

中国新一代人工智能科技产业发展报告·2020

China's New Generation Artificial Intelligence Technology Industry Development Report 2020

新挑战和机遇下的 中国人工智能科技产业发展

China's Artificial Intelligence Technology Industry Development
Under New Challenges and Opportunities

 **中国新一代人工智能发展战略研究院**
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一、前言和梗概

(一)

2019年初至今，包括美国技术封锁、新冠肺炎疫情冲击和新型基础设施建设启动在内的一系列事件的发生，对中国人工智能科技产业发展产生了深远影响。中国人工智能科技产业内生于经济转型升级过程中创造的智能化需求。市场需求牵引、政府战略推动和产业界积极响应，是中国人工智能科技产业发展的关键驱动因素。面对外部冲击带来的机遇和挑战，消费互联网升级和产业互联网的兴起预示着人工智能已经步入与经济社会全面融合发展的新阶段。

美国对我国高科技企业技术封锁的升级再次让我们清醒地认识到，通过自主创新加快弥补在芯片和基础软件领域短板，是发展人工智能科技产业的当务之急。构建自主可控和开放协作的全球价值网络，加速形成新的全球创新循环系统，是提升人工智能科技产业国际竞争力的基础。

突如其来的新冠肺炎疫情，为人工智能科技产业的发展创造了特殊应用场景。数字和人工智能技术应用不仅为疫情防控做出了积极贡献，而且为经济秩序的稳定和恢复创造了条件。在人工智能科技产业支撑下，线上经济和非接触经济成为中国经济发展的稳定器。在疫情防控常态化背景下，在线课堂、在线会议和线上经济逐步成为惯例化和常规化活动，加速了数字和人工智能技术的创新和应用，催生了包括5G在内的新型基础设施建设计划的出台和实施。

在人工智能与经济社会的融合发展过程中，跨产业和跨学科技术元素的重组和融合趋势不断增强。多元技术元素在不同应用场景中的重组和融合，引发了一系列互补性创新和专用性技术体系积累。包括区块链、5G、边缘计算和数据中台^[1]在内的技术创新和应用，正在掀起新一轮人工智能技术创新浪潮。

无论在技术创新还是应用方面，区块链技术都取得了突破性进展。2019年，在我国重点探索的区块链存储、智能合约、共识算法和加密技术等领域，累计公开有效专利964项、420项、101项和42项。^[2]在加密算法研究和应用中，更加注重自主可控。目前，区块链技术已被广泛应用于包括政务、金融和供应链管理在内的诸多应用领域。

2019年，在5G技术领域，商用环境逐步完善，标准技术取得了新的突破，在产业发展上走在了世界前列。2019年6月，工业和信息化部正式发放了5G商用牌照，标志着5G正式进入商用。2019年9月，中国联通与中国电信签署《5G

^[1] 作为平台提高数据服务能力的战略举措，数据中台通过垂直业务的数据汇聚整合、数据提纯加工、数据服务可视化和数据价值变现，把数据转化为服务企业各项业务发展的资产。

^[2] 赛迪区块链生态联盟：《2019-2020年中国区块链年度发展报告》，转引自CNNIC中国互联网信息中心第45次《中国互联网络发展状况统计报告》。

网络共建共享框架合作协议书》，在全国范围内共同建设 5G 接入网络，通过共享频率资源，降低网络建设和运维成本。在 2020 年 4 月 28 日召开的国务院常务会议部署加快推动信息网络等新型基础设施建设，明确提出“创新投资建设模式”和“以应用为导向”要求，加快制定和实施包括 5G 在内的新型基础设施建设计划。

在技术创新方面，5G 增强技术研发取得了阶段性成果，专利项数居全球第一。2019 年，在芯片测试、低频和高频技术研究领域取得了突破。截至 2019 年 11 月，华为声明的 5G 标准必要专利数以 3325 项排名世界第一，中兴通讯以 2204 项排名第五。从通过认证的专利数量看，华为以 1337 项排名世界第四，中兴通讯以 596 项排名第七。截至 2019 年 4 月，我国已有 16 个省级行政单位实现了 5G 通话。截至 2019 年 10 月，我国已有 52 座城市实现了 5G 商用。截至 2019 年 12 月，全国共建成 5G 基站超过 13 万个。

2019 年，包括语音识别和计算机视觉在内的人工智能核心技术在应用中取得了长足进步。科大讯飞拥有了深度全序列卷积神经网络语音识别框架，输入法准确率达到 98%。阿里巴巴人工智能实验室通过语音识别技术开发出音纹购物功能。百度开发出人脸检测深度学习算法 PyramidBox，海康威视提出了以预测人体中轴线替代预测人体标注框的方式，解决了弱小目标在行人检测中的问题。核心技术的日益成熟，为人工智能在更广泛范围的应用奠定了基础。

随着消费互联网升级和产业互联网的发展，在多元技术元素的重组和融合过程中，信息物理系统(CPS)和数字孪生(DT)概念再次焕发生机和活力，逐步演化为实现物理空间、社会空间和网络空间融合的实现途径和架构，指引数字和人工智能技术的全面落地。在信息物理系统和数字孪生架构的指引下，数字化进程的加速和三维空间的融合，使“数据和计算”真正成为驱动经济发展的“关键生产要素”。在网络空间中，信息物理和数字孪生系统能够真实映射物理和社会空间的数据汇聚、整合和分析，把“数据和计算”持续转化为实现价值创造的资产，使数据和计算成为国家、地区和企业的战略资源和关键资产。^[1]

(二)

截至 2019 年 12 月 31 日，本报告共发现 797 家中国人工智能企业，^[2]大约占世界人工智能企业总数 5386 家的 14.80%，仅次于排名第一的美国（2169 家，

^[1] 如果说互联网、大数据和云计算更多地表现为技术的话，数字孪生和信息物理系统则不仅是技术，而是由技术集成构成的技术体系架构。

^[2] 797 家人工智能企业筛选的主要依据为：一是从事人工智能核心技术和产品的研发和生产；二是发生过投融资事件；三是存在稳定的市场业务关系。

占比 40.27%)。^[1]

中国的人工智能企业主要分布在北京市、广东省、上海市和浙江省，占比分别为 42.5%、16.9%、15.3%和 8.3%。中国人工智能企业的创建时间集中分布在 2010 年至 2017 年之间，占比达到 69.9%。企业创建的峰值出现在 2015 年，占比为 15.8%。2016 年之后，尽管中国人工智能企业的创建数量显著下降，但是无论从融资额还是从应用领域的拓展看，企业均表现出良好的成长性。

