黄 东 浩 博 士

万事达卡研发副总裁兼全球新兴技术负责人 | AI 领域高管学者

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新加坡公民 | 专利：10 项已授权，50+项审批中

职业概述

资深科技高管，拥有 27 年以上从业经验，横跨软件工程、Web3、AI/ML/生成式 AI 与支付创新领域。融合顶尖企业实战与前沿学术研究，近期于新加坡管理大学完成人工智能工程博士学位。发表 28 篇同行评审论文，发明 60 余项专利，专注于将前沿 AI 突破转化为可规模化的金融基础设施。

教育背景

人工智能工程博士 (Doctor of Engineering) 2023 年 8 月 – 2026 年 5 月

新加坡管理大学，新加坡

- 博士论文：*Generative AI in Enterprises: Optimizing Applications with Large Language Models*（244 页）。主导师：Prof. Zhaoxia Wang; 副导师：Prof. Chong Wah Ngo.
- 2025 年获新加坡资讯通信媒体发展局（IMDA）数字奖学金（研究生）
- 专题报道：https://computing.smu.edu.sg/engd/community-stories/engineering-future-ai-smu-engd-powers-innovation-global-technology-leader
- 研究方向：检索增强生成（RAG）、边缘 AI、LLM 和 ML 模型优化、多智能体系统、情感分析、推理型 LLM
- 在 AI 学术会议和期刊发表 25 篇同行评审论文（AAAI、AAMAS、NAACL、IJCNN、PAKDD、IEEE CAI、IEEE SSCI、IEEE ICDM、IEEE Intelligent Systems、Artificial Intelligence Reviews、ACM Computing Surveys）

软件工程技术硕士 2004 年 1 月 – 2007 年 11 月

新加坡国立大学，新加坡

新加坡经济发展局(EDB)研究与培训项目证书 2001 年 9 月 – 2002 年 8 月

新加坡国立大学光电子中心，新加坡

理论物理学硕士 1998 年 9 月 – 2001 年 7 月

北京大学，中国北京

- 在物理学术期刊发表 2 篇同行评审论文

工程物理学学士 1989 年 9 月 – 1995 年 7 月

清华大学，中国北京

职业经历

研发副总裁 / 全球新兴技术负责人 – Mastercard（美国） 2025 年 8 月 – 至今

美国弗吉尼亚州阿灵顿

- 领导 AI 新兴技术（EmTech）领域的全球研发计划
- 领导 5 个战略性"大赌注"项目的 EmTech 研究——旨在塑造 Mastercard 下一代支付基础设施和 AI 驱动商业解决方案的高影响力机密项目
- 对话式支付智能体（CPA / ConvPayMAS）——构建并领导智能体商务支付技术栈，融合 Google A2A 智能体间协议、AP2 三重授权链（Intent → Cart → Payment）与 MCP 工具服务，采用分层 LangGraph 主管智能体调度卡片注册、选卡、验证与扣款工作流，并由 PCI/PII 防护智能体保障合规。发表 3 篇论文（PAKDD 2026 主会、PAKDD 2026 AIDS4DF 研讨会、AAMAS 2026 演示论文），提交 3 项专利申请。
  - 提出智能体成功率（ASR）指标——一种比较实际与预期智能体转移序列的轨迹保真度度量，而非仅看最终结果；在 9 万次任务实例（18 个 LLM × 4 个场景 × 250 个用例 × 5 次重复，约 1.15 亿 tokens）的评测中，发现 18 个模型中有 10 个会静默跳过支付确认环节——该缺陷在任务成功率与交接指标下完全不可见。
  - 依据上述诊断，将本地部署开源模型的支付任务成功率从 4.0%提升至 93.4%（Llama 3.1-8B）、从 3.2%提升至 94.7%（Magistral-24B），大幅缩小与 GPT-4.1 的差距。
- GAIME（生成式 AI 商户信息增强）——领导面向 Mastercard 交易描述符的商户信息抽取与实体匹配研究项目，该生产系统日均处理数百万笔交易。发表 1 篇论文（PAKDD 2026 RAFDA 研讨会），1 篇已录用（IEEE ICDM 2026），1 篇在审（EACL 2027 产业论文）。
  - 在 8,015 条标注交易描述符上对四大模型家族（Gemma 3 270M-4B、Qwen 3.5 0.8B-4B、Aya 3.35B、Llama 3.1-8B）的 24 个变体进行 LoRA 微调；以 4B 模型达到 96.60% F1，媲美现有 Llama-3.1-8B 生产基线（96.95% F1），参数量减半且有效推理速度提升 1.2 倍，并通过 MLflow 将 14 个变体部署为 Databricks 模型服务端点。
  - 在 8 个实体匹配数据集上对 46 种 LLM 配置进行基准评测——开源 GPT-OSS-120B 以约 1/20 的成本达到 92.1 F1，媲美高推理强度的 GPT-5；并识别出可媲美现有生产判别模型（F0.5 94.8）且延迟减半的本地方案。
- 组织并主持 SENTIRE'25（第 15 届情感分析与语言关联数据研讨会），与 IEEE ICDM 2025 联合举办，2025 年 11 月 13 日，美国华盛顿特区

