)

Trend 2: Data plays an increasingly important role in generative AI

The improvement of generative AI capabilities relies heavily on high-quality

datasets, and in the future, there will be a greater focus on the accuracy of data and the diversity of data sources. In terms of multimodal data, more and more applications in the future will need to combine multiple types of data, such as text, images, audio, and video. This requires data collection and generation to cover a wider range of content and forms to support the training and application of multimodal models. In terms of real-time data, the development of IoT devices and sensors has made the collection of real-time data possible, which has not been exploited on a large scale. IoT devices can provide real-time sensor data, such as temperature, humidity, and motion. This data can be used in real-time monitoring and prediction systems to support the application of generative AI in smart homes, smart cities, and other areas. At the same time, it provides a richer and more dynamic data source for generative AI, enabling real-time updates and feedback. In terms of synthetic data, generative AI technology can be used to generate high-quality synthetic data that can be used in the future for model training, testing, and validation, reducing the reliance on real data.

2) Model layer: LLM business models will gradually be closer to front-line users

In generative AI, the "model layer" is the core of a generative AI system, responsible for processing and generating data. The core task of the large language model is to constantly predict the next "reasonable" character based on prompt words and existing text. At the bottom of the LLM is a deep learning network that can absorb knowledge like a sponge and compress it losslessly.

The model layer is divided into two categories: general LLMs and industrial LLMs, of which the general LLMs mainly include closed-source and open-source models; while the industrial LLMs mainly include specialized models for finance, healthcare, law, and other fields. The scale of computing power determines the efficiency of model upgrade iterations, and the training time of LLMs is inversely proportional to the total computing power, so companies with higher capital advantages and computing power resources have a better chance of releasing model updates ahead of the curve.

Currently, the U.S. is the leader in the field of LLMs, and China started slightly behind and is currently making up ground in the global process.

In the model layer, the industry's development of LLMs will continue to evolve in the direction of multimodality. MaaS has reconstructed the business ecology of the generative AI industry and stimulated the emergence of new divisions of labor and modes in the industrial chain, making the model layer closer to the application layer. The specific main trends in the development of the model layer are as follows:

Trend 3: MaaS reconstructs the value circulation and technology delivery paths of the AI industry chain

MaaS[4] model lowers the threshold for application development, reconstructs the ecology of the commercial structure of the generative AI industry, and stimulates the emergence of new industrial chain divisions and business models. In the future, MaaS will become the dominant business mode for LLMs. MaaS models are now the top strategic priority for cloud vendors, who see this model as a key production element. Relying on the established laaS facilities and PaaS platform architecture, it provides downstream customers with services such as data processing, feature engineering, model training, model tuning, and inference deployment centered on LLMs. In the future, in line with the trend of open-source LLMs, MaaS services will focus on building LLM-based e-commerce platforms, making efforts to develop LLM ecosystems, incorporating more open-source models that are allowed for commercial use, enhancing the platform's base model types and capabilities, and enriching the toolchain products and services. Gradually, it can form technical barriers through flowback data and model iteration, creating core competitiveness for the vendors.

In addition, there is a difference between the commercialization of the MaaS model on the B/G end and the C end while implementing it. On the B/G end, there is a need to carry out a large amount of engineering work for industry domains and business scenarios, especially in traditional industries where it takes a long time to acquire and accumulate knowledge; even within the same industry, the pain points of each subdivided scenario are different, and the penetration rates of the large AI

[4]*MaaS (Model as a Service): refers to the cloud computing, intelligent computing power, modeling capabilities and other resources to achieve high degree of integration. The customer can invoke, development and deploy these models directly in the cloud*

LLMs are significantly different. The fragmented nature of application scenarios leads to a longer cycle for the construction of low-cost capability platforms with strong generalization capabilities. The C-end user volume is huge, the threshold of tool use is low, the application and future growth speed is faster, and "application store" and other innovative business models continue to emerge. Through the "dialog + plug-in" approach, the LLM's single point of access tools can be connected to the vendor's own or third-party applications, creating a new user interaction interface and portal.

Trend 4: AI agent will inject new productivity into various industries

An AI agent is an agent that can sense the environment and its needs, make decisions and perform actions. Compared to the infrastructure of the LLM, the AI agent near the application layer is more autonomous, an evolution of prompt engineering that disassembles customer instructions and performs tasks autonomously. The biggest improvement of the AI agent over the LLM is the addition of the ability to act autonomously, eliminating the need for human intervention in achieving goals. The current trend is that AI is evolving from a simple tool to an assistant or even an agent for complex tasks. The turning point of this transformation lies in the breakthrough of AI technology in deep learning and autonomous decision-making capabilities and then integrating vertical industry data and business insights into the agent framework. This ensures the LLM application can accurately understand the complex task requirements, autonomously select the most appropriate solution, and effectively control the task progress. At that time, it can achieve intelligent transformation in various industries and promote exponential growth in productivity. In the future, AI agents may be integrated into all levels in an organization and form an interconnected ecosystem with human employees. This deep integration not only optimizes the organizational structure and improves operational efficiency, but also creates unprecedented value for the enterprise.

3) Application layer: content, scenario and ecology will be the key to application development

The application layer reflects the specific implementation and commercialization scenario of generative AI technology, which contains two major application scenarios: software and hardware. At the software level, generative AI technology applications are mainly categorized into two scenarios: productivity and pan-entertainment, and at the hardware level, the end use gradually expands from cell phones and computers to wearable devices and from self-driving cars to robots. The main development trends of the application layer are as follows:

Trend 5: Content and ecology are the cornerstones of future generative AI applications

"Content" and "ecology" will determine the development of generative AI applications, and "scenario-based experience" is the ultimate reflection of user value. Content-enabled models and scenario-driven implementations complement each other. The ability of generative AI mainly comes from the learning and training data, so having high-quality and diversified content resources will be the key foundation for the development of its application. The high-quality content ecosystem behind the application will be the core element that determines its ability. A strong content ecosystem not only provides impetus for model training but also establishes the knowledge foundation for customized applications. Enterprises with leading content advantages will have a head start in application expansion. On top of the content, how to provide users with a seamless intelligent experience is the key to the actual implementation of generative AI. Generative AI needs to be fully embedded in the application scenario, serve the user in a highly intelligent and natural way, and ultimately achieve the effect of a "senseless" experience. Enterprises need to synchronize the plan of the two dimensions of "content ecology" and "scenario-based experience" in order to lead the innovation of generative AI applications in the fierce competition.

Trend 6: On-device applications bring broad application scenarios and promote on-device intelligence transformation

The application of on-device AI reduces the scale of parameters in LLMs to tens of billions, greatly reducing marginal inference costs. Compared to the public cloud,

local deployments have the advantages of low cost, low latency, high privacy, and being free of geographic network restrictions. AI inference will run on end-user devices such as cell phones, portable computers, and automobiles. On-device AI has some unique advantages, such as more efficient local data processing, savings in cloud server bandwidth and computational costs, and better privacy protection for user data. Among them, the on-device AI application will bring users a new experience that is smooth, convenient, and attentive and will become the main driving force to promote users' consumption upgrading. As the vane of new technology applications, automobiles and cell phones will be prioritized in the implementation of on-device LLM technology. On mobile devices, AI assistants on cell phones can provide cross-application, system-level services that allow users to communicate with the assistant through voice input or other interactions. On the automobile side, users can have direct conversations with AI assistants in the in-vehicle system to enjoy a full range of services, including ordering food, shopping for clothing and household items, and planning transportation.

III.
Typical Examples of Practices and Applications of Generative AI in China

With the rapid development of generative AI in recent years, the AI infrastructure has been gradually improved. Deep learning technology has continued to make progress, and the application scenarios of generative AI have gradually increased. In the age of AI, data has become a key building block to drive its development, with LLMs as the efficient host. With the versatility and customizability of LLMs, a solid foundation has been laid for generative AI, which in turn drives its ability to innovate and break through in a wider range of domains.

The penetration path of generative AI can follow the basic development logic of the digital industry, which is divided into two main areas: the C-end and the B-end/G-end. On the one hand, the application of generative AI in the C-end has gradually matured. Various types of C-end products for general users form various AI creation tools by flexibly invoking the generalized LLM APIs to reach users in the form of content and tools. They provide a wide range of functions, such as text generation, image generation, audio/video generation, and code generation, which have greatly enriched users' daily lives and work experiences. On the other hand, the C-end-driven B-end/G-end development model will become an important evolutionary trend for generative AI. With the combination of the significant features of generative AI, such as authenticity, diversity, controllability, and combinability with the LLM's capability, generative AI is expected to gradually replace or supplement the traditional small computing models and software functions and penetrate deeply into various industries. This will help companies improve production and operation efficiency and provide customized solutions such as precision marketing and customer service optimization. Meanwhile, generative AI will continue to drive innovation and lead industry transformation in sectors with high digitization and content requirements, such as healthcare, finance and education.

The rise of LLM technology has led to a boom in generative AI. On the supply side,

the basic capabilities of the LLM will further drive the development of upper-layer applications, the formation of developer tool ecosystems, and the technological routes of the underlying hardware; on the demand side, the LLM greatly improves the user experience in chat conversations, text translation, search engines, and content generation, and facilitates the explosion of the next-generation generative AI-native applications in diversified scenarios. This chapter explores the application practice of generative AI in China in depth and analyzes the product matrix, service model, key scenario applications, and other dimensions comprehensively. It also shares the successful application experience of generative AI in China, providing a clear and in-depth understanding of the perspective for the BRICS countries and getting ready to embrace the arrival of a new era of generative AI together.

1) Generative AI Embeds in Daily Life Scenarios, Reshaping a New Chapter of Intelligent Living

Generative AI is penetrating people's lives and work, and on the demand side, C-end users' needs for generative AI are diversified and personalized. Whether it's the convenience of intelligent interaction, the efficiency of document creation, the accuracy of code generation, or the intelligence of decision assistance, users are looking for application solutions that better suit their particular scenarios. And on the supply side, LLM vendors are working harder, enhancing their application capabilities based on core functionalities such as text, images, and audio. For LLM vendors and industry participants, how to better dig deeper into user needs, lower the barrier for entry to using LLMs, grasp emerging technology trends, and promote ecological co-construction and sharing will be the keys to future development.

In our daily lives, the applications of LLMs are exemplified by ChatGLM, ERNIE Bot, Kimi, etc. Based on their own technological accumulation and university research resources, they have launched a series of open services with text and image generation at their core. The result is that they have lower barrier of entry for users through AI agent creation and other technologies, further explore the potential

application scenarios of generative AI and achieve seamless integration between the external tools and services and the LLM, thus accelerating the virtuous cycle and development of the whole application ecology.

In the scenarios for work, generative AI has covered a number of segments, such as intelligent interaction, document creation, code generation, etc., providing users with a full range of support. SenseTime's innovation, SenseNov Raccoon, has excellent code generation and modification capabilities, which can improve the coding efficiency of users by 20% to 78%. Meanwhile, Kingsoft WPS AI and others have realized leaps in office efficiency and quality in multiple dimensions, enabling users to complete routine tasks that used to take hours in just tens of seconds, thereby lowering the barrier to entry for using generative AI in the office.

In the entertainment scenario, from picture design to video generation to cutting-edge technologies such as avatars and 3D model generation, each technological breakthrough has brought users a new experience. The video creation applications, represented by Pixverse, can generate high-quality, continuous, and consistent video content based on their excellent video generation capability. This lowers the barrier to entry for video creation and allows more users to participate in it. Zhumengdao focuses on the innovation and development of avatars. Relying on the corpus of copyrighted novels from China Literature, users can have in-depth communication with their favorite virtual characters, meeting the needs of users for emotional companionship.

1. Gen AI+ Everyday: Integrating into Daily Lives and Enhancing Intelligent Experience

Generative AI's search Q&A functionality is already playing an important role in everyday life. Through deep learning and analyzing massive data, combined with the ability to search through the whole network, this function enables AI to understand and respond to all kinds of questions, covering diversified fields such as general knowledge, academics, and technology. It is able to infer and logically

analyze the user's query, providing more accurate and efficient answers compared to traditional search engines. The generative AI's search Q&A functionality has a wide range of applications, not only helping students solve their academic problems but also providing medical advice to doctors, assisting investors in analyzing market dynamics, and helping people cope with problems in daily life. In addition, this function is known for its significant scalability and intelligent features. Based on user feedback and data, it can continue to learn and optimize to reduce the user's search time and improve the quality and efficiency of the search.