在 797 家人工智能企业中，基础层和技术层企业占比分别为 3.4%和 23.8%，应用层企业占比则高达 72.8%。应用层企业广泛分布在包括企业技术集成与方案提供、智能机器人、关键技术研发和应用平台、新媒体和数字内容、智能医疗、智能硬件、金融科技、智能商业和零售、智能制造在内的 18 个应用领域。人工智能与传统产业的融合发展，正在成为中国经济转型升级的关键驱动力量。

从 797 家人工智能企业核心技术的分布看，大数据和云计算占比最高，为 27.6%；其次是机器学习和推荐、视觉识别、机器人技术，占比分别为 15.4%、15.3%、14.7%；语音识别和自然语言处理、智能硬件、智能芯片和生物识别的占比分别为 9.0%、7.7%、2.3%、1.5%。

截至 2019 年 12 月，在 797 家人工智能企业中，能够检测到发生融资事件的企业为 655 家，融资总额为 15298.06 亿元。从 655 家企业融资情况看，截至 2019 年 12 月，37.37%的企业融资额小于 1 亿元，39.51%的企业融资额在 1-10 亿元之间，融资额超过 10 亿元的企业数占 23.12%。

在可获得研发强度数据的 131 家人工智能企业中，^[2]平均研发强度为 12.1%，远高于 2018 年国内企业的平均研发强度，研发强度在 5%-15%之间的的企业数占比为 47.33%，研发强度大于 15%的企业数占比为 23.66%。持续的高强度研发投入，为人工智能科技产业注入了强大动力。同时，能否实现市场规模的快速扩张，是高研发强度人工智能产业发展面临的风险因素。

基于 797 家人工智能企业关系数据的价值网络分析表明，中国人工智能科技产业的创新生态系统是高度开放的。797 家中国人工智能企业核心人力资本的 21.17%拥有在国外高校和研究机构学习的经历，10.9%拥有在国外企业和研究机构工作的经历。同时，技术关系中 17.33%的技术输入关系来自国外企业和研究机构，技术赋能方为国外企业和机构的关系数占比仅为 9.44%。其中，作为基础硬件和软件企业的英特尔、高通、英伟达和微软，是中国人工智能科技产业的重要技术赋能者。

^[1] 对于全球和中国人工智能企业数，在各种版本的人工智能报告中存在明显差异。在本报告中，全球人工智能企业数和美国人工智能企业数采用的是中国信通院《全球人工智能产业数据报告》（2019）公布的数据，797 家中国人工智能企业数则是截至 2019 年 12 月 31 日本报告检测到和核实确认的企业数。其中全球人工智能企业数为 5386 家，中国人工智能企业数为 1189 家。

^[2] 因为数据的可获得性关系，研发强度分析的主要对象是 113 家公司，主要是上市公司。

从 797 家中国人工智能企业关系数据的分类统计看，在技术关系中技术输入和技术赋能关系系数占比分别为 21.33% 和 78.67%，在投融资关系中融资关系和投资关系系数占比分别为 39.15% 和 60.85%。技术赋能和投资关系占比相对较高表明，中国人工智能企业具有很强的辐射和带动作用。

中国人工智能科技产业价值网络呈现出明显的“极核”状结构。包括腾讯、阿里巴巴、百度、华为、京东、科大讯飞在内的平台企业，是人工智能科技产业发展的主导者。科技部重点支持的 15 家开放创新平台仅占 797 家人工智能企业数的 1.9%，但是与之相关联的节点数和关系系数占比却高达 32.6% 和 30.9%。从关系分类和占比看，15 家开放创新平台不仅是人工智能企业的主要技术赋能者和人力资本的重要供应方，而且是重要投资者。随着产业互联网的兴起和发展，以华为代表的硬科技平台企业将发挥越来越重要的作用。

人工智能科技产业包括两个基本组成部分：核心产业部门和融合产业部门。在融合产业部门的发展中，除了基础层的平台和技术层企业之外，传统产业的龙头企业，尤其是非初始人工智能上市公司成为人工智能与实体经济融合发展的关键主导者。

在 797 家样本企业中，580 家应用层企业是融合产业部门的市场主体。其中，平安集团、苏宁易购、小米和滴滴出行是融合产业部门最为活跃的企业。应用层企业在数字化和智能化转型过程中，积累和集成人工智能技术，构建创新生态系统，赋能传统产业的智能化，催生出新技术、新产品、新业态和新模式。

平台主要依靠数据生态和技术集成优势，赋能中小企业和开发者，不断拓展业务领域，推动融合产业部门的发展。在推动人工智能与实体经济融合发展过程中，平台不仅为应用层企业提供技术赋能，而且是应用层企业核心人力资本供应方和投资者。

作为传统产业的龙头企业，50 家非初始人工智能上市公司是融合产业部门发展的主要推动者。2000 年之后，50 家非初始人工智能上市公司通过自主研发、与其他企业合作研发、与高校和科研机构合作研发和兼并收购的方式发展为人工智能企业，占比分别为 30%、25%、22% 和 21%。在转型升级为智能企业之前，50 家企业主要分布在传统制造和安防产业，占比分别为 88% 和 12%。从 50 家企业的地域分布看，集中分布在广东省、浙江省和北京市，三地区企业数占比高达 60%。在 50 家样本企业中，进入智能制造领域的企业数占比达到 40%，其次是智能硬件领域，占比为 22%，再次是智能安防领域，占比为 12%。其余企业则广泛分布在智能汽车、智能家居、智慧城市、智能医疗和智能教育等领域。其中，安防产业是目前智能化转型最为成功的融合产业部门。除了平台，掌握核心技术活跃的中小企业和开发者是 50 家非初始人工智能上市公司的技术创新和集成的重要来源。

作为独角兽公司，商汤科技、旷视科技、依图科技和云从科技依托在计算机视觉领域的技术优势，是技术层企业的代表。四家独角兽公司通过与平台和传统产业龙头企业的合作，推动人工智能核心技术与实体经济的融合发展。其中，平台和传统产业龙头企业主要是为技术层独角兽公司提供应用场景。在四家计算机视觉独角兽公司中，技术赋能关系数排名第一的是商汤科技，占比为 32.55%，排名第二的是旷视科技，占比为 27.18%，排名第三和第四的是依图科技和云从科技，占比分别为 21.81%和 18.46%。通过对金融、安防、城市管理、交通和教育领域的技术赋能，推动科技金融、智能安防、智慧城市、智能交通和智慧教育产业的发展。