研发副总裁 / 全球新兴技术负责人 – Mastercard 亚太 2022 年 5 月 – 2025 年 7 月

新加坡

- 领导新兴技术（EmTech）领域的全球研发计划：AI / 机器学习 / 生成式 AI 和 Web3
- AI/LLM/GenAI 项目：
  - 领导 Mastercard 助手平台（MAP）的 EmTech 研究，这是一套旨在简化 Mastercard 产品客户入门流程的数字助手

- 使用 LangChain、FAISS 向量数据库和 HuggingFace 嵌入构建初始 RAG 原型
- 在 NVIDIA A40 和 L40 GPU 上对开源 LLM（Llama 2、Orca 2）进行早期基准测试，展示 24-49%的推理速度提升
- 开发创新的重复感知性能（RAP）评估框架，现已部署于 MAP 生产环境
- 领导使用 Ollama 在多种硬件平台上进行边缘感知 LLM 部署研究

  - 使用 LLM（GPT-4/5、Claude、Llama、Qwen）开创企业 GenAI 应用，实现支付/商业自动化
    - 使用 QLoRA 在多 GPU 配置上微调 70B+参数模型，用于中英翻译和逻辑推理
    - 开发多智能体系统，使用边缘部署 LLM 实现 99.9%准确率的发票对账
    - 开发 HMASP——首个实现端到端智能体支付工作流的基于 LLM 的多智能体系统
    - 开发 CMAS4G2 协作多智能体系统，用于自动生成 Gherkin 验收测试
    - 创建 LLM-as-a-Judge 评估框架，相比 GPT-5 实现 47 倍成本降低
- 经典机器学习、预测与风险建模项目：
  - 构建结合经典 ML 模型（逻辑回归、SVM、随机森林、XGBoost）与工程化及 LLM 衍生特征的金融决策流水线——采用网格搜索超参数调优、5 折交叉验证、序列特征选择和对数损失概率校准，驱动风险敏感的凯利准则下注规模
  - 为 ICO / 加密项目成功预测开发集成模型（朴素贝叶斯、SVM、逻辑回归、随机森林、CatBoost、神经网络），结合基于情感和参与度的特征工程
  - 对完整建模范围进行基准测试——传统 ML（随机森林、基于 TF-IDF 的 SVM）、深度学习（CNN、RNN、LSTM）和 Transformer（BERT、RoBERTa）——用于假新闻检测和自动化海事风险分类，引入新颖的输出可靠性指标：有效类别比率
- Web3 项目：
  - 开发 Mastercard 代币化卡片 NFT 解决方案，支持将支付卡作为灵魂绑定代币（SBT）进行代币化
  - 开发 DigiPay，利用 Layer 2 区块链和 ERC-4337 账户抽象的 Web3 微支付稳定币解决方案

研发副总裁 / 新加坡研发负责人 – Mastercard 亚太 2011 年 8 月 – 2022 年 5 月

新加坡

- 创建并领导新加坡研发团队——Mastercard 全球创新与研发部门；管理位于新加坡的高绩效研发团队
- 从事支付/商业领域的创新与研发，涵盖前沿技术：EMV 芯片、物联网、二维码支付、车联网、人形机器人、对话式 AI、AR/VR、区块链和数字资产、Web3、NFT、DeFi、元宇宙
- 推动复杂项目从创意到商业化交接的全流程；促进项目向 Mastercard 商业化流程的过渡
- 作为技术创新的倡导者，与各类合作伙伴（内部部门、外部合作伙伴、大学）协作，确保 Mastercard 在支付领域建立技术卓越的声誉
- 主要商业化项目：