Generative AI is commonly used in the field of literary creation. Relying on automated, intelligent, and adaptive text generation technology, this feature significantly improves the efficiency and quality of content creation. In **inspiring creativity**, the generative AI writing tool can automatically generate engaging article titles and summaries, provide writing suggestions according to context, and generate content based on keywords or topics. This helps creators break through the limitations of their thinking and quickly capture creative inspiration. In **ensuring an article's quality**, the generative AI error correction tool helps creators avoid common mistakes and improve the professionalism and readability of their articles through meticulous grammar, spelling, and punctuation checks, as well as style and wording suggestions. In **broadening the field of creation**, the generative AI co-creation tool helps achieve cross-domain knowledge integration, human-machine collaboration, and promotes creation to a higher level of innovation and exploration. In addition, the application scenarios of the generative AI writing ability are extremely rich, covering a wide range of fields such as creative copywriting, novel creation, travel guides, scientific research literature, etc. It not only reduces the manpower but also decreases the cost associated with creating and brings unprecedented convenience and possibilities to creators.

Long text reading and processing capabilities have become a differentiator in the competitive generative AI market. Users' needs for text processing have expanded from short text acquisition to ultra-long text generation, ultra-long text comprehension and analysis, and personalized dialogues with ultra-long memories.

All of these are closely related to the problems people face in real life and at work. Excellent long text processing capabilities enable generative AI systems to thoroughly understand complex information such as books, research reports, legal documents, and business materials, providing significant practical value to knowledge-intensive workers. This feature effectively addresses the urgent needs of users in the areas of knowledge summarization, content extraction from long text, document analysis and semantic understanding. In view of this, Chinese generative AI vendors have keenly captured this critical need. They are competing to improve the ability of LLMs in long text processing, which is a new competitive advantage in the market.

Success case 1 - ChatGLM

ChatGLM is an intelligent assistant based on GLM-4, which is based on more than one hundred billion parameters, and can answer many types of questions for users in their everyday lives. In addition to its outstanding performance in multimodal interaction, ChatGLM has also introduced the agent customization function, which allows users to create their own GLM agent with simple prompts and commands, thus making LLM development available to the general public. By April 2024, there were over 10 million users on ChatGLM, as well as 300,000 active agents. In terms of general questions and answers, ChatGLM can answer users' queries in real time and accurately, covering various fields and providing information support for decision-making. In terms of creative writing assistance , ChatGLM can inspire users to create, build the framework of the article, generate high-quality content, and improve the efficiency and quality of writing. In terms of image generation and image interpretation , ChatGLM not only supports text-to-picture generation but also provides users with image descriptions, image annotations, answers to questions about the image, and visual localization services for the input image and text. For network enhancement, ChatGLM can automatically retrieve resources from the web and provide reference links. For document processing, ChatGLM can thoroughly analyze PDF documents, provide services such as retrieval, summarization, rewriting, translation, etc., and analyze the structure of the document and generate summary,

outline, keyword analysis, etc. All these can help user understand the document and gain more value from it.

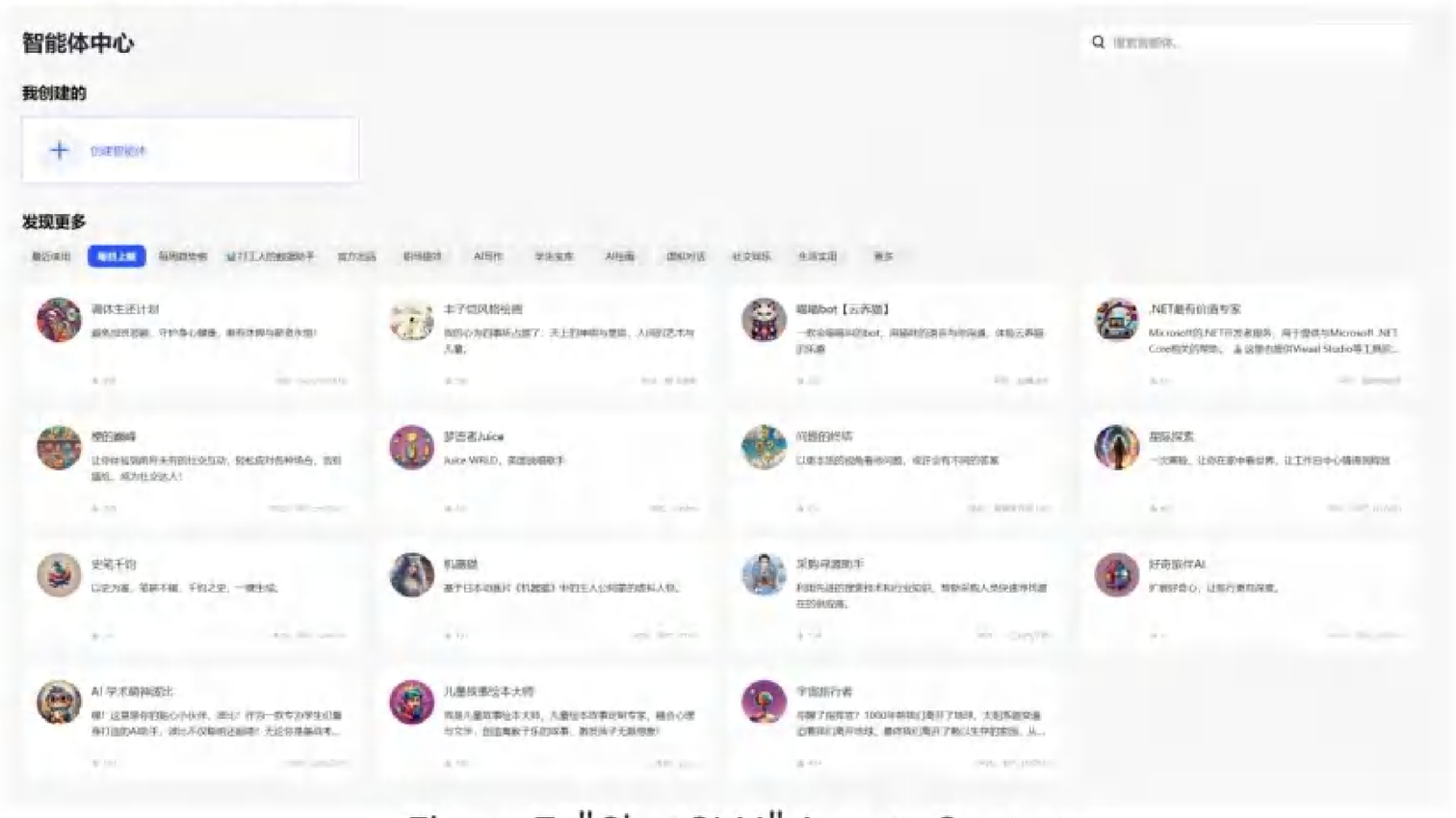


Figure 7: "ChatGLM" Agents Center
(Source: ChatGLM)

Success Case 2 - ERNIE Bot

Based on the ERNIE 4.0 LLM infrastructure, ERNIE Bot is a new generation of Baidu's knowledge-enhanced large language model with cross-modal and cross-language in-depth semantic understanding and generation capabilities. Compared with other products of the same type, ERNIE Bot excels in providing a variety of practical plug-ins and user-friendliness. It is suitable for use in application scenarios with high expansion requirements, providing users with more convenient and efficient solutions. **In terms of literary creation**, ERNIE Bot can clearly express opinions, convey emotions, stimulate creative thinking, and provide users with new inspirations and ideas, so it can be applied in the creation of novels, essays, poems, and other literary works. **For search and answer questions**, ERNIE Bot can interact with users in natural language, understand their intentions and needs, and provide appropriate answers and suggestions. It can be widely used in sectors such as life services. **In terms of multimodal generation**, ERNIE Bot supports image generation and processing. It can generate images or process and edit existing images according to user needs. **In terms of featured applications**, ERNIE Bot and Oracle Bone Script Information Processing Key Laboratory of the Ministry of Education have jointly

created the interactive program "Answers from Oracle Bone", which allows users to ask questions by simply typing in the form of a prompt, and then receive answers from oracle bone. The ancient oracle bone scripts are "brought to life" through ERNIE Bot's interaction ability via dialogue and the interpretation of oracle bone scripts. As of June 2024, ERNIE Bot has attracted more than 300 million users and boasts more than 500 million daily uses.

Success Case 3 - Kimi

Kimi Intelligent Assistant is a practical product based on the self-developed Kimi LLM by Moonshot AI. Based on hundreds of billions of model parameters and with long text processing as its core capability, in the initial stage, Kimi unlocked numerous new application scenarios for users with its lossless context processing capability of about 200,000 Chinese characters. Compared with other products of the same type, Kimi features advantages in document processing and information retrieval, and is suitable for report optimization, web content extraction and long text summarization. Currently, Kimi has increased her contextual processing power to 2 million Chinese characters and is able to read 500 or more documents in depth at once. In terms of responsiveness, Kimi is able to quickly analyse up to 30 pages and output relevant summaries in less than 20 seconds. In terms of the ability to summarize long texts, when processing many articles at once, Kimi is able to fully grasp the core ideas of each article and effectively compare and integrate similar ideas while ensuring that the output text is easy to read and has a hierarchical structure.

2. Gen AI+Office: Innovate Workflows and Increase Productivity

In the wave of digital transformation, the traditional business model has difficulties in meeting the increasing demands for work efficiency and personalized needs. To follow this trend, empowering the business operations with generative AI is a key initiative. Integrating advanced generative AI technology can inject AI power into all kinds of work scenarios, achieving automated code generation, intelligence data

analysis, and precise information management. This not only greatly improves office efficiency and reduces labor costs, but also creates a more flexible and efficient collaboration environment for employees. The introduction of generative AI not only optimizes the work process, but also brings innovative thinking and strategic advantages to enterprises, ushering the office environment into the intelligent age.

Generative AI code writing assistants are driving change in the software and information industry as efficient productivity tools. The value of Gen AI programming assistants plays a significant role throughout a developer's work process, from writing and documenting code to testing. Gen AI programming assistant can not only significantly improve the efficiency and quality of software development through intelligent optimization, error detection, and code refactoring but also effectively reduce the developer's time and effort invested in programming tasks by automatically generating code and performing tedious and repetitive tasks. With its help, developers can focus on higher-priority design and innovation tasks. In addition, the Gen AI programming assistant can be used as a powerful learning tool to help developers acquire new software development skills. With AI-assisted tutorials, code interpretation and debugging tools, developers can master new technologies and programming languages faster, thus driving software development into a new era of greater efficiency and quality.

Generative AI empowers data analysis and report generation, making efficient transformation and accurate presentation of data possible. With powerful data processing capabilities, generative AI can quickly analyze and interpret all types of data, including structured tabular data as well as unstructured multimedia data such as text and images. It can efficiently identify, classify, and extract valuable information, thus significantly shortening the data analysis cycle and reducing manual analysis costs and error rates. Based on the results of the analysis, generative AI can automatically produce clear, intuitive, and logical reports. These reports not only contain detailed data analysis results but also make complex data information easy to understand through graphs, images, and other visual elements. In addition, the generative AI can adjust the format and content of the report according to different needs and scenarios to meet the reading

habits of different audiences.

Success Case 1 - Raccoon by SenseTime

Raccoon is a software intelligent research and development assistant based on SenseTime's large language model, covering software requirements analysis, architecture design, code writing, software testing, and other aspects. It meets various user needs, including writing code and learning programming. Raccoon supports 90+ mainstream programming languages such as Python, Java, JavaScript, C++, Go, SQL, etc., and mainstream IDEs such as VS Code, IntelliJ IDEA, etc. It covers the whole life cycle of software development, including requirements analysis, architectural design, code writing, software testing, deployment, system maintenance, etc. It helps developers with many application scenarios, including code generation and completion, translation, refactoring, error correction, Q&A, test case generation, and more. In practice, Raccoon can help developers improve programming efficiency by more than 50%. In addition, Raccoon can provide users with personalized learning paths, recommend appropriate resources based on the developer's existing skills and learning progress, and also analyze a large number of codebases to provide advice on best practices and design patterns to improve the developer's technical skills and productivity.