在人工智能科技产业的发展中，中国的学术界通过构建人工智能学术生态与产业界协同创新，推动人工智能产业化和产业智能化步伐。截至 2019 年 12 月 31 日，本报告共检测到大陆境内 109 所 AI 大学^[1]。从地域分布看，109 所 AI 大学分布在全国 23 个省级行政区，北京市、江苏省、上海市、广东省、浙江省等是中国 AI 大学分布集中的省市。其中北京市 15 所，占比 13.8%，排名第一。江苏省 13 所，占比 11.9%，排名第二。上海市、广东省、浙江省分别为 9 所，占比皆为 8.3%。按主管部门划分，在 109 所 AI 大学中，教育部直属高校 52 所，占比为 47.7%；省级政府主管高校 44 所，占比 40.4%；工业和信息化部直属高校 7 所，占比为 6.4%；其他部属高校 6 所，占比为 5.5%。

随着人工智能技术的发展，我国教育部门开始在不同层次的高校布局人工智能学科的建设。根据教育部网站公示，我国 2018 年有 35 所高校开始设置人工智能本科专业，2019 年新增了不同层次的 180 所高校设置了人工智能本科专业，至今共 215 所普通高校设置了人工智能本科专业。同时为紧扣国家经济发展新业态和新需求，教育部于 2019 年 10 月就《普通高等学校高等职业教育（专科）专业目录》增补了人工智能技术服务专业，从 2020 年起执行，截至 2020 年 3 月，我国 26 个省市自治区共 171 所高职院校成功申请设置人工智能技术服务专业。目前，我国高校已形成人工智能基础理论研究、技术开发和技术应用多层次的人才培养体系。

对 Scopus 数据库的检索表明，截至 2019 年 12 月 31 日，共检测到 117 所中国大学和 14 家中国非大学科研机构发表国际论文 52976 篇^[2]。在国际论文发表数排名前列的中国大陆高校中，排名第一的是清华大学，发表国际论文数占比为 3.70%；其次是上海交通大学，占比为 3.12%；排名第三的是哈尔滨工业大学，

^[1] 判断是否是 AI 大学的主要依据是大学在国际期刊发表论文的数量和是否设置人工智能相关的专业学院、系和研究所。109 所 AI 大学都是我国大陆境内具有人工智能基础科学研究能力的本科院校。

^[2] 检索结果以 Scopus 数据库为基础，以“Artificial Intelligence、Machine learning、robot、Speech Recognition、pattern recognition”五个关键词按照“或”的关系进行检索，筛选出所有标题、摘要或关键词中出现检索词的论文，在文献类型中只保留论文一项，在出版物类型中只保留期刊一项。

占比为 3.08%；排名第四和第五的是浙江大学和中国科学院大学，占比分别为 3.03% 和 2.06%。

在与中国合作发表国际论文的国外高校和机构中，新加坡南洋理工大学、新加坡国立大学、澳大利亚悉尼科技大学、微软亚洲研究院、美国佐治亚理工学院、澳大利亚悉尼大学、加拿大阿尔伯塔大学和法国国家科研中心排名前列。

截至 2019 年 12 月 31 日，本报告共检测到 103 家人工智能领域的非大学科研机构，与 2018 年底的 75 家相比，新增 28 家。在新检测到的非大学科研机构中，包括中国农业科学院、公安部第一研究所、中国铁道科学研究院、机械科学研究总院、中国电力科学研究院和中国空间技术研究院在内的国家和部委下属研究机构展开人工智能领域的科学研究。与以往检测到的非大学科研机构大多从事人工智能基础理论研究不同，新增研究机构主要结合各自行业展开人工智能技术应用研究。

103 家人工智能领域的非大学科研机构分布在北京的有 56 家，占比为 54.37%，位列第一；排名第二的上海有 9 家，占比为 8.74%；排名第三的广东有 6 家，占比为 5.83%。浙江、山东、江苏分别有 4 家，占比同为 3.88%。

在 103 家非大学科研机构中，专利数量排名前十的机构共拥有专利 39244 项，约占样本机构专利总量的 47.15%。从专利数占比看，排名前十的机构是人工智能领域非大学科研机构科技研究的主导力量。

在人工智能科技产业发展的“政产学研用”协同推动机制中，作为链接者的产业联盟和会议同样发挥着重要作用。2019 年，全国共召开人工智能领域的会议 909 场，远高于 2018 年的 823 场。北京市、上海市、深圳市和杭州市是人工智能会议举办最为密集的城市，分别达到 236、156、144 和 55 场。

截至 2019 年 12 月 31 日，本报告共检测到人工智能领域的产业联盟 190 家，其中，72 家是 2019 年新创建的，占比为 38%。新成立的 72 家产业联盟广泛分布在 18 个省市自治区，其中广东省和北京市数量最多，分别为 11 家、10 家，上海市 7 家，江苏省、山东省和重庆市均为 6 家。各地纷纷通过成立人工智能产业联盟的方式来推动人工智能科技产业的协同创新和发展。

为了积极响应国家政策和当地智能科技产业发展的需要，地方政府通过出台相关政策和建设人工智能产业园的方式推动产业的发展 and 产业结构的调整。在 2019 年，地方政府共出台 276 项涉及人工智能发展的相关政策，超过 2018 年的 259 项。政策内容不仅包括人工智能、数字经济、5G、工业互联网等直接相关的政策和战略规划，而且包括“双创”、金融支持、科研奖励、科技成果转化、赋予科研人员更大自主权等支持类政策。从政策出台针对的产业领域看，覆盖了智慧政务、智慧医疗、工业互联网、智能制造、智能车联网、智慧教育等诸多领域。2019 年，北京市出台 20 项政策，在数量上排名第一。同时，从各省市自治区出

台的政策内容看，与 2018 年相比更加细化，推出了一系列对具体产业和应用场景开放的扶持政策。

在 2018 年 163 家人工智能产业园区的基础上，2019 年新增产业园区 138 家。在各省市自治区中，山东省新增 20 家，江苏省新增 14 家，广东省新增 13 家，浙江省和上海市均新增 10 家。通过产业园区的规划和建设，各地区将会形成一批人工智能科技产业发展的重要载体，成为引领区域产业结构调整的智能科技创新区。

(三)