- 2021 年 11 月：Mastercard 与新奥尔良市和 MoCaFi 合作推出 Crescent City Card 项目
- 2020 年 9 月：Mastercard 与三星、Airtel 和 Asante 合作，通过按需付费服务推动非洲数字普惠
- 2018 年 10 月：Mastercard、Centenary Bank 和 M-KOPA Solar 在乌干达推出首创能源解决方案
- 2018 年 2 月：Mastercard 使用 Facebook Messenger 帮助小企业数字化
- 2017 年 9 月：SPH Buzz 与 Mastercard 合作推出新型混合商店概念
- 2017 年 2 月：BharatQR——全球首个可互操作的二维码受理解决方案在印度推出
- 2016 年 5 月：MasterCard 为软银机器人人形机器人"Pepper"提供首个商业应用
- 2015 年 9 月：MasterCard 变革援助物资分发方式
- 2012 年 8 月：StarHub 与 DBS、EZ-Link 和 MasterCard 合作推出智能钱包

高级软件工程师 – PayPal 2008 年 7 月 – 2011 年 8 月

新加坡

- 领导软件开发团队，负责一系列针对巴西市场的项目，以满足这一快速增长市场的需求
- 限额/验证/合规领域的主题专家
- 主要商业化项目：
  - 领导 12 人开发团队，在 8 个月内交付最大的欧盟合规项目（EU KYB Receiving Limit）
  - 构建中国银联（CUP）集成，实现实时交易处理

软件研发经理 – Streaming21（新加坡） 2007 年 10 月 – 2008 年 7 月

新加坡

- 建立研发中心并领导媒体中继服务器的开发——一款领先的 IPTV 流媒体服务器

软件开发负责人 – Schmidt Electronics (S.E.A.) 2006 年 1 月 – 2007 年 9 月

新加坡

软件工程师 – Unaxis 新加坡 2005 年 2 月 – 2005 年 12 月

新加坡

软件工程师 – ASM Technology 新加坡 2002 年 9 月 – 2005 年 2 月

新加坡

软件工程师 – 北京智达科技 1995 年 8 月 – 1998 年 8 月

中国北京

演讲与论坛

- 受邀演讲，IMDA AI Agents 技术分享会，新加坡（2026 年 4 月 23 日）—— 与南洋理工大学校长讲席教授、AAAI Fellow 安波教授同台

- 受邀演讲，InnoAI 2026 全球人工智能创新未来峰会 —— 与摩根大通、谷歌、英伟达、eBay 等公司嘉宾同列
- 研讨会主席，SENTIRE’25（第 15 届情感分析与语言链接数据研讨会），与 IEEE ICDM 2025 联合举办，2025 年 11 月，美国华盛顿特区
- 受邀演讲，SuperAI Singapore 2025，新加坡滨海湾金沙（2025 年 6 月 19 日）—— “企业级开源大语言模型优化与基准测试”
- 受邀论坛嘉宾，IEEE 人工智能大会 (IEEE CAI 2024)，新加坡滨海湾金沙（2024 年 6 月）—— 论坛由 Simon See（英伟达 AI 技术中心总监）主持，同台嘉宾包括杉山将教授（日本理化学研究所先进智能研究中心主任）。800+全球参会者。
- 独立演讲及论坛嘉宾，CALM SUMMIT ’ 24 (Rasa)，2024 年 10 月 —— “面向对话式 AI 的开源大语言模型优化与基准测试” + 论坛 “可扩展语言模型的优势”
- 主旨演讲，Token 2049 — WSPN Stable Rise，新加坡（2024 年 9 月）— “构建信任与流畅商业体验：引领 Web3 技术支付未来”
- 受邀演讲，FCon 2023 全球金融科技大会，中国上海（2023 年）— 代表万事达卡实验室 — “Web3 时代的商业未来” 。视频：https://www.infoq.cn/video/3UlpCdtmzxz5OwRjd6j9
- 受邀演讲，Upbit 开发者大会 (UDC) 2022，韩国釜山（2022 年 9 月）—— “万事达卡为 Web3 和元宇宙做好准备” ，代表万事达卡出席，同场嘉宾包括孙宇晨（波场创始人）、Sebastien Borget（The Sandbox COO）、Bryan Pellegrino（LayerZero Labs CEO）及 Leemon Baird（Hedera 联合 CEO）
- 论文发表演讲：PAKDD 2024/2025/2026（台北/悉尼/香港）、ICDSAAI 2026（2026 年 5 月，中国成都）、AAMAS 2026（2026 年 5 月，塞浦路斯帕福斯）、IEEE ICDM 2025（2025 年 11 月，美国华盛顿特区）、IJCNN 2025（2025 年 6 月，意大利罗马）、NAACL 2025（2025 年 4 月，美国阿尔伯克基）、IEEE SSCI 2025（2025 年 3 月，挪威特隆赫姆）、IEEE CAI 2024（2024 年 6 月，新加坡滨海湾金沙）