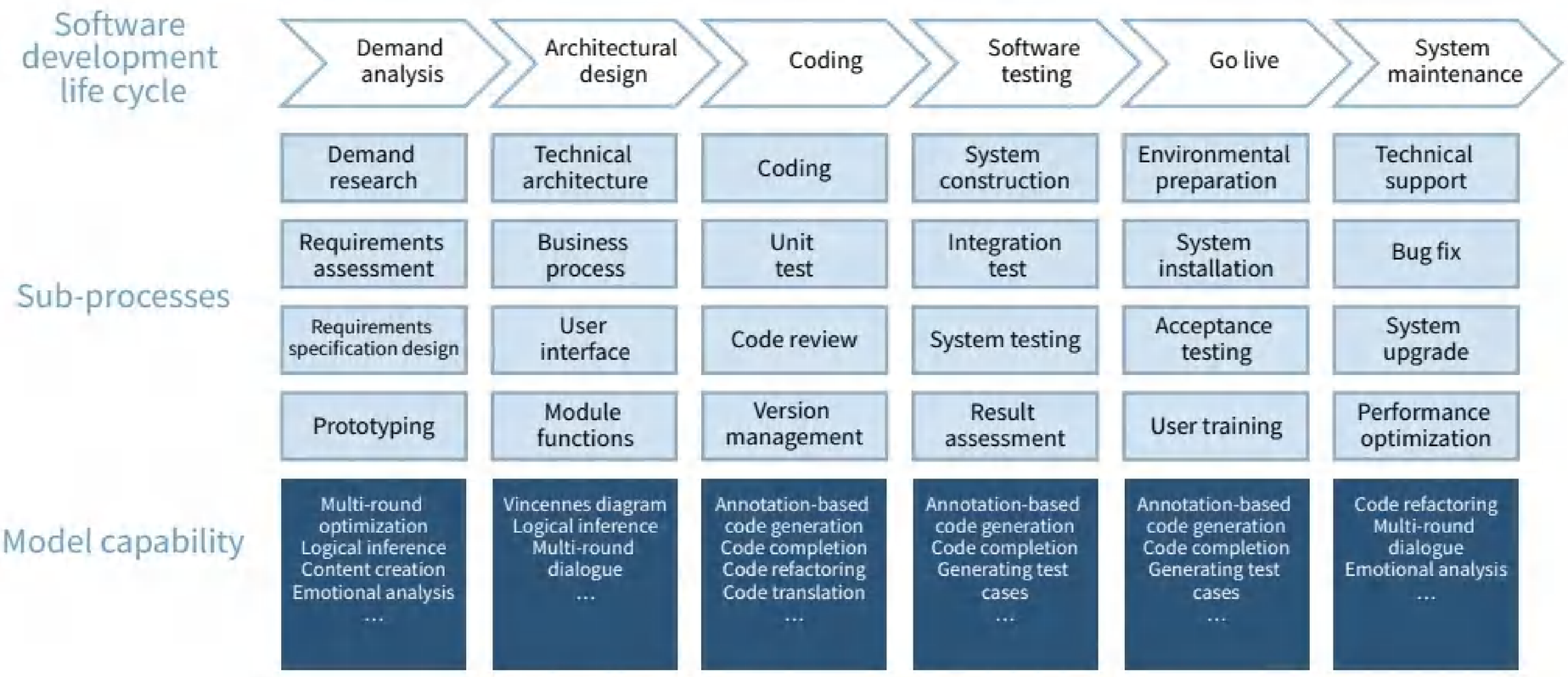


Figure 8: Raccoon Software Development Process
(Source: IDC)

Success Case 2 - Kingsoft WPS AI

WPS AI is Kingsoft's AI Office Assistant based on the large language model, which opened for public beta testing in November 2023. It anchors its development in three directions: AIGC (content creation), Copilot (intelligent assistant), and Insight (knowledge insights). Currently, WPS AI 2.0 has been released, offering four new AI office assistants for individual users. In terms of **data analysis**, WPS AI Data Assistant can perform AI calculations, analysis, and categorization of massive data within a spreadsheet. Users can express their requirements in natural language, and the AI can convert these into the appropriate code and execute it within the spreadsheet. In terms of **report generation**, WPS AI can automatically generate various kinds of financial statements, data reports and other documents according to users' needs and preset rules. Users only need to enter the appropriate commands or rules, WPS AI can automatically perform complex formula calculations, create pivot tables, and generate standardized, detailed reports. In addition, WPS AI also has intelligent charting and reporting features that can automatically select the appropriate chart type based on the data content and generate intuitive and easy-to-understand charts to display the data. WPS AI Design Assistant can quickly complete typesetting, design style, and image processing for existing data, text, and images, such as automatically adjusting text and image positions. No more cumbersome formatting tasks since document typesetting can be done with a click of the cursor. Each document is clear and standardized and the report is more reader friendly.

3. Gen AI+Entertainment: Expanding the Entertainment Sector and Stimulating Innovation

In a booming digital economy, the entertainment industry has become increasingly important, not only in building a strong connection between products and services and consumers but also in subtly meeting the profound need for a sense of belonging among modern people. Thanks to the power of generative AI, the entertainment industry has been able to effectively broaden its reach through audio, video, avatars,

and other forms to connect with consumers in a more intimate and accessible way, thus injecting new vitality into the industry and driving its continuous innovation and development.

Generative AI inspires user creativity and revolutionizes the audio content industry. The audio sector focuses on creating audio content using advanced AI technology and complex algorithms. By integrating machine learning and deep learning algorithms, AI audio generation technology is able to mimic and reproduce human speech, musical rhythms, and a variety of sound effects to achieve highly natural and realistic effects. With advances in generative AI technology, AI audio generation is not only able to accurately mimic known sounds, but also create entirely new audio experiences. From music creation to speech synthesis to audio processing, generative AI has not only enriched the way audio content is created but also improved production efficiency and quality, revolutionizing the audio industry.

Generative AI reshapes video content creation, creating a new chapter in the integration of intelligent technology and creativity. In terms of video generation, users only need to input text and images and set parameters such as style, motion and ratio to quickly generate accurate, consistent and vivid HD videos, which greatly enhances the efficiency and convenience of video production. While editing a video, with the help of intelligent editing tools, users can remove specific subjects from videos, automatically track and clip, generate video effects, automatically add elements, and retouch the video. These intelligent editing features further enrich the possibilities of video creation, making it easy for ordinary users to produce professional-grade videos.

Generative AI is becoming an emotional support for humans, and virtual socialization is becoming the new web traffic source on the Internet. Along with the breakthrough of generative AI technology, AI agents are not only given personality traits but also gradually win people's acceptance, love, and trust. This opens up a disruptive and innovative interaction mode of "human-AI character" based on the traditional "human-human" social networks. By simulating human emotional responses, AI characters are able to deeply understand and respond to

complex human emotions, which in turn greatly enriches the user's social experience. Among today's various ToC LLM applications, the most visited app is Character.AI, which specializes in virtual AI ChatBots. 18 million ChatBots were created on this AI platform established in 2021. At the end of 2023 it attracted more than 200 million monthly visits, 300% more than ChatGPT in the same period, demonstrating how much young internet users love virtual AI characters.

Success Case 1-- Moyin Workshop by Mobvoi

The "Moyin Workshop" by Mobvoi is a one-stop AI software that integrates copywriting, dubbing and editing. It features six core functions, i.e., software voice dubbing, text-to-speech, real voice dubbing, voice store, efficiency tools, sound cloning, and video editing. It also offers cutting-edge sound technologies covering four aspects, namely, sound cloning, sound search, emotion synthesis/character transition, and sound synthesis. Relying on the Sequence Monkey LLM, "Moyin Workshop" can quickly complete voice cloning based on 3–10 seconds of short audio and support cross-language migration and emotional tone generation. Its overseas version, DupDub, also supports multi-speech audio generation, which currently covers English, French, Japanese, Spanish, Portuguese, Thai, and more.

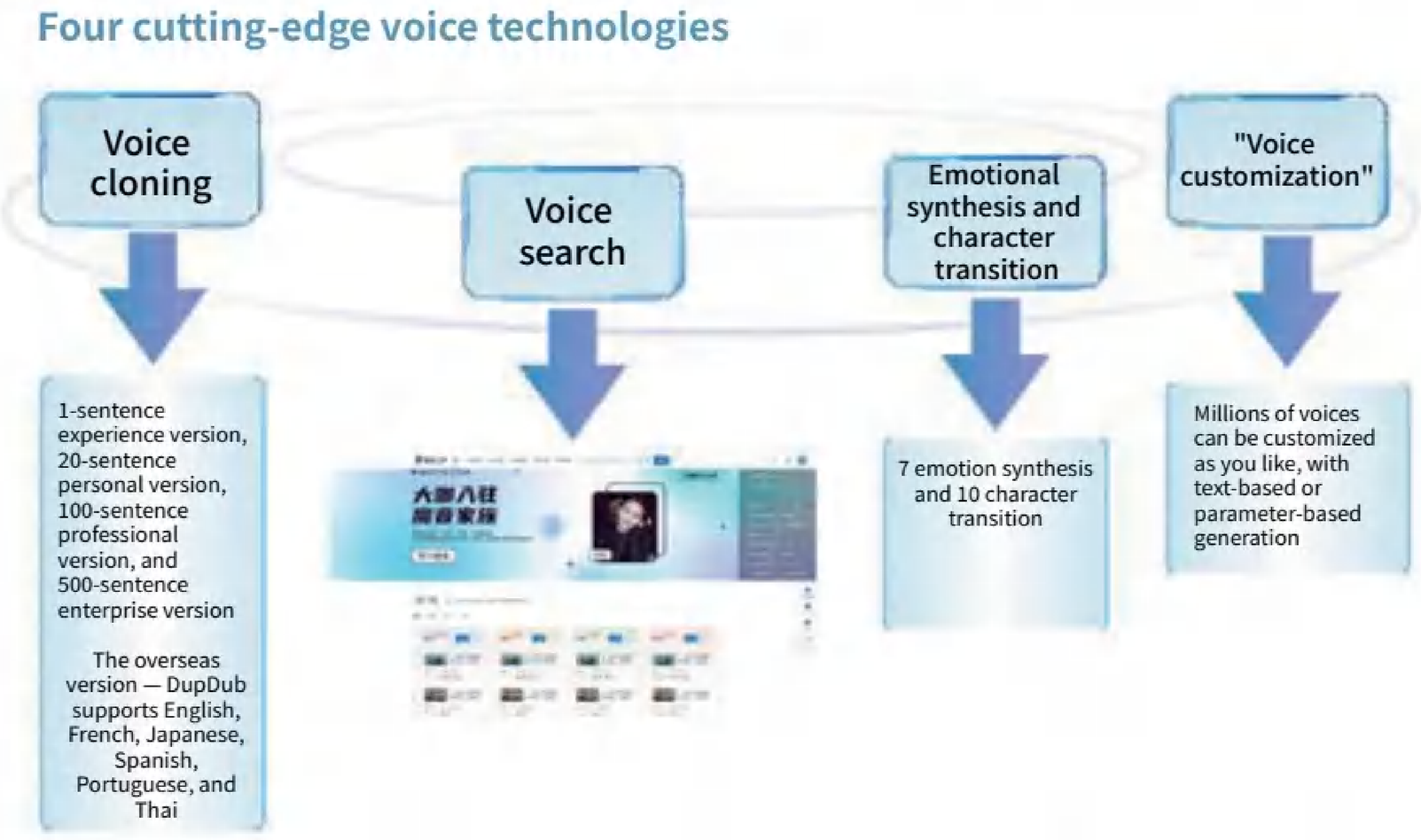


Figure 9: Four Cutting-edge Voice Technologies of "Moyin Workshop" (Source: Moyin Workshop)

Success Case 2 - PixVerse by Aishi Technology

PixVerse, a division of Aishi Technologies, is an online AI video generation platform. The platform is known for its simple and intuitive user interface and powerful back-end technology, allowing users to get started quickly without complex operations or specialized video production knowledge. Its main application scenarios are text-to-video, image-to-video, and character-to-video generation modes. In the text-to-video generation mode, users can generate a video with one click by simply typing in the cue word, selecting the style, and setting the parameters. While in the image-to-video generation mode, users can transform existing images or video clips into new content and use the Magic Brush function to control the motion of local areas of the image, including the direction, magnitude of the motion, angle, etc., to achieve more detailed video editing. Character-to-video generation is the world's first of this kind that allows users to create their own "character libraries," select specific characters for continuous video generation, and incorporate them into different scenarios and story lines according to their creative needs. This feature addresses the consistency challenge in AI video creation at a preliminary level, unlocking a more efficient and flexible workflow for creators.

Success Case 3 - Zhumengdao by China Literature

Released in 2023 by China Literature, the Zhumengdao APP is a native virtual eco-social platform built on the SenseChat-Character LLM as its base and provides users with interesting and easy-to-follow social experiences in several modes, such as one-on-one chatting with avatars, small scene simulation dialogues, observing group chats, and creating a virtual world and its stories. The platform takes the public's favorite AI characters into consideration from a technical point of view and develops them in depth in three directions: "persona", "image", and "voice". The persona is developed based on SenseChat-Character LLM, creating a virtual character with memory, experience, worldview, and emotions. The image is generated by SenseMirage text-to-image generation LLM, producing high-quality, multi-style images of the character's appearance. The voice generation relies on a voice LLM to

produce low-latency, high-quality voice conversations. As of the end of April 2024, there are 150,000 AI virtual "dreamers" on the Zhumengdao APP, including characters from films and TV shows, online novels, anime series, games, historical characters, as well as UGC original characters and AI tools and assistants, among which the number of the most popular IP characters reached 300.