作为第四次工业革命的引擎，人工智能科技产业包括两个基本组成部分：核心产业部门和融合产业部门。核心产业部门主要由基础层（包括大数据、云计算、芯片和智能传感器在内的基础技术）和技术层（人工智能核心技术）研发和生产企业构成，是人工智能科技产业发展的基础技术和核心技术的供应方。融合产业部门则是由运用人工智能技术改造传统产业的应用层企业构成。

在 797 家人工智能样本企业中，286 家与国外企业存在技术合作关系。对 286 家企业与国外企业的技术合作关系分析表明，除了数据生态优势，中国人工智能企业的主要竞争优势集中在算法和应用软件领域，而在包括芯片在内的基础硬件和软件领域存在竞争劣势。尤其是在算力方面，中国企业依赖美国企业的技术和产品。在基础硬件和软件领域的自主崛起，是美国技术封锁中国人工智能科技产业发展的必然选择。

数据、算力和算法构成了人工智能科技产业发展的三大要素。随着核心产业部门的发展和人工智能核心技术的成熟，人工智能与传统产业的融合不仅带动了融合产业部门的发展，而且丰富和完善了核心产业部门的数据生态、算法和算力优势。围绕着数据、算力和算法协同发展，核心产业部门和融合产业部门的正反馈效应和良性互动，是人工智能科技产业健康发展的关键机制。

中国互联网信息中心（CNNIC）2020 年 4 月 28 日发布的第 45 次《中国互联网络发展状况统计报告》显示，截至 2020 年 3 月 15 日，我国网民规模达到 9.04 亿，互联网普及率为 64.5%，网络购物用户规模达到 7.10 亿，2019 年交易规模达到 10.63 万亿，同比增长 16.5%。2019 年，通过海关跨境电子商务管理平台零售进出口商品总额达到 1862.1 亿元，增长 38.3%。疫情冲击下，互联网普及的持续推进进一步提升了数据生态优势，为数字和智能技术的广泛应用创造了条件。

数据生态的完善和经济的智能化需求，强力驱动着算力和算法的技术进步和落地应用。2019 年，边缘计算的兴起以及云边的深度融合，成为算力技术创新的前沿。为了适应人工智能在安防、城市交通管理、新零售、智能制造和智慧医

疗领域的应用，围绕着边缘计算能力的提升和云边融合，跨产业和跨领域技术融合引发了一系列互补性创新和专用技术积累，使数据的存储和计算能力得到提升。尽管面对美国的技术封锁，包括芯片、关键硬件和基础软件领域的突破，自主可控生态的逐步形成，为中国人工智能科技产业发展提供了保障。

2019年，以华为为代表的硬科技平台的崛起，成为中国人工智能科技产业发展的最大亮点。依托在芯片和基础软件领域的技术优势，华为陆续推出了HMS、鸿蒙系统、鲲鹏计算生态和5G自动驾驶生态系统。以华为海思、寒武纪科技、中芯国际和紫光展锐代表的智能芯片公司，成为人工智能技术在智能终端、智能安防和智慧城市应用中的关键推动者。如果说阿里巴巴、腾讯和百度为代表的消费互联网平台的发展是建立在传统架构基础上的话，以华为为代表的硬科技平台的兴起则意味着自主架构和生态系统的兴起和发展。

随着数据生态、计算能力和算法领域的协同创新，人工智能与经济社会融合发展为基础研究、应用开发和规模生产之间创新循环的形成创造了条件。中国人工智能科技产业的发展，在驱动国内经济数字化转型和智能化转型升级的同时，将使中国企业成为全球价值链重构的引领者，为主动迎接后疫情时代新一轮经济全球化浪潮奠定基础。

2019年，在人工智能科技产业获得快速发展的同时，同样暴露出一系列问题。首先，美国的技术封锁打破了全球技术研发与市场规模扩张之间创新的良性循环，在危害全球经济发展的同时，同样会削弱美国在高科技领域的领导地位。在技术封锁条件下，中国构建自主可控创新生态系统的过程中，将面临在一国范围内形成创新循环的挑战。其次，在加强基础研究的过程中，如何建立科技创新风险的社会分摊机制，形成基础研究、应用开发和规模生产之间的良性循环，是科技体制和机制创新的重点领域。第三，无论对中小企业和创业者还是对消费者而言，如何抑制超级平台的垄断和消除算法歧视，建立公平和有效的人工智能治理体系，是政府、产业界和学术界需要共同面对的问题。最后，面对人工智能科技产业发展中明显的创新“极化”趋势，要及早制定数字化反贫困战略，让人工智能科技产业更好地赋能贫困地区的经济和社会发展，为国家脱贫攻坚战略提供技术支撑。

I. Introduction and Summary

1

From the beginning of 2019 to the present, a series of events, including the technology blockade of the U.S., the impact of the COVID-19 pandemic and the launch of new infrastructure construction, have had a profound impact on the development of China's artificial intelligence technology industry. China's artificial intelligence technology industry is endogenously created by the intelligence demand that produced during the process of economic transformation and upgrading. The traction of market demands, the promotion of government strategies and the active responses from industries are the key driving factors of China's artificial intelligence technology industry development. Facing the opportunities and challenges brought by the external shocks, the upgrading of the consumer internet and the rise of the industrial internet herald that artificial intelligence has entered a new stage of comprehensively integrated development with the economic society.

The upgrading of the US technology blockade of China's high-tech enterprises once again makes us soberly aware that the top priority for the development of the artificial intelligence technology industry is to accelerate to make up for the shortcomings in the field of chips and basic software by independent innovation. Constructing an independent, controllable, open, and collaborative global value network, and accelerating the formation of a new global innovation cycle system, are the foundation for enhancing the international competitiveness of the artificial intelligence technology industry.

The sudden outbreak of the COVID-19 pandemic has created special application scenarios for the development of the artificial intelligence technology industry. The application of digital and artificial intelligence technology has not only made active contributions to the prevention and control of pandemic situations, but also created conditions for the stability and restoration of the economic order. Supported by the artificial intelligence technology industry, the online economy and the non-contact economy have become the stabilizers of China's economic development. In the context of routinized epidemic prevention and control, online class, online meetings and online economy have gradually become routine activities, accelerating the innovation and application of digital and artificial intelligence technologies, and enabling the introduction and implementation of new infrastructure construction plans, including 5G.