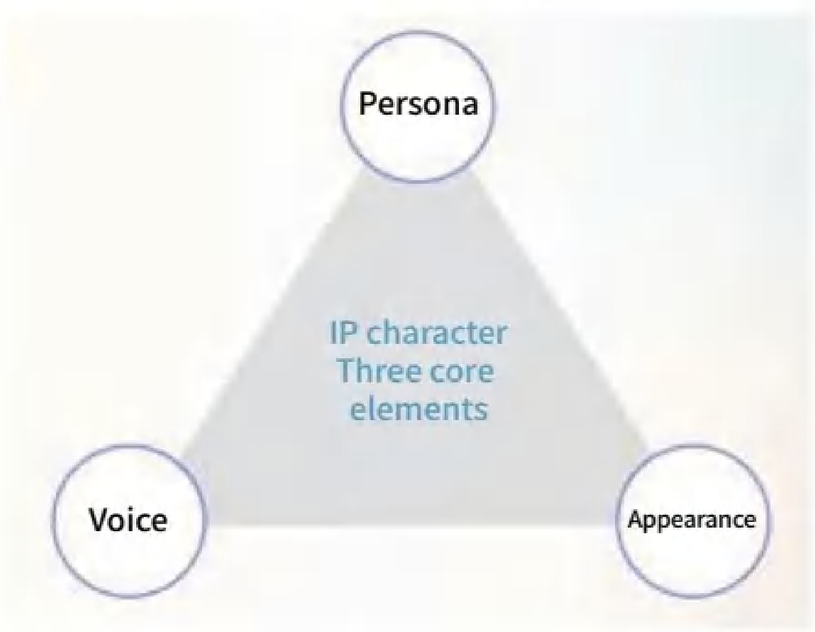


Figure 10: "Zhumengdao" IP Character's Three Elements

(Source: Zhumengdao))

2) Generative AI Drives Industry Change Leads to a New Trend of Transformation and Upgrading

In the process of generative AI penetration into industries, the order of acceptance and benefit for each industry varies according to its IT infrastructure, data resources, and industry characteristics. The Internet and high-tech, financial, and professional services industries will be among the first to benefit, with their solid IT foundations and large pools of user data driving the rapid deployment of generative AI. It is followed by industries such as education, communications, healthcare services, retail, and advanced manufacturing. These industries have invested relatively little in information technology; however, generative AI technology can bring a wide range of value. In addition, traditional industries such as agriculture, construction, and energy are still in their infancy in the application of generative AI technology. They need more time and resources to explore the application scenarios and value of generative AI.

The application scenarios and focus of generative AI vary somewhat across industries. **In the communications industry**, generative AI was initially applied to customer service scenarios to save operational costs and improve service quality. With the evolution of technology, the generative AI LLM in telecom is gradually penetrating into other industries, providing strong support for the digital transformation of vertical industries. **In the healthcare industry,** generative AI has been widely used in the whole process, from diagnosis to treatment. By processing massive medical data, it provides accurate diagnosis advice, and carrying out personalized treatment plans, it not only enhances the efficiency of medical information technology but also improves patients' diagnosis and treatment experience. **In the education industry**, generative AI is driving the industry to become more personalized and efficient, providing customized resources and tutoring based on each student's situation. At the same time, it helps teachers improve teaching quality while promoting fairness and access to education. **In the financial industry**, generative AI can respond quickly to changes in the financial market, provide accurate risk assessment and investment advice, and improve the intelligent capabilities of financial services. **In the industrial sector**, generative AI integrates production, operational, and management data to automate production processes and achieve intelligence transformation, thereby increasing productivity and reducing production costs.

1. Gen AI+Telecom: Generative AI Helps Telecom Operators Transform and Upgrade

In the age of digital transformation, the second wave of growth for Chinese operators is climbing fast, and the proportion of emerging business revenue continues to rise. The telecom industry is on a new track in the digital economy, AI, and many other areas. It is ready for a comprehensive strategic upgrade. As the mainstay of the digital economy, there is a growing consensus among telecom operators in the age of AI. Building a robust AI infrastructure and improving generative AI services and operational capabilities are the foundations for achieving

AI inclusion, AI ubiquity, and efficient scale-up development of AI industries.

The application of generative AI is gradually becoming the core of telecom operators' AI strategies. Large, advanced generative AI LLMs can process and analyze massive amounts of data to provide accurate insights and predictions to optimize network operations, improve customer service experiences, enhance cybersecurity, and drive innovation in business models. By integrating LLMs, telecom operators are able to achieve more efficient data processing, smarter decision support, and more personalized service customization, which actively promotes the digital transformation and intelligent upgrading of the telecom industry.

Generative AI LLMs will not only become an important tool for telecom operators to improve operational efficiency and innovation, but also a driving force to elevate vertical industries to a higher level. As generative AI technology continues to advance, telecom operators will be able to better leverage their strengths in data, infrastructure, and user resources to broaden generative AI applications. It will result in richer and more efficient services for vertical industry customers and aid their business processes in achieving automation and intelligent transformation.

Success Case 1- China Unicom's Yuanjing LLM Comprehensively Improves 10010's Customer Service Quality

(1) Technical introduction

China Unicom has launched the Yuanjing "1+1+M" LLM system. The first "1" refers to a set of basic LLMs, which consists of two main bases. The first is the large language model. For different functional needs, multiple versions with varying parameters have been configured. Currently, versions with 1 billion, 7 billion, 13 billion, 34 billion, and 70 billion parameters have been completed. The second "1" refers to an underlying model infrastructure—the MaaS platform. By drawing on the way humans acquire their vocational skills, the Yuanjing LLM creates a toolchain for selecting, modifying, and using models, which enables the shaping of "vocational skills" from general to professional competence levels. "M" refers to M kinds of industry-specific

LLMs. At present, based on Yuanjing's LLM capability, a number of LLMs for various industries have been released, such as network expert LLM, customer service LLM, anti-fraud LLM, etc. They have been applied to more than 200 scenarios in various industries, such as industry, city, and transportation.

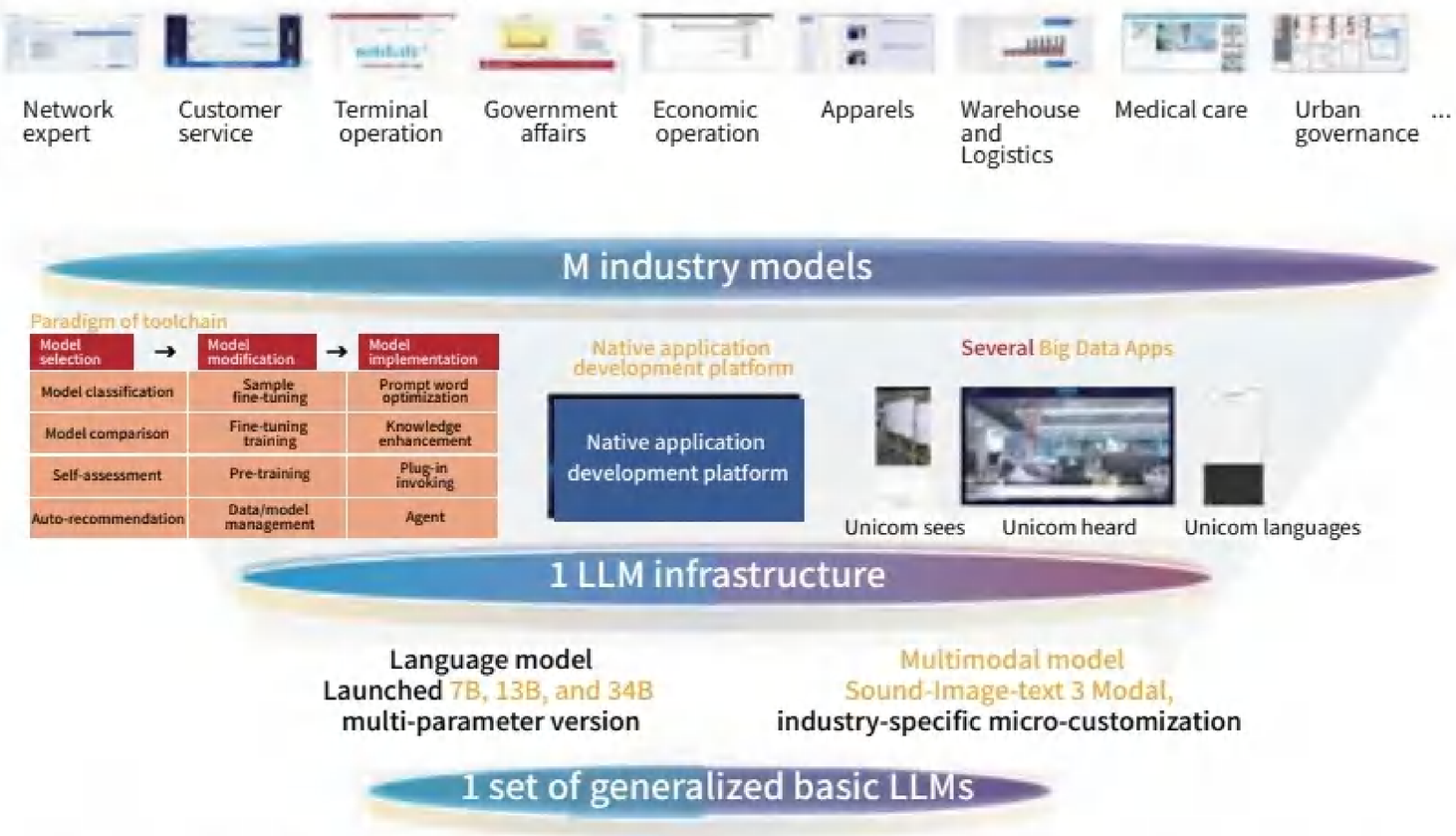


Figure 11. China Unicom's Yuanjing "1+1+M" LLM System

(Source: China Unicom)

(2) Service model

In terms of service model, China Unicom has developed **10 industrial LLMs** for internal and external business scenarios using the Yuanjing LLM as infrastructure. They empower networks, customer service, terminal operations, and more, and demonstrate applications in the fields of government affairs, economic operation, medical care, clothing, logistics, and urban governance.

(3) Application

China Unicom fully explores the value of generative AI, takes advantage of its self-developed LLM, and creates 26 AI innovative services based on its customer service LLM. All of these empower its customer contact center (10010) to guarantee accurate and intelligent services. Through the whole process and all-scenario digital intelligence empowerment, customer experience, front-line efficiency, and management effectiveness are comprehensively improved. The number of intelligent

services accounts for more than 85%, the average call length has reduced by 15%, the problem-solving rate with the first call has increased by 1.6 pp, and the user satisfaction rate has risen to more than 98%. 10010's "one-call solution" intelligent services have helped the hotline satisfaction rate rise to the top in the industry.

Success Case 2 - China Mobile Jiutian LLM helps 10086 build intelligent customer service

(1) Technical introduction

China Mobile's Jiutian - customer service LLM, relying on the customer service industry's deep business knowledge, rich interaction data, system interface information and the professional experience of the manual seat, adopts a scientific and effective large and small model fusion strategy. The model takes natural language processing as the entry point and seamlessly connects with the existing system to realize integrated service. By enhancing the ability of intent recognition and task-based dialogue, the model reshapes the customer service process centered on collaboration between the LLM and manual customer service, covering the whole scene and the whole process. This innovation has significantly improved user satisfaction and loyalty, and through the application of closed-loop tracking technology, the intelligent customer service system has also made significant progress in the problem resolution rate.

(2) Service model

China Mobile Jiutian LLM for customer service not only can independently provide services for the user by analyzing the user's questions and invoking the API to get the answer according to user's natural language description; It can also work with a human agent to analyze the semantics and context of previous communications, summarizing and highlighting the key points and important information of the conversation. Based on the content of the conversation, it can provide customer service staff with tips on how to respond, thereby reducing the time and cognitive burden of answering. In this way, a three-party communication scenario of "LLM -

human operator - user" is formed, which has greatly improved the work efficiency of traditional manual customer service. At the same time, the customer service LLM will redefine the connotation and model of customer service to a certain extent, bringing users a new experience.

(3) Application status

Relying on the Jiutian LLM, China Mobile has successfully combined the service experience of the customer service industry with advanced technology. Through the combination of "professional + general LLM", the integration of training and inference computing of deep learning, and relying on the robust guarantee of the computing center, a variety of intelligent interactive services are made available, including smart search, companion consulting, multi-round interaction, etc. China Mobile has started to have a basic grasp of the ability to identify complex customer-oriented scenarios and effective response capabilities.

Before the generative AI LLM is applied to the intelligent customer service system, the online user resolution rate is about 46%. By replacing the original small model with a large one, applying the LLM throughout all stages of customer service through a set of scientific and effective pipeline solutions, and using the LLM to enhance intent recognition and task-based dialogue capabilities, the text-machine-human interaction experience has been enhanced, thus improving user satisfaction and loyalty. Through the closed-loop tracking of customer service LLM technology, since the Jiutian LLM for customer service has gone online, the intelligent customer service system's intent recognition accuracy rate has increased from 92% to 95%, the resolution rate has increased from 46% to 65%, and the problem-solving ability enhancement has saved 200 manpower.[5]

2. Gen AI+Healthcare: Generative AI Leads Innovation in the Healthcare Industry

The medical industry faces pain points such as large data volumes, poor data quality, data privacy protection, insufficient physician resources, and

[5]*Data Source: White Paper on Intelligent Transformation Practices of Leading Enterprises*

low diagnostic efficiency. The application of generative AI in healthcare brings revolutionary changes to improve the efficiency of healthcare informatization, enhance the online medical consultation experience, achieve real-time monitoring and warning, and assist in drug development, thus providing patients with a better diagnosis and treatment experience and personalized management.

Thanks to the continuous iteration of healthcare LLM in recent years, complex healthcare data analysis tasks can be handled more efficiently. Given the uniqueness of patient behavioral data, generative AI LLMs are widely used in the fields of smart imaging, smart surgery, smart healthcare, etc., through personalized design to meet the needs of "thousands of patients with thousands of situations" in healthcare services. Smart imaging covers a wide range of medical imaging scenarios such as CT, MR, DR, US, DSA, molybdenum target, etc. It offers patients early detection, diagnosis and health risk assessment. Smart surgery feature, on the other hand, dramatically improves the accuracy of patient condition evaluation, laying a solid foundation for pre-operative risk assessment, intra-operative surgical planning, and post-operative prognosis estimation. The smart health serves as a personal health assistant for general patients, providing them with high-quality guided services and personalized health advice through mini programs and other convenient methods.

Success Case 1 - SenseChat-Medical Helps Xinhua Hospital Become a Smart Hospital

(1) Technical introduction

SenseChat-Medical is a large language model for medical and healthcare developed by SenseTime, based on the company's self-developed generative LLM "SenseChat" with hundreds of billions of parameters (with trillions of tokens of pre-training corpus) and trained with high-quality medical knowledge data of more than 20 billion tokens. The data range covers medical textbooks, medical guidelines, clinical pathways, drug libraries, disease libraries, medical reports, and 40 million real medical records, doctor-patient Q&A, and dialogues.

(2) Service model

In terms of service model, SenseChat-Medical focuses on four major application areas, namely, smart health, smart patient service, smart clinical practice, and digital intelligence transformation. It also covers 13 subdivided medical and health scenarios, including intelligent self-diagnosis, physical examination consultation, health Q&A, guided diagnosis, pre-questioning, medication counseling and post-diagnosis follow-up management, intelligent medical records, consultation room interpretation robots, intelligent medical assistants, intelligent follow-up, imaging, report structuring, and medical record structuring, achieving accurate matching between model functions and specific scenarios. In order to meet the differentiated deployment needs of customers, SenseTime has launched several versions of SenseChat-Medical, with the number of parameters ranging from hundreds of billions to tens of billions. They can not only provide services for partner organizations in the form of public cloud services but also help partner organizations efficiently complete the deployment of model privatization.

(3) Application

Based on the medical and healthcare LLM "SenseChat-Medical" developed by SenseTime, Xinhua Hospital achieves the seamless integration of multiple medical scenarios. A smart hospital is established with four sections: "smart medical care", "smart management", "smart service" and "smart research", aiming for continuous promotion of the high-quality development of public hospitals with service as the key. The full integration of medical technology and AI has reshaped the service experience in the three stages of medical care: pre-diagnosis, during diagnosis, and post-diagnosis.

In the pre-diagnosis stage, the "Intelligent Companion Assistant" developed by SenseTime based on "SenseChat-Medical" recommends appropriate hospital departments and specialist doctors for each patient, addressing the confusion and needs arisen from knowing symptoms but not the disease, knowing the disease but not the relevant department, or knowing the department but can not the right

doctor. Most patients usually do not know which department to consult. To address this issue, patients can log into the "Shanghai Xinhua Hospital" WeChat service account, enter the "Outpatient Appointment - Intelligent Diagnosis" section, and access the convenient medical services of "Intelligent Companion Assistant". By describing their symptoms in text or voice, they can receive system-pushed links for online registration to relevant departments, specialists, and experts. This AI assistant has acquired the capability of "intelligent triage" through comprehensive learning of massive medical data and has also "consulted" experienced pre-examination nurses to strengthen its understanding of common diseases among some patients, enabling the "Intelligent Companion Assistant" to provide intelligent triage recommendations. During the diagnosis, SenseTime's independently developed SenseCare© Smart Diagnosis and Treatment Platform can significantly improve the efficiency of doctors. The platform is equipped with a wealth of AI-assisted diagnosis and treatment applications that can quickly and accurately identify small lesions (such as nodules) based on various examination images, and reconstruct high-precision three-dimensional organ models, thereby effectively assisting in early disease screening and precise individualized treatment. In traditional approach, three-dimensional reconstruction often requires a lot of manual interaction, which brings a heavy workload to doctors, limits the number of cases for detailed reconstruction, and also has limitations in the reconstruction effect of fine structures such as blood vessels. The SenseCare© Intelligent Lung Surgery Planning System can achieve fully automatic fine segmentation and three-dimensional reconstruction of multiple tissue structures in the chest, reducing the reconstruction time from 1-2 hours of traditional manual operation by doctors to 3-5 minutes. It helps doctors plan and design personalized surgery plans efficiently, accurately, and conveniently.

In the post-diagnosis management stage, SenseTime's "SenseChat-Medical" platform has assisted Xinhua Hospital in taking the lead in establishing a "hospital-wide intelligent follow-up center," which supports three types of post-diagnosis follow-up needs flexibly, efficiently, and conveniently. These include "caring follow-ups," "post-treatment follow-ups," and "research follow-ups." The advantages of SenseChat-

Medical's follow-up system lie in its ability to ask questions based on follow-up forms and adjust questions according to patient responses while patiently answering any questions from the respondents. Additionally, SenseChat-Medical can provide intelligent risk assessments and follow-up recommendations based on patient records and follow-up information.

Success Case 2 - Baidu Lingyi Medical LLM Helps Gushengtang Optimize its Whole Process

(1) Technical introduction

The Lingyi LLM is China's first "industry-level" medical LLM which was developed and launched by Baidu Group. With its self-developed, home-grown and knowledge-enhanced ERNIE LLM as the infrastructure, this LLM for the medical industry has been formed through pre-training and instruction fine-tuning of massive high-quality medical and health corpus, as well as the following evidence-based medical practice. **In terms of algorithms**, the Lingyi LLM is based on the ERNIE LLM, creating a LLM with hundreds of billions of parameters and with a number of built-in enhancement technologies, such as knowledge enhancement, retrieval enhancement, and context enhancement. The accuracy and diversity of the LLM generation have improved. **In terms of computing power**, the Lingyi LLM is guaranteed by the computing power cluster with 10,000 cards and a full lifecycle model development toolchain. It can perform label-free pre-training and continuous optimization of the underlying parameters. **In the aspect of data**, the Lingyi LLM uses a training corpus with hundreds of billions of tokens, including massive desensitization clinical data, massive medical knowledge atlases, three million+ cases of multimodal image data, 600 million+ health science content, and 700,000+ clinical trial study information. The rich corpus of data improves the model's ability to serve the whole industry chain.

(2) Service model

In terms of service model, the Lingyi LLM's architecture is divided into four layers, each providing services to different users on demand. **The application layer**

mainly provides AI-native applications for patients, hospitals, enterprises, and other users. With the help of Lingyi Bot, it currently focuses on three major directions, namely, intelligent health care manager, intelligent physician assistant, and intelligent enterprise service, to meet the specific needs of doctors, patients, and the pharmaceutical sector. **The capability layer** mainly provides high-quality AI services to partners in this ecology in the form of APIs or AI plug-ins and helps partners carry out secondary development to build AI-native applications. **The model layer** provides flagship, lite, and customized services based on different application needs and deployment resources. **The computing layer** focuses on users with private deployment needs, providing three levels of integrated hardware and software computing power support.

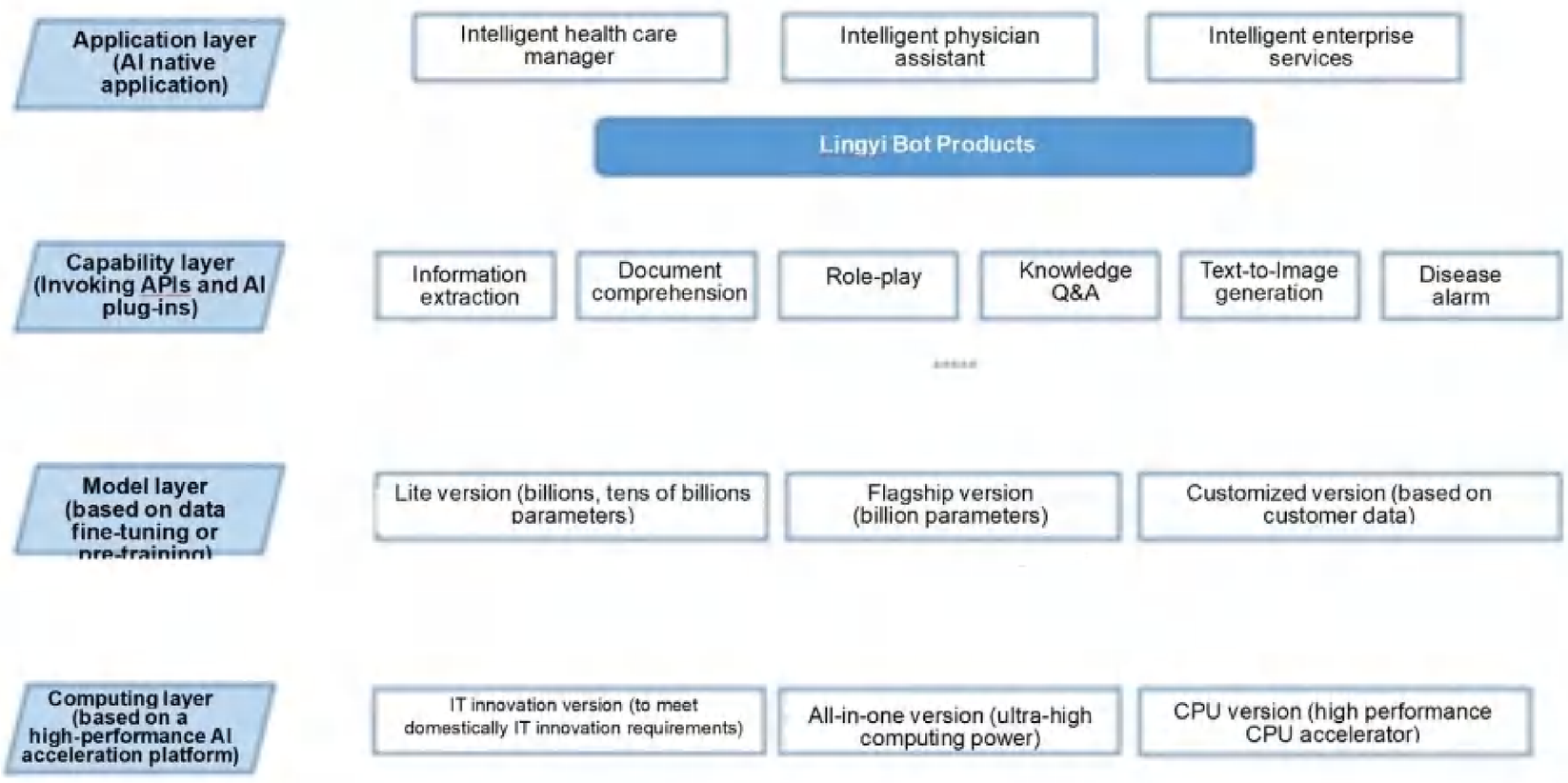


Figure 12: Commercial Service Model of Lingyi LLM

(Source: Baidu Lingyi LLM)

(3) Application

Gushengtang, one of the largest Traditional Chinese Medicine service providers in China, provides patients with Traditional Chinese Medicine diagnosis and treatment services both online and offline. Baidu and Gushengtang have jointly launched the "Intelligent Health Care Assistant" based on the Lingyi LLM. This project achieves two major functions: **intelligent triage** and **intelligent Q&A (customer service)** by integrating the capabilities of the Lingyi LLM. **The intelligent triage system** is able to assign the most suitable department and physician to the patient according to their

symptoms and needs, which greatly enhances the patient's healthcare experience. Judging from the data, Gushengtang's patient satisfaction improved by 12%. **Intelligent Q&A (customer service)**, on the other hand, can automate basic patient questions such as order delivery and invoicing, which not only reduces labor costs but also improves the response speed and accuracy of customer service. According to statistics, by applying the Lingyi LLM, Gushengtang has improved the service manpower efficiency of its operation staff by about 76%, which has greatly improved the overall operation efficiency.