In the process of the integrated development of artificial intelligence and the economic society, the trend of reorganization and integration of cross-industry and interdisciplinary technical elements continues to increase. The reorganization and integration of multiple technical elements in different application scenarios have triggered a series of complementary innovations and specialized technical system accumulation. Technology innovation and application, including blockchain, 5G, edge computing and data middle office^[1], are raising a new wave of artificial intelligence technology innovation.

In the both aspects of technology innovation and application, breakthrough progress has been made in blockchain technology. In 2019, a total of 964, 420, 101 and 42 effective patents have been published respectively in the areas that China focuses on, including blockchain storage, smart contracts, consensus algorithms and encryption technology.^[2] In the research and application of encryption algorithms, more emphasis is placed on autonomous control. At present, blockchain technology has been widely used in many application fields, including government affairs, finance and supply chain management.

In 2019, in the field of 5G technology, the commercial environment has been gradually improved, with the new breakthroughs that have been made in standard technology, and the industrial development is at the front rank of the world. In June 2019, the Ministry of Industry and Information Technology officially issued a 5G commercial license, marking the official entry of 5G into commercial use. In September 2019, China Unicom and China Telecom signed the “5G Network Co-construction and Sharing Framework Cooperation Agreement” to jointly build a nationwide 5G access network, and reduce the cost of network construction, operation and maintenance by sharing frequency resources. The State Council executive meeting was held on April 28, 2020, to accelerate the construction of new infrastructure such as information network, and clearly proposed the “innovative investment construction model” and “application-oriented” requirements, to accelerate the formulation and implementation of new infrastructure construction plans, including 5G.

In terms of technology innovation, 5G enhanced technology research and

^[1] As a strategic measure for platforms to improve data service capabilities, the data middle office transforms data into assets that serve the development of various enterprise business, by the data aggregation and integration, data purification and processing, data service visualization, and data value realization of vertical businesses.

^[2] CCID Block Chain Ecosystem Alliance. “2019-2020 China’s Block Chain Development Annual Report”, cited in CNNIC China Internet Information Center. The 45th “Statistical Report on the Development of China’s Internet”.

development has achieved phased results, with the number of patents ranking first in the world. In 2019, breakthroughs have been made in chip testing, low-frequency and high-frequency technology research. As of November 2019, Huawei ranked first in the world with the number of 3,325 declared 5G standard essential patents, and ZTE ranked fifth with 2,204. According to the number of certified patents, Huawei ranked fourth in the world with the number of 1,337, and ZTE ranked seventh with 596. As of April 2019, 16 provincial-level administrative units in China achieved 5G calls. As of October 2019, 52 cities in China achieved 5G commercial use. As of December 2019, more than 130,000 5G base stations were built in the country.^[1]

In 2019, the core technologies of artificial intelligence including speech recognition and computer vision have made great progress in application. Iflytek has a deep full-sequence speech recognition framework of convolutional neural network, and the accuracy of the input method reaches 98%. Alibaba Artificial Intelligence Lab has developed a voiceprint shopping function through speech recognition technology. Baidu has developed PyramidBox, a deep learning algorithm for face detection, and Hikvision has proposed a method of predicting human body's central axis instead of labeling box, which solves the problem of weak targets in pedestrian detection.^[2] The increasing maturity of core technologies lays the foundation for the wider application of artificial intelligence.

With the upgrading of the consumer internet and the development of the industrial internet, in the process of reorganization and integration of multiple technological elements, the concepts of Cyber-Physical System (CPS) and Digital Twin (DT) revive vitality, and gradually evolve into the realization approach and architecture of the integration of physical space, social space, and cyberspace, to guide the full implementation of digital and artificial intelligence technologies. Under the guidance of CPS and DT Architecture, the acceleration of the digital process and the integration of three-dimensional space make “data and computing” truly become the “key production factors” that drive economic development. In cyberspace, CPS and DT can truly map the data aggregation, integration and analysis of physical space and social space, and continuously transform “data and computing” into the assets that realize value creation, making data and computing become the strategic resources

^[1] Cited in CNNIC China Internet Information Center. The 45th “Statistical Report on the Development of China’s Internet”.

^[2] Cited in CNNIC China Internet Information Center. The 45th “Statistical Report on the Development of China’s Internet”.

and key assets of countries, regions, and enterprises.^[1]

2

As of December 31, 2019, this report found a total of 797 Chinese artificial intelligence enterprises,^[2] accounting for about 14.80% of the world's total 5,386 artificial intelligence enterprises, which is second only to the United States. (2169 enterprises, accounting for 40.27 %).^[3] China's artificial intelligence enterprises are mainly located in Beijing, Guangdong, Shanghai and Zhejiang, respectively accounting for 42.5%, 16.9%, 15.3% and 8.3%.

The establishing year of Chinese artificial intelligence enterprises is concentrated between 2010 and 2017, accounting for 69.9%. The peak of enterprise creation appears in 2015, accounting for 15.8%. After 2016, despite the significant declining number of Chinese artificial intelligence enterprise establishment, from the perspective of both financing amount and application field expansion, the enterprises have shown good growth.

Among the 797 artificial intelligence enterprises, the base-layer enterprises and technology-layer enterprises respectively account for 3.4% and 23.8%, and the proportion of application-layer enterprises reaches 72.8%. Application-layer enterprises are widely distributed in 18 application fields, including enterprise technology integration and solution providing, intelligent robots, key technology research, development and application platforms, new media and digital content, smart health care, intelligent hardware, technology finance, intelligent business and retail, and intelligent manufacturing. The integrated development of artificial intelligence and traditional industries is becoming a key driving force for China's economic transformation and upgrading.

From the distribution of the core technologies of the 797 artificial intelligence enterprises, big data and cloud computing account for the highest proportion, 27.6%; followed by machine learning and recommendation, visual recognition, robot

^[1] If the Internet, big data and cloud computing are more likely to be considered the demonstration of technology, DT and CPS are the technical system architecture composed of technology integration, more than technology.

^[2] The main selection criteria of the 797 artificial intelligence enterprises is as follows: the first is the engagement in the research and development of artificial intelligence core technologies and products; the second is the occurrence of investment and financing events; the third is the existence of stable market business relationships.