The Lingyi LLM also helps Gushengtang optimize the allocation of medical resources and medical service processes by providing rich data support. Through the analysis of patient visit data, Gushengtang is able to more accurately understand the needs and preferences of patients, so as to adjust the department settings, doctor scheduling and other resource allocation, and improve the relevance and efficiency of medical services. At the same time, the Lingyi LLM is also able to monitor and optimize the medical service process in real-time to ensure that the quality and efficiency of medical services are continuously improved.

3. Gen AI+Education: Generative AI Advances Personalized Education in this Industry

The traditional teaching model in today's education industry faces a certain degree of contradiction between personalized and inclusive education. Although personalized education can provide precise teaching plans according to the characteristics and needs of students, thus maximizing the potential of each students. However, the implementation of individualized teaching requires the continuous investment of supporting teacher resources, which reveals the problem of scarcity of teachers and excessive education expenditure in countries with large-scale education needs.

How to utilize cutting-edge technology in combination with modern educational theory to achieve a larger scale, higher-quality, more efficient, and better education

system has always been the core topic of contemporary educational research. In 2023, various types of generative AI LLMs for the education industry were released one after another, blazing the path for the education industry to move towards generative AI. It helps teachers and students dramatically improve the efficiency of education and promotes the gradual implementation of individualized teaching on a large scale.

Success Case 1 - Abab Series LLM Helps Gaotu Techedu Explore the Innovative Education Scenarios

(1) Technical introduction

Abab is a full-stack, self-developed multimodal LLM with leading text and speech capabilities by MiniMax. In April of this year, MiniMax released the first abab 6.5 series model in China. It is based on MoE architecture and contains trillions of parameters. It also supports up to 245k tokens of context length, achieving the ability to efficiently handle complex tasks. Combined with the application of the speech model abab-speech, MiniMax is committed to improving teaching efficiency and quality in the education field, promoting personalized learning and holistic development, and injecting new momentum into the education industry to reduce costs and increase efficiency.

(2) Service model

In terms of service model, MiniMax focuses on the two groups of teachers and students, providing a variety of digital teaching platforms and learning assistants in different teaching and learning phases, such as before, during, and after school. Thus, the precise matching of model functions and educational scenarios in the innovative exploration of digital education can be realized. Through cooperative research with educational institutions, MiniMax develops and provides AI assistants such as lesson plan generation, course material generation, classroom assistant, essay correction, classroom summation, etc. to assist educators in accomplishing high-quality classroom teaching. AI tools such as class preparation, classroom assistants, and

after-school tutoring help students further improve learning outcomes.

(3) Application

MiniMax has partnered with Gaotu Techedu to launch a series of intelligent assistants that address the characteristics and learning patterns of students at different school ages. These assistants apply advanced text and speech LLM technology to dozens of specialized scenarios, such as intelligent Q&A, digital course material explanation, digital lecturer, etc., which provide teachers and students with rich learning interaction experiences. In addition, the two companies have jointly developed functions such as digital lecturers and career assistants, which enable tasks such as Q&A, chat, content generation, and planning guidance specifically for the teaching content. Among them, features such as MiniMax teacher voice reproduction can customize the characteristic voice according to different scenarios, achieve a high degree of reproduction of key IP voice, and interact with the user on a one-to-one basis. Abab-speech voice modeling technology, on the other hand, supports the synthesis of more natural voices and the elimination of mechanical sounds, thus enhancing the learning experience of Gaotu's students. At present, MiniMax has joined hands with Gaotu Techedu to launch more than 30 digital teachers, cumulatively producing more than 100,000 minutes of AI digital courses and assisting in generating more than 10,000 virtual course material resources.

Generative AI has also shown innovative practical value for candidates who are seeking advancement in education, such as college entrance and graduate school exam takers. Using the MiniMax LLM and the full RAG toolchain, Gaotu Techedu has launched the "Career Assistant" application by combining data such as university information, enrollment information, and information for the preliminary and reexamination. In this application scenario, "Career Assistance" can answer candidates' questions based on AI, which refers to helping them gradually select ideal colleges and majors during the dialogue with the LLMs and automatically generates personalized answers and suggestions for each candidate.

Success Case 2 - iFlytek's Spark Desk Intelligent Education Empowers The Open

University of China with English Teaching

(1) Technical introduction

iFlytek actively promotes the implementation of education LLMs. Multiple application scenarios, including class preparation, classroom instruction, student learning, mental health, science education, and literacy training, have demonstrated the innovative exploration of generative AI in the digital transformation of education. An intelligence education section has been established with the Spark Desk LLM by iFlytek as the infrastructure, and an intelligence education system has been developed spanning the state, provincial, municipal, county (district) school and family levels.

(2) Service model

In terms of the service model, iFlytek combines the Spark Desk LLM with the smart classroom. From the three dimensions, i.e. lesson preparation, instruction, and evaluation, it offers teachers a new mode of classroom instruction in the digital era that is more efficient and smarter. **In the lesson preparation stage**, it provides systematic curriculum resources, such as course materials, instruction design, study sheets, lecture videos, virtual experiments, etc. to help teachers prepare lessons with ease. **For instruction**, a set of IT instruction evaluation and management integration tools is created for teachers. These tools support various scenarios including experimental teaching, project-based teaching, and collaborative teaching. **For evaluation,** Spark Desk Programming Assistant helps to realize one-click approval and correction of programming tasks and offers personalized guidance. In addition, based on accompanying data collection, it can also help teachers generate students' semester evaluations with AI's help. In addition, iFlytek has also given full play to its advantages in English teaching and has developed an English listening, speaking, teaching, and testing platform. This platform integrates all the data from the scenarios of teaching, learning, and testing, providing ways to comprehensively analyze students' listening and speaking abilities.

(3) Application

The Open University of China is a new type of higher education institution directly overseen by the Ministry of Education. It provides open education for the whole country with the support of modern information technology. With more than 3 million English learners per year with diverse learning needs, English teaching is in dire need of personalized support services with full interaction and timely feedback. Based on iFlyteks core AI technology and Spark Desk LLM's capabilities, the Open University of China has created a personalized language learning environment where each student can train in spoken English with the intelligent training system and instantly get feedback in different dimensions. Based on the dual driver of LLM + knowledge graph, the university has built an adaptive learning platform and transformed the "Degree English" course into a new type of digital course. Students can learn with a self-adaptive approach according to their own needs. Through course knowledge graphs and learning portraits, they can independently discover blind spots in their knowledge base, check for deficiencies, and achieve targeted improvement. With the help of iFlytek avatar technology, the university has also created a new digitalized instruction model relying on virtual teachers, helping teachers to conveniently customize AI course resources and improve the efficiency of resource construction. It provides students with 7*24-hour intelligent Q&A services, and during the answering process, knowledge and learning resources related to the questions are simultaneously displayed to provide more exercise resources. After the teaching and learning participation of nearly 10,000 teachers and students, the intelligent teaching resource system of the Open University of China has been formed. With the completion of one intelligent Q&A resource library, one adaptive course, 200 knowledge points disassembled from the knowledge graph, 141 virtual resource course materials, and 844 minutes of virtual resources, a brand-new paradigm of "teaching according to the students' abilities" in open education has been established.

4. Gen AI+Finance: Generative AI Drives Quality and Efficiency in the Financial Industry

The core competitiveness of the financial industry lies in the continuous reduction of financial risks and the improvement of the industry's service level. Currently, China's financial services sector is characterized by intelligent services, scenario-based business, integrated channels, and deep integration. With its powerful comprehension, learning, generation, and inferring capabilities, as well as considerable knowledge capacity and excellent multi-tasking generalization ability, the generative AI LLM will further promote the intelligent upgrading of financial services.

The financial industry's front-, middle- and back-end operations have benefited from the empowerment of generative AI, and significantly improved operational efficiency. Generative AI applications such as chat bots and virtual assistants have gradually appeared in service scenarios such as personalized service, customer service, financial fraud detection, and credit support. In terms of **personalized service**, based on the in-depth analysis of customer data, the generative AI LLM is able to customize financial and product plans for customers, thus offering targeted services. In terms of **customer service**, the generative AI LLM can generate personalized emails and messages based on customers' behavioral preferences and provide differentiated intelligent customer service, effectively enhancing the customer experience. In terms of **financial fraud detection**, generative AI LLM helps professionals efficiently retrieve and analyze large amounts of data to accurately identify fraudulent behavior and safeguard financial security. In terms of **credit support**, the generative AI LLM generates high-quality credit program proposals for credit department personnel by analyzing massive work, lifestyle, and credit data, thus reducing loss of earnings.

Success Case 1 - Tencent's Cloud Finance LLM Empowers Banks to Develop Intelligent Customer Service

(1) Technical introduction

Tencent Cloud has officially released a financial industry LLM, which helps financial

industry to improve efficiency by constructing four main architectural layers, including computing power layer, platform layer, LLM layer and application layer. At **computing power layer**, this LLM is based on the HCC high-performance computing cluster, cloud-native data lakehouse, and vector databases to provide high-performance computing and data access capabilities. At **platform layer**, Tencent Cloud TI platform has achieved one-stop training from data preprocessing, model training, to model deployment, which, together with the training acceleration suite, dramatically improves the efficiency of model training. In **the LLM layer**, financial institutions can access Tencent's Hunyuan LLM, the finance LLM, and more than 20 mainstream open-source models through the Model Store MaaS according to the business needs of different specific scenarios. It reduces the cost of use by flexibly choosing the type of LLM. **At the application layer**, Tencent Cloud has built a series of intelligent applications based on the finance LLM combined with multiple business scenarios in the front, middle and back end. It is committed to better serving all types of financial institutions.

(2) Service model

At present, the Tencent cloud finance LLM has been used in intelligent customer service, intelligent investment and other practical scenarios. In the scenario of insurance business development, the finance LLM has achieved a high degree of matching and is used in specific financial practices. The insurance agents have begun to combine the digital-human application scenario to develop market, conduct business training, and provide intelligent customer services, etc. In addition, for the financial industry's key concern about compliance, Tencent Cloud ensures that financial institutions are secure and compliant in the process of using the model through means such as private deployment of models, permission control, and data encryption.

(3) Applications

There are three major pain points in the customer service scenarios of banks. First,

the amount of knowledge and information to be maintained is large. The cost of cold-start knowledge configuration ranges from 14 days to 1 month, and continuous investment is required to keep it running. Second, the Q&A coverage is low, and the interception rate is low. Due to the limitations of knowledge, questions not in the knowledge base cannot be answered or are often incorrectly answered, even after multiple rounds. Thirdly, there is a low reception ceiling and inefficient service, as after receiving a call, the operator needs to go through a complex process of understanding the information, searching, and organizing a response.

Based on Tencent Finance Cloud LLM's capability, bank customers combine data from their own scenarios, fine-tune it through Tencent Cloud's TI platform, build an exclusive financial customer service LLM, and therefore, privatize and deploy it. Bank's exclusive AI assistant has been created by fast accessing the bank's corporate knowledge base, directly learning from existing resources in the corporate document library and search engine, while directly interfacing with the bank's APIs for task-based dialog Q&A. Banks can use voice recognition, speech synthesis, face recognition, and other AI technologies to analyze natural language in depth and provide accurate responses on the basis of security authentication, so that the service is "visible" and "audible." It significantly reduces labor costs and greatly enhances the user interaction experience. The first one is **intelligent voice Navigation and Smart Q&A**. Through intelligent voice navigation and smart Q&A, it can provide reasonable guidance to customers, flatten complex function menus, and improve the efficiency of customer service. The second is **smart telemarketing and Smart QA**. On the one hand, the bank utilizes Tencent finance LLM, NLP, emotion recognition, and speech recognition technologies to transcribe the recordings of human customer service operators. Based on this, data analysis is conducted to form a thematic analysis. On the other hand, tasks such as telemarketing and debt collection, which were previously handled by people, are now assigned to robots, and there is real-time in-depth analysis of data to support transformation towards customized customer management solutions. Third, **customer service assistant**. Customer service assistants can provide instant discourse support to employees while human hotline operators are helping the

customer and can also provide instant assistance to human operators according to their needs, thus enhancing work efficiency.