^[3] For the number of global and Chinese artificial intelligence enterprises, there are significant differences in various versions of artificial intelligence reports. In this report, the number of global artificial intelligence enterprises and the number of U.S. artificial intelligence enterprises are based on the data of "Global Artificial Intelligence Industry Data Report" (2019) published by CAICT, and the number of 797 Chinese artificial intelligence enterprises was detected and confirmed by the Japan report as of December 31, 2019. Among them, the number of artificial intelligence enterprises in the world is 5,386, and the number of artificial intelligence enterprises in China is 1,189.

technology, respectively account for 15.4%, 15.3%, 14.7%; speech recognition and natural language processing, intelligent hardware, intelligent chips and biometric identification respectively account for 9.0%, 7.7%, 2.3%, 1.5%.

As of December 2019, among the 797 artificial intelligence enterprises, financing events were detected in 655 enterprises, with a total financing amount of 1,529.81 billion yuan. From the perspective of the financing of the 655 companies, as of December 2019, the proportion of the enterprises with the financing amount less than 100 million yuan is 37.37%, the enterprises with the financing amount between 100 million and 1 billion yuan is 39.51%, and the proportion of the enterprises with the financing volume of more than 1 billion yuan is 23.12%.

Among the 131 artificial intelligence enterprises whose R&D intensity data are available,^[1] the average R&D intensity is 12.1%, which is much higher than the average R&D intensity of domestic enterprises in 2018. The proportion of enterprises with R&D intensity between 5% and 15% is 47.33%, and the proportion of enterprises with R&D intensity greater than 15% is 23.66%. Continuously high-intensity R&D investment has injected a strong impetus into the artificial intelligence technology industry. At the same time, the ability to achieve rapid expansion of market size is a risk factor for the development of the high-intensity R&D artificial intelligence industry.

The value network analysis based on the relationship data of the 797 artificial intelligence enterprises shows that the innovative ecosystem of China's artificial intelligence technology industry is highly open. 21.17% of the core human capital of the 797 Chinese artificial intelligence enterprises have experience of studying in foreign universities and research institutions, and 10.9% have experience of working in foreign enterprises and research institutions. At the same time, in terms of technology relationship, 17.33% of the technology input relationship comes from foreign enterprises and research institutions, and the proportion of the relationship that technology empowerment party is foreign enterprises and institutions is only 9.44%. Among them, Intel, Qualcomm, NVIDIA and Microsoft, as basic hardware and software enterprises, are important technology empowerment parties of China's artificial intelligence technology industry.

From the classification statistics of the 797 Chinese artificial intelligence enterprise relationship data, the relationship number of technology input and

^[1] Because of the availability of data, the main targets of the R&D intensity analysis are 113 enterprises, mainly listed companies.

technology empowerment respectively account for 21.33% and 78.67%, and in the aspect of investment and financing relationship, the relationship number of financing relationship and investment relationship respectively account for 39.15% and 60.85%. The relatively high proportion of technology empowerment and investment relationship indicates that Chinese artificial intelligence enterprises play a strongly radiating and leading role.

The value network of China's artificial intelligence technology industry presents an obvious “polar core” structure. Platform enterprises, including Tencent, Alibaba, Baidu, Huawei, Jingdong, and Iflyteck, are dominant players in the development of the artificial intelligence technology industry. Among the 797 artificial intelligence enterprises, the proportion of the 15 open and innovative platforms supported by the Ministry of Science and Technology is only 1.9%, but the proportion of the number of related nodes and relationships is as high as 32.6% and 30.9%. From the perspective of relationship classification and proportion, these 15 open and innovative platforms are not only the main technology empowerment parties and important human capital suppliers of artificial intelligence enterprises, but also important investors. With the rise and development of the industrial internet, Key & Core Technology platform enterprises, represented by Huawei, will play an increasingly important role.

The artificial intelligence technology industry includes two basic components: the core industry sector and converged industry sector. In the development of the converged industry sector, in addition to the base-layer platforms and the technology-layer enterprises, leading enterprises in traditional industries, especially non-initial listed AI enterprises, become the key leading players in the integrated development of artificial intelligence and the real economy.

Among the 797 sample enterprises, 581 application-layer enterprises are the market entity in the converged industry sector. Among them, Ping An Group, Suning, Xiaomi and Didi Chuxing are the most active enterprises in the converged industry sector. In the process of digital and intelligent transformation, application-layer enterprises accumulate and integrate artificial intelligence technologies, building innovative ecosystems, empowering the intelligence of traditional industries, and generate new technologies, new products, new formats and new models.

Platforms mainly rely on the advantages of data ecosystem and technology integration, to empower SMEs and developers, continuously expand business areas, and promote the development of the converged industry sector. In the process of promoting the integrated development of artificial intelligence and the real economy,

platforms not only provide technical empowerment for application-layer enterprises, but also serve as the core human capital supplier and investor of application-layer enterprises.

As leading enterprises in traditional industries, 50 non-initial listed artificial intelligence enterprises are the main promoters of the development of the converged industry sector. After 2000, 50 listed non-initial artificial intelligence enterprises have developed into artificial intelligence enterprises in the fashion of independent R&D, cooperative R&D with other enterprises, cooperative R&D with universities and research institutions, and mergers and acquisitions, respectively accounting for 30%, 25%, 22% and 21%. Before upgrading and transforming into intelligent enterprises, the 50 enterprises were mainly distributed in traditional manufacturing and security industries, accounting for 88% and 12% respectively. From the perspective of the geographical distribution of the 50 enterprises, they are mainly located in Guangdong, Zhejiang and Beijing, and the number of enterprises in the three regions accounts as high as 60%. Among the 50 sample enterprises, the number of enterprises entering the field of intelligent manufacturing accounts for 40%, followed by the enterprises in the field of intelligent hardware, accounting for 22%, and the third is in the field of intelligent security, accounting for 12%. The remaining enterprises are widely distributed in the fields of intelligent vehicles, smart homes, smart cities, smart health care, and smart education. Among them, the security industry is currently the most successful converged industry sector in intelligent transformation. In addition to platforms, active SMEs and developers with core technologies are the important sources of technology innovation and integration for the 50 non-initial listed AI enterprises.

As unicorn companies, SenseTime, Megvii Technology, Yitu Technology and CloudWalk relying on the technological advantages in the field of computer vision, are representatives of technology-layer enterprises. The four enterprises promote the integrated development of artificial intelligence core technologies and the real economy through the cooperation with platforms and leading enterprises in traditional industries. Platforms and leading enterprises in traditional industries mainly provide application scenarios for technology-layer enterprises. Among the four computer vision unicorn enterprises, SenseTime ranks first in the number of technology empowerment relationship, accounting for 32.55%, and Megvii Technology ranks second, accounting for 27.18%, Yitu Technology and CloudWalk respectively rank third and fourth, accounting for 21.81% and 18.46% respectively. The technological

empowerment in the fields of finance, security, urban management, transportation and education promotes the industrial development of technology finance, intelligent security, smart cities, intelligent transportation and smart education.