Success Case 2 - Xuanyuan LLM Drives Duxiaoman Finance Comprehensive Scenario Intelligent Application Upgrade

(1) Technical introduction

Xuanyuan LLM by Duxiaoman is China's first 100 billion-level large open-source finance LLM. It is trained based on the Bloom LLM with 176 billion parameters. The model demonstrates exceptional capability in understanding and generating financial domain content through its innovative hybrid-tuning training method. As of March 2024, there are already 17 open-source LLMs in the Xuanyuan series by Duxiaoman, adapted to a wide range of scenarios and tasks to meet the needs of different developers. In terms of the ability to address actual financial tasks, the evaluation results show that Xuanyuan LLM of each parameter scale all exhibits the strength of "performing big task with small scale", reaching the level of their own 2-5 times the number of parameters of the model. The Xuanyuan LLM not only excels in the financial sector, but with the comprehensive capability of integrating Baidu's ERNIE Bot, the Xuanyuan LLM also covers a number of general ability dimensions such as mathematical computation, scenario writing, logical reasoning, and text summarization.

(2) Service model

Xuanyuan finance LLM is not only widely used in key financial scenarios, such as financial product marketing, financial data operation, financial risk control management, and financial knowledge Q&A, but also plays an important role in a number of general application scenarios, such as code R&D and office assistance. Since it became open-sourced, hundreds of financial institutions have applied to try the Xuanyuan LLM.

Sales, credit review, customer service, and other call center operator-related scenarios are indispensable core scenarios for financial business, and improving

call center operator's efficiency and business conversion rate is both an opportunity and a challenge. The call center operator assistant developed based on the Xuanyuan LLM can summarize customer information in the CRM system, helping the operator to know about the customer in advance and make the conversation more targeted. During the conversation, the call center operator assistant can recommend discourse tactics in real time to help the operator seize the opportunity and improve the conversion rate. After the conversation is completed, the call center operator assistant can summarize the call process to help the operator review the performance and improve the service ability.

(3) Application

Duxiaoman has explored large-model training and fine-tuning techniques based on the Xuanyuan open-source LLM and eventually formed its own self-developed LLM technology stack. In the pre-training and instruction fine-tuning stages, in addition to general data, the Xuanyuan series also adds massive financial data. Duxiaoman builds this financial data based on years of industry practice experience and updates the business knowledge base in real time. This approach enhances the core capabilities of financial scenarios, such as analysis, summary, logic, and calculation. This makes the LLM's understanding of financial knowledge more professional, more accurate, more controllable, and more secure. On this basis, Duxiaoman fine-tunes and aligns the model with instructions based on manually calibrated, high-quality instruction data, further enhancing the Xuanyuan series even better financial capabilities.

At present, Xuanyuan LLM technology has been applied in various business scenarios of Duxiaoman, from marketing, customer service, risk control, office to R&D, and has begun to shown results. In terms of code assistants, the adoption rate of the code generated by Duxiaoman with the assistance of the Xuanyuan LLM has reached 42%, helping the company's overall R&D efficiency increase by 20%. In the field of smart office, the current intent recognition accuracy of the Xuanyuan LLM has reached 97%. In terms of the core call center operator assistant application, the Xuanyuan LLM

has also made some progress, such as telemarketing operator assistant, the current hallucination problem resolution rate is 96%, and the conversion rate has increased by 12%. The service efficiency of the call center operator assistant has increased by 25%. For the credit enhancement call center operator assistant, the efficiency of the credit enhancement supplemental document has increased by 37%.

5. Gen AI+Industry: Generative AI Drives Industrial Intelligence Upgrade

Industrial development is accelerating in the intelligentization. Following the phases of mechanization, electrification, automation, and informatization , the industry is now at a critical juncture, transitioning from digitalization to intelligentization. Currently, China has accumulated massive data, basic capabilities and scenario demands in the industrial field. With the ability of generative AI, industries can be upgraded and remodeled in a profound way, thus increasing production efficiency, reducing production costs and improving product quality. In addition, generative AI technology can penetrate various fields, including industrial production, operation, and management. It continuously optimizes key links such as perception, cognition, decision-making and promotes industrial development to achieve the "automated adaptation, automated decision-making, and automated execution" intelligent mode.

Generative AI LLMs are expected to open up a new dimension of industrial intelligence. Compared to traditional small models, generative AI LLMs are expected to explore new scenarios of intelligent applications in the industrial field and enhance the popularity of generative AI applications. For example, during the R&D and design phases, Generative AI LLMs can mine, generate, and analyze massive amounts of data to provide more accurate and innovative ideas for product design. At the operation and management levels, Generative AI LLMs can monitor various aspects of the production process, supply chain management, and optimize these areas with AI to improve the operational efficiency and market competitiveness of enterprises.

Success Case - China Unicom's Yuanjing LLM Empowers Hangzhou Jiayi Garment Co., Ltd.

(1) Technical introduction

Relying on Zhejiang Unicom, China Unicom Garment Manufacturing Corps undertakes the mission of helping the garment and textile industry's intelligent manufacturing upgrade using the group's Yuanjing LLM. It provides the cloud-generative AI capability for garment platform with leading performance based on the Yuanjing LLM as its infrastructure. The platform integrates the capability units, such as compliance of visual contents, visual quality inspection, garment and textile AIGC, etc.

(2) Service model

With the help of Yuanjing LLM, China Unicom Garment Manufacturing Corps has successfully built a number of key benchmarking projects in the national garment industry, including Zhejiang's SAINT ANGELO, China Jushi, JiaYi Garment, and other key projects. Additionally, the Corps provides services to several platforms, including Haining Warp Knitting Industrial Park, Anhui's Susong Development Zone, and others.

(3) Application

China Unicom and Hangzhou Jiayi Garment Co., Ltd. have jointly developed a customized Yuanjing LLM for garments. Relying on the ability of the Yiying LLM, designers only need to input the description of the clothing style they want to generate into the LLM chat box, within just a few seconds, the model wearing the style of clothing will appear on the screen. Designer can then make modifications and adjustments to it with brush tools and the LLM will instantly generate a new style after modification. This LLM can generate various styles and designs, including shirts, long skirts, coats, collegiate style, Chinese style, and more. In addition to real-time style generation based on text, the Yiying LLM can also import the existing image for

automatic style adjustment.

Hangzhou JiaYi Garment Co., Ltd. leverages the Yuanjing LLM's ability to significantly improve the efficiency of the designer. In the past, skilled designers could only design 3 to 4 pieces of clothing in a day, and finalizing a design took about 2 days. Now, it only takes 3 seconds to generate the design and see the effect. On average, to get a satisfactory result, designers only need to generate and modify with the Yiying LLM about a dozen times, which is a great improvement of work efficiency.

IV.
Exploring New Paths for Future Development of Generative AI

1) Focusing on Plan for Computing Platforms and Establishing a Mechanism for Computing Power Cooperation

In the future, BRICS countries may face computing power shortages in the area of generative AI. To address this challenge, a cloud computing-based platform can be built to support the joint training of industry-specific training datasets and AI. This approach can facilitate the creation of a technical and commercial closed loop, covering theoretical model innovation, model engineering, and scenario-based services, thus establishing a unified, open, and orderly large-scale AI industry ecosystem. In this process, the following specific aspects can be considered:

Firstly, encourage the establishment of regional and national-level cooperative platforms for computing power in BRICS countries, and set up a shared directory of computing resources for cross-regional and cross-industry computing power resource deployment. Through the integration of cloud computing and edge computing, computing resources can be dynamically allocated within the region, thereby improving resource utilization and efficiency. For example, distributed computing technology is used to connect supercomputing centers and data centers around the world to achieve flexible scheduling and on-demand allocation of resources to meet the needs of large-scale generative AI model training. Through the establishment of an AI computing resource sharing directory, supporting the open sharing of infrastructure resources such as supercomputing centers, arithmetic platforms, industry training datasets, and AI training platforms to avoid waste of resources and redundant construction. Concurrently, it is recommended that BRICS countries open up their computing platforms in national laboratories to support a variety of LLM training.

Secondly, telecommunication enterprises, Internet companies, and scientific research institutions in BRICS countries are encouraged to form a computing cooperation alliance to jointly build high-performance computing platforms. These platforms should focus on leveraging the computing power resources of existing high-grade GPUs and provide the computing power required for data training for LLMs, and promote the in-depth integration of industry, academia, and research through joint laboratories and research institutes, thus accelerating the industrialization process of cutting-edge technological research achievements. For example, the joint development of specialized AI acceleration chips and efficient computing frameworks can improve the performance and efficiency of computing platforms and support the rapid development of generative AI.

The third measure is to promote the construction of green data centers and to do a good job of coordinating computing power and electricity. Adopting advanced energy-saving technologies and renewable energy sources to optimize data center energy management and enhance the environmental friendliness and sustainability of the computational infrastructure. To address the issue that the supply of green electricity is greatly affected by factors such as location, time, and weather, methods such as energy storage and integration of generation, grid, storage, and load can be used. In addition, in the future, the BRICS countries can consider deploying a joint carbon-smart computing platform to find the best match between computing tasks and low-carbon electricity supply. It can be done by obtaining and analyzing the historical, real-time, or 24-hour hourly electricity supply structure and carbon intensity of each country and region and, based on it, adjusting the time and location of the computing tasks.

2) Optimizing Supply of High-quality Data and Promoting Data Openness and Sharing

Most of the BRICS countries currently suffer from a lack of public data from the government side and professional data from the industry. Currently, the source data that can reflect the traditional culture of the BRICS countries is insufficient, so the BRICS countries need to improve the supply of data and focus on creating professional data services. Training LLM requires large high-quality datasets, some of which need to be manually labeled. Collecting and cleaning data is a time-consuming fundamental task, the quality of which directly determines the intelligence level of the model. To this end, it is recommended to accelerate the promotion of the integration, sharing, development, and utilization of data resources. One of the success factors of ChatGPT is its availability of a high-quality corpus and a rich underlying scientific dataset. The BRICS countries possess rich public and industry data. The government, enterprises, and society can comprehensively utilize the resources from multiple parties to build a cooperative ecology of sharing and co-creation and to stimulate the vitality of data elements. The suggested key measures at the operational level are:

Firstly, the government can formulate a list of public data resources, carry out opening-up pilot projects, and encourage the "opening up as much as possible" of public data that can be used for generative AI. The opening up of high-value, low-sensitivity, large-scale public data related to people's livelihoods should take priority. Presetting too many real-life scenarios in the process of data opening is not desired, and the opening up of public databases and industry-specialized databases should be carried out gradually. The government should regularly maintain the data related to generative AI and periodically update, classify, clarify, annotate, structure, and determine the levels of open access while providing API data interfaces for the public to promote. The goal is to promote the convergence and integration of government data and industry data.

Secondly, at the societal level, it is encouraged to promote the joint construction of a high-quality corpus of source languages with a BRICS value

orientation, thus enhancing the supply of high-quality data. In order for generative AI to better understand the objective world and grasp its laws of operation, it needs to learn a large amount of data from the knowledge and values layers. The BRICS countries possess a rich and extensive cultural and historical heritage. Nations should collaborate to establish BRICS country databases, promoting international cooperation among libraries, publishing houses, and research institutions. This collaboration would involve systematically digitizing and sharing historical texts, mainstream media values data, and scientific journals in original languages such as Chinese, Spanish, Arabic, and Russian. These efforts could expand the supply of high-quality data reflecting "BRICS-style culture and values," which would in turn promote the development of generative AI and further the construction of a community with a shared future for mankind.

Thirdly, the government and social forces need to work together to build an industrial data resource service platform, innovate data trading mechanisms, and promote data trading and circulation. The government, through the establishment of a data resource service platform, aggregates data resources from multiple industries, such as transportation and energy, and promotes multi-party data integration through the establishment of unified data aggregation standards and the standardization of data description formats. Social forces form pre-training datasets based on government open data and massive network data processing. In terms of data circulation, the non-sensitive part of some industry data can be traded in accordance with the "use first, gain later" principle. When confirmed for use, LLM training can be used free of charge. After obtaining commercial profits, data usage fees should be paid proportionally.

3) Increasing Investment in Fundamental LLMs and Collaboratively Developing Industry-Specific LLMs

LLM is one of the core technologies of generative AI, and its research and

development require a large amount of resource allocation. Currently, there is still significant room for improvement in the foundational LLM capabilities of the BRICS countries. Efforts should be concentrated on supporting leading enterprises and research institutions in the field of artificial intelligence. By dividing responsibilities and collaborating. Foundational LLMs, that are competent and influential, thereby empowering multiple industries can be built. The specifics are as follows:

Firstly, in terms of the general LLM, the government should formulate a clear support policy to encourage leading enterprises, research institutes, and institutions of higher learning to increase their investment in the research and development of the basic LLMs. Policy protection can be provided to leading enterprises through the introduction of special support policies and the formulation of AI development plans. For example, setting up a special AI development fund to provide financial support to enterprises, research institutions and colleges involved in the research and development of LLMs, encouraging them to explore and innovate in LLM technology. Carrying out demonstration projects to show the actual effect of the LLM can promote the application of the technology in the whole industry.

Secondly, In the field of LLM for various industries, leading LLM enterprises and companies in each segment can collaborate on division of labor in various domains, jointly developing LLMs within their respective segments. Each enterprise should choose different research directions according to its own strengths and specialties and jointly develop competitive and high-level LLMs. Establishment of cross-enterprise and cross-field collaboration networks can promote collaborative research and development of LLMs. Through regular technical exchanges, joint projects, and sharing of R&D results, a benign cooperation mechanism can be formed. This not only accelerates technological breakthroughs, but also avoids redundant R&D and saves resources.

Thirdly, BRICS countries can establish joint R&D institutions across national borders. The countries can collaborate to establish generative AI research centers

or laboratories, pooling resources and scientific expertise to jointly tackle technical challenges. These institutions should focus on the collaborative research and development of AI LLMs. Serving as a platform, they gather top scientists, engineers, and technical experts from member countries, sharing equipment, resources, and data to work together on solving problems. This collaboration aims to accelerate the advancement and application of LLM technologies, enhancing the efficiency and quality of scientific research outcomes.

4) Planning Content and Ecosystem to Drive Overall Capability Development through Applications

BRICS countries can adopt differentiated development paths at the application level, driving overall capability improvement by developing content, scenarios, and ecosystems, and implementing strategies by category led by scenario-driven development. The future competitiveness of generative AI will increasingly rely on its content ecosystem, which not only includes data resources and algorithmic innovations, but also covers a wide range of application scenarios and partnerships. Establishing a strong content ecosystem will be at the core of the development of generative AI. To achieve this goal, it is essential to do a good job with the applications across all industries first. By integrating the massive user data from the consumer end (C-end) with the specialized domain data from the business end (B-end), we can continuously improve and strengthen the foundational capabilities and application effects of LLMs. By establishing super applications at the consumer end, we can cultivate user awareness and drive the development of business-end applications.

Firstly, in terms of C-end applications, content, scenario, and ecology are the three key elements of the overall development, which should be the focus in the plan. The common needs of users in C-end applications should receive attention. They refer to content generation and creative design, information refinement and professional assistance, and intelligent interaction. In terms of content strategy, by

promoting applications such as intelligent assistants and content generation tools, a large number of users can be attracted to use and generate rich interactive data to help in optimizing the model's natural language processing and content generation capabilities, and improve the accuracy and applicability of the model through user feedback. Focusing on frequently used user scenarios such as office assistants, personalized learning aids, and emotional virtual companions, customized solutions can be developed to create hit applications, establish user awareness, while simultaneously driving the development of industry-specific applications, forming a virtuous cycle.

Secondly, in the B-end industry application, strategies can be implemented by category, led by scenario-driven development. Big efforts are put into promoting small applications to facilitate the use in a large scale. The selection of key industries and business scenarios follows the principle of "**step by step, from easy to difficult.**" In terms of key industries, focus should be placed on sectors such as finance, education, and law, which have strong demands in customer service and data processing, and benchmark applications should be implemented on a large scale. In heavy-asset industries like manufacturing, specialized datasets should be selectively collected and model training and development should be gradually proceeded with to promote the progressive development of applications. In key business scenarios, it is best to start by penetrating from the fastest-progressing marketing/service segments into core segments such as research and development, design, and production/manufacturing. This approach can lower the barriers to the use of generative AI, allowing enterprises to first enhance the efficiency of marketing and service activities and user experience through content generation and intelligent dialogues using their own knowledge bases. This, in turn, boosts confidence and promotes the exploration and application of complex time-series analysis and real-time decision-making in the core segments of production and manufacturing.

5) Implementing Inclusive and Prudent Regulation and Promoting International Cooperation and Innovation

As a new development, generative AI products encourage innovation and progress, which is the main theme. Generative AI applications may "make mistakes" at the initial stage, but they have gradually established their own technical mechanisms to filter and block risks related to content and ethics and have gradually matured and improved after user feedback and the expert iteration mechanism. Relying on an excellent network environment, rich experience in content governance, and a sound AI regulatory framework, China and other BRICS countries are fully equipped to govern generative AI applications, as suggested below:

Firstly, establish inclusive and prudent regulatory norms to promote the development of generative AI technology according the AI-45° Law. In promoting the development of credible generative AI technology, safety is the priority, while the long-term development of generative AI performance should be ensured to helping the long-term development of generative AI technology according to the AI-45 ° Law. Focus should be on technology-driven, full-process optimization, multi-body participation, and agile governance. For example, a specialized AI ethics committee should be set up to review and guide the ethical risks of AI technology; and a personal data protection and content review mechanism should be established to safeguard user rights and interests and social security in response to the personal data privacy and content security issues that may be brought by generative AI.

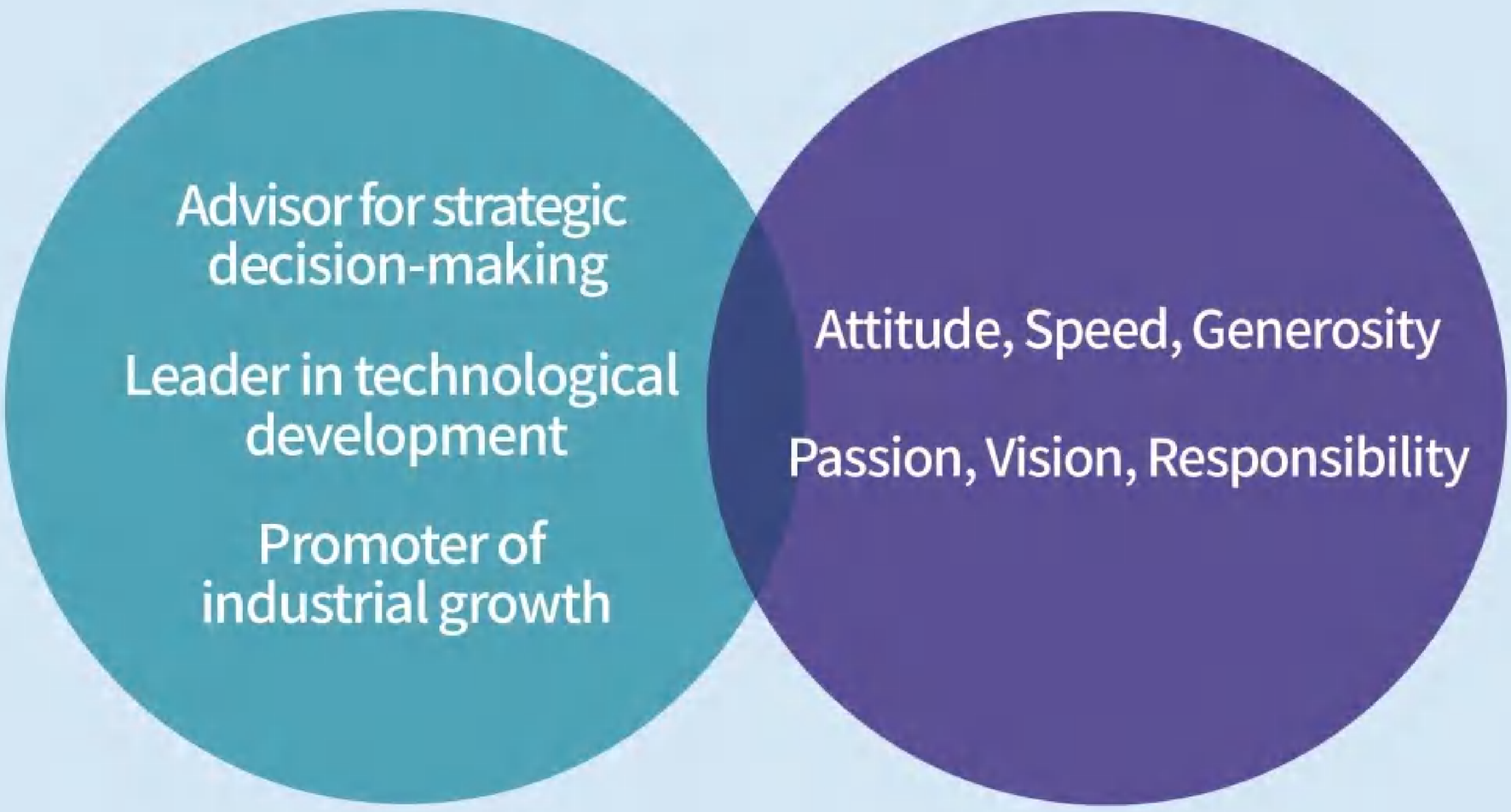
Secondly, establish a BRICS cooperation mechanism on AI. An international mechanism for scientific research and exchange covering the BRICS countries should be established. Research achievements and practical experiences can be shared by research institutions, enterprises, and governments of each country, thereby promoting the coordinated development among the countries in areas such as the research and development of generative AI technology and standard setting. At the same time, BRICS countries can set up a special transnational talent exchange

program to encourage mutual exchange, visits and joint research among researchers, engineers and students in the field of generative AI, and to promote knowledge sharing and technology interoperability.

Thirdly, establish a joint investment fund for the generative AI industry in the BRICS countries. The BRICS countries can consider jointly setting up an investment fund to bring together the strengths of governments, enterprises and capital to provide sufficient financial support to help the research and development and industrialization and application of generative AI technologies. The BRICS countries can consider jointly setting up an investment fund to bring together the strengths of governments, enterprises, and capital to provide sufficient financial support to the research and development, industrialization and application of generative AI technologies. The fund can accelerate the technological breakthroughs and application implementation, thereby enhancing the competitiveness of BRICS countries in the global generative AI arena.

There is an old Chinese saying, "With concerted efforts, we can overcome all difficulties; with collective wisdom, we can achieve all goals." This is exactly what we believe when we face challenges. China is willing to work hand in hand with BRICS countries to achieve breakthroughs in both the depth and breadth of generative AI applications in consumer and industrial sectors. We will continue to promote the construction of an open world economy and build a community with a shared future for mankind, making the world more prosperous and people's lives happier.

Rooted in China Unicom, China Unicom Research Institute is a second-tier organization shouldering the responsibility of technological innovation directly under China Unicom. Since 2022, it has set up the China Institute of Cybersecurity, the National Engineering Research Center for Next-Generation Internet Broadband Business Applications and the first national-level operation center for intellectual property rights in the cybersecurity industry in China, forming a development pattern of "Two Institutes & Two Centers" and creating a new situation of its high-quality development. China Unicom Research Institute, as an adviser for strategic decision-making, a leader in technology development, and a booster for industrial development serving the national strategy, industry development, and enterprise production, insists on taking the mission of high-level independent development of technologies, focusing on the main responsibility of building China's strength in cyberspace and building a digital China, expanding the network communication and computing power-network-big data-AI business, and forming a culture of "Attitude, Speed, Magnanimity, Sentiment, Pattern and Responsibility". The Institute focuses on the fields of next-generation Internet, optical network, 5G-A/6G, cybersecurity, big data & AI network optimization, low-altitude intelligent network connection and new forms of think-tank research. Adhering to the "Four Focuses", the Institute will strive to make breakthroughs in core technologies, build the technological innovation power, construct professional and technical talent teams and transform the innovation results, and make efforts to enhance its value creation capability, improve its strategic technological power, and increase its value as a specialized, high-end and innovation-driven SME to take initiatives to become the main force of technological innovation in the communications industry, and increase efforts to develop into a first-class modernized institute "trusted by the country, leading in the industry, relied on by the Group, and making its employees proud".



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