In the development of the artificial intelligence technology industry, Chinese academia promotes the pace of artificial intelligence industrialization and industrial intelligence by constructing artificial intelligence academic ecosystem and collaborative innovation with the industry. As of December 31, 2019, this report detected a total of 109 AI universities in mainland China.^[1] From the perspective of regional distribution, the 109 AI universities are located in 23 provincial-level administrative regions of the country. China's AI universities mainly distribute in the provinces and cities including Beijing, Jiangsu, Shanghai, Guangdong, and Zhejiang. Among them, 15 are in Beijing, accounting for 13.8%, ranking first. 13 are in Jiangsu Province, accounting for 11.9%, ranking second. There are 9 in Shanghai, Guangdong and Zhejiang, respectively accounting for 8.3%. According to the competent departments, among the 109 AI universities, 52 are directly under the administration of the Ministry of Education, accounting for 47.7%; 44 are under the administration of provincial government, accounting for 40.4%; 7 are under the Ministry of Industry and Information Technology, accounting for 6.4%; 6 universities are under other ministries, accounting for 5.5%.

With the development of artificial intelligence technology, China's education sector begins to lay out the construction of artificial intelligence disciplines in universities at different levels. According to the announcement on the Ministry of Education website, 35 universities in China began to set up AI undergraduate major in 2018. In 2019, 180 universities at different levels set up AI undergraduate major. So far, a total of 215 colleges and universities have set up AI undergraduate major. At the same time, in order to keep abreast of the new format and needs of national economic development, the Ministry of Education added an artificial intelligence technology service major to the "Major Catalogue of Higher Vocational Education (Junior College Education) in General Colleges and Universities" in October 2019, which has been implemented since 2020. As of March 2020, a total of 171 vocational colleges in 26 provinces, municipalities and autonomous regions in China successfully applied for the establishment of artificial intelligence technology service major. At present,

^[1] The main basis for the judgment of an AI university is the number of papers published by the university in international journals and whether there are professional colleges, departments and institutes related to artificial intelligence. The 109 AI universities are all undergraduate universities with basic artificial intelligence research capabilities in mainland China.

Chinese colleges and universities have formed a multi-level talent training system for artificial intelligence basic theory research, technology development and technology application.

A search of the Scopus database indicates that as of December 31, 2019, 117 Chinese universities and 14 Chinese non-university scientific research institutions have published 52,976 international papers.^[1] Among the top-ranked universities in mainland China, Tsinghua University ranks first, and the proportion of its published international paper number is 3.70%; followed by Shanghai Jiaotong University, accounting for 3.12%; and Harbin Institute of Technology ranks third, accounting for 3.08%; Zhejiang University and University of Chinese Academy of Sciences respectively ranking fourth and fifth, accounting for 3.03% and 2.06%.

Among the foreign universities and institutions that have published international papers in cooperation with Chinese universities and institutes, Nanyang Technological University (Singapore), National University of Singapore, University of Technology Sydney (Australia), Microsoft Research Asia, Georgia Institute of Technology (U.S.), The University of Sydney (Australia), University of Alberta (Canada) and the CNRS (France) rank the top.

As of December 31, 2019, a total of 103 non-university scientific research institutions in the field of artificial intelligence were detected by this report, with an increase of 28, compared with the number of 75 at the end of 2018. Among the newly detected non-university scientific research institutions, including the research institutes under the national ministries and commissions such as the Chinese Academy of Agricultural Sciences, the First Research Institute of the Ministry of Public Security, the China Academy of Railway Sciences, the China Academy of Mechanical Sciences, the China Electric Power Research Institute, and the China Academy of Space Technology, carry out scientific research in the field of artificial intelligence. Unlike most of the non-university scientific research institutions that are engaged in basic theoretical research on artificial intelligence detected in the past, the newly added research institutions mainly carry out artificial intelligence technology application research in conjunction with their respective industries.

Among the 103 non-university scientific research institutions in the field of artificial intelligence, 56 are located in Beijing, accounting for 54.37%, ranking first;

^[1] The search results are based on the Scopus database, with the five search keywords of "Artificial Intelligence", "Machine learning", "robot", "Speech Recognition", "pattern recognition" in the order of "or", and the papers, whose title, abstract or keywords include one of the five search keywords, are selected. Paper is the sole selected item of literature type, and journal the sole selected item of publication type.

9 are located in Shanghai, ranking second, accounting for 8.74%, and 6 are located in Guangdong, ranking third, accounting for 5.83%. There are 4 institutions in Zhejiang, Shandong and Jiangsu, accounting for 3.88% respectively.

Among the 103 non-university scientific research institutions, the total patent number of the top ten institutions is 39,244, accounting for 47.15% of the total sample institution patents. From the perspective of the proportion of patents, the top ten institutions are the leading force for scientific research in non-university scientific research institutions in the field of artificial intelligence.

In the collaborative promotion mechanism of “politics, industry, academy, research, and application” of the artificial intelligence technology industry development, industry alliances and conferences as linkers also play an important role. In 2019, a total of 909 meetings in the field of artificial intelligence were held nationwide, much more than 823 in 2018. Beijing, Shanghai, Shenzhen and Hangzhou are the cities with the most intensive AI conferences, holding 236, 156, 144 and 55 sessions respectively.

As of December 31, 2019, this report detected a total of 190 industry alliances in the field of artificial intelligence, of which 72 were newly created in 2019, accounting for 38%. The newly established 72 industry alliances are widely distributed in 18 provinces, municipalities and autonomous regions, of which Guangdong and Beijing have the largest numbers, with 11 and 10 respectively, 7 in Shanghai, and 6 in Jiangsu, Shandong and Chongqing respectively. Various places establish artificial intelligence industry alliances to promote the collaborative innovation and development of the artificial intelligence technology industry.

In order to actively respond to national policies and the needs of the local intelligence technology industry development, local governments promote the development of the industry and the adjustment of the industrial structure by promulgating relevant policies and building artificial intelligence industrial parks. In 2019, local governments issued a total of 276 policies related to the development of artificial intelligence, and more than 259 policies in 2018. The policy content includes both directly related policies and strategic plans, such as artificial intelligence, digital economy, 5G, and the industrial internet, and support policies, such as “Mass Entrepreneurship and Innovation”, financial support, scientific research awards, scientific and technological achievement transformation, and giving more autonomy to researchers. From the perspective of the target industrial fields of policies, a variety of areas are covered, including intelligent government affairs, smart health care, the

industrial internet, intelligent manufacturing, intelligent vehicle network, and smart education. In 2019, Beijing issued 20 policies, ranking first in number. At the same time, from the perspective of the policy content issued by provinces, municipalities and autonomous regions, and a series of support policies that are open to specific industries and application scenarios have been launched, which are more detailed than the policies in 2018.

Based on the 163 artificial intelligence industrial parks in 2018, 138 new industrial parks were established in 2019. Among the provinces, municipalities and autonomous regions, 20 industrial parks were newly established in Shandong, 14 in Jiangsu, 13 in Guangdong, and 10 in Zhejiang and Shanghai respectively. Through the planning and construction of industrial parks, various regions will form a group of important carriers for the development of the artificial intelligence technology industry and become the intelligent technology innovation zones that lead the adjustment of regional industrial structure.

3

As the engine of the fourth industrial revolution, the artificial intelligence technology industry includes two basic components: the core industry sector and converged industry sector. The core industry sector is mainly composed of the R&D and production enterprises in base layer (basic technologies including big data, cloud computing, chips and intelligent sensor) and technology layer (artificial intelligence core technology), the basic technology and core technology suppliers of the artificial intelligence technology industry development. The converged industry sector is composed of application-layer enterprises that use artificial intelligence technologies to transform traditional industries.

Among the 797 artificial intelligence sample enterprises, 286 have technical cooperation relationships with foreign enterprises. An analysis of the technical cooperation relationship between the 286 enterprises and foreign enterprises shows that, in addition to the advantage of data ecosystem, the main competitive advantages of Chinese artificial intelligence enterprises are concentrated in the fields of algorithms and application software, while there are competitive disadvantages in the fields of basic hardware and software, including chips. Especially in terms of computing power, Chinese enterprises rely on the technologies and products of American enterprises. The independent rise in basic hardware and software is an inevitable choice for the US technology to block the development of China's artificial

intelligence technology industry.

Data, computing power and algorithms constitute the three major elements of the development of the artificial intelligence technology industry. With the development of the core industry sector and the maturity of the artificial intelligence core technologies, the integration of artificial intelligence and traditional industries has not only driven the development of the integrated industry sector, but also enriched and improved the data ecosystem, algorithm and computing power advantages of the core industry sector. Focusing on the collaborative development of data, computing power and algorithms, the positive feedback effect and benign interaction between the core industry sector and converged industry sector are the key mechanisms for the healthy development of the artificial intelligence technology industry.

The 45th “Statistical Report on the Development of China’s Internet” released by the China Internet Information Center (CNNIC) on April 28, 2020, shows that as of March 15, 2020, the number of the Internet users in China reached 904 million, and the Internet penetration rate reached 64.5%, the scale of online shopping users was 710 million, and the scale of transactions in 2019 reached 10.63 trillion, an increase of 16.5% from a year earlier. In 2019, the total retail imports and exports through the customs cross-border e-commerce management platforms reached 186.21 billion yuan, an increase of 38.3%. Under the impact of the pandemic, the continued advancement of the popularity of the Internet has further enhanced the data ecosystem advantage and created conditions for the widespread application of digital and intelligent technologies.

The improvement of data ecosystems and the needs for the intelligent economy are strongly driving the technological progress, implementation, and application of computing power and algorithms. In 2019, the rise of edge computing and the deep fusion of cloud and edge computing became the forefront of computing power technological innovation. In order to adapt to the application of artificial intelligence in the fields of security, urban traffic management, new retail, intelligent manufacturing, and smart health care, around the improvement of edge computing power and the fusion of cloud and edge computing, the cross-industry and interdisciplinary technology convergence has triggered a series of complementary innovations and specialized technology accumulation, and has improved the data storage and computing power. Despite the technical blockade of the United States, the breakthroughs in the fields of chips, key hardware and basic software, and the gradual formation of an autonomous and controllable ecosystem guarantee the development of

China's artificial intelligence technology industry.

In 2019, the rise of the Key & Core Technology platform represented by Huawei has become the biggest highlight of the development of China's artificial intelligence technology industry. Relying on the technological advantages in the field of chips and basic software, Huawei has successively launched HMS, Harmony System, Kunpeng Computing Ecosystem and 5G Autonomous Driving Ecosystem. Smart chip enterprises represented by Huawei HiSilicon, Cambrian, SMIC and UNISO have become key promoters of the artificial intelligence technology application in smart terminals, intelligent security and smart cities. If the development of the consumer internet platforms represented by Alibaba, Tencent and Baidu is considered to be based on traditional architectures, the rise of Key & Core Technology platforms represented by Huawei means the rise and development of autonomous architectures and ecosystems.

With the collaborative innovation in the fields of data ecosystem, computing power and algorithms, the integrated development of artificial intelligence and economic society has created conditions for the formation of an innovation cycle of basic research, application development and large-scale production. The development of China's artificial intelligence technology industry, while driving digital transformation and intelligent transformation and upgrading of domestic economy, will make Chinese enterprises become leaders in the reconstruction of global value chains, laying the foundation for the new round of economic globalization in the post-epidemic era.

In 2019, while the rapid development of the artificial intelligence technology industry, a series of problems have been exposed. Firstly, the US technology blockade has broken the benign innovation cycle between global technology R&D and market expansion, harming the development of the global economy and weakening the leading position of the US in the high-tech field. Under the conditions of the technological blockade, China will face the challenge of forming an innovation cycle within a country in the process of building an independent and controllable innovation ecosystem. Secondly, in the process of strengthening basic research, how to establish a social allocation mechanism of scientific and technological innovation risks and form a benign cycle of basic research, application development and large-scale production, is a key area of scientific and technological system and mechanism innovation. Thirdly, for SMEs, entrepreneurs and consumers, how to suppress the monopoly of super platforms and eliminate algorithmic discriminations, establishing a

fair and effective artificial intelligence governance system, is the problem that the government, industry and academia need to face together. Finally, confronted with the obvious trend of innovation “polarization” in the development of the artificial intelligence technology industry, it is necessary to formulate a digital anti-poverty strategy as early as possible, so that the artificial intelligence technology industry can better empower the economic and social development of poor areas, providing technical support for national poverty relief strategies.