荣誉与奖项

- IMDA 新加坡数字奖学金（研究生），2025 —— 新加坡政府颁发的竞争性奖学金，授予从事高级研究的资深技术专业人员
- 新加坡管理大学图书馆 "Generate Your L(AI)brary" 黑客松一等奖，2023 —— 在新加坡管理大学 AI 黑客松中获得第一名（2023 年 8 月 26–27 日）: https://www.linkedin.com/posts/donghao-huang_yesterday-our-team-won-1st-prize-in-smu-library-ugcPost-7101786441805926400-LW0S/
- Smart Sentosa 挑战赛冠军，2016 —— 万事达卡亚太区智慧城市引擎赢得 Smart Sentosa 挑战赛，该赛事为新加坡政府智慧城市创新竞赛

精选媒体报道

- “Engineering the Future of AI: SMU EngD Powers Innovation for a Global Technology Leader” — 新加坡管理大学计算机与信息系统学院，2026 年 2 月。

https://computing.smu.edu.sg/engd/community-stories/engineering-future-ai-smu-engd-powers-innovation-global-technology-leader

- Token 2049 Side Event Coverage — Investing.com，2024 年 9 月。https://hk.investing.com/analysis/article-110563
- “支付科技与安全交易” 论坛 — 新浪财经，2018 年 3 月。https://finance.sina.cn/blockchain/2018-04-02/detail-ifysvnxn1920535.d.html
- “零距离感受万事达卡的支付黑科技” — 新浪/支付产业网，2017 年 11 月。https://k.sina.cn/article_6007803312_16617cdb0001001wwd.html
- “不换手机和掏不起钱的人，怎样才能用上新支付技术？” — 中国电子银行网/cnBeta，2017 年 11 月。https://www.cebnet.com.cn/20171127/102444564.html
- “亚洲最大！万事达卡支付科技创新，9 间实验室撑腰” — Business Next (数位时代)，2017 年 11 月。https://www.bnext.com.tw/article/47137/mastercard-innovation-lab

志愿服务经历

会长 – 宝严（新加坡）教育协会	2025 年 11 月 – 至今
副会长 – 北京大学新加坡校友会	2016 年 6 月 – 2020 年 6 月
导师 – Startupbootcamp 金融科技新加坡	2015 年 1 月 – 2019 年 1 月
IT 与支付顾问 – ConneXions 国际（新加坡）	2011 年 3 月 – 2015 年 12 月
技术顾问 – 圣安德烈自闭症中心（新加坡）	2006 年 11 月 – 2008 年 7 月

技术技能

- AI/ML/GenAI：LLM（GPT-4/5、Claude、Gemini、Llama、Qwen、DeepSeek-R1、Mistral、Magistral、Phi、Nemotron）、PyTorch、Transformers、PEFT、LoRA/QLoRA 微调、LlamaFactory、Unsloth、RAG、LangChain、LangGraph、Autogen、Ollama、LM Studio、FAISS、向量数据库、少样本学习、微调、提示工程、情感分析、NLP
- GPU/硬件：NVIDIA H100、L40、A40、RTX A6000、RTX 4080、RTX 4090、Jetson AGX Orin、DGX Spark；Apple M 系列；4 位量化、模型优化、边缘 AI 部署
- 编程语言与框架：Python、C/C++、Java、NodeJS、React、Vue、Spring Boot/Cloud、Solidity
- 云与基础设施：AWS、Azure、Heroku；微服务、CI/CD、Docker
- Web3/区块链：区块链、IPFS、NFT、DeFi、x402 协议

专利

（10 项已授权，50+项待审 — 均归属万事达卡）

已授权专利

- **US12417452B2** – Smart chip payment acceptance (2025)
- **US12217246B2** – Method and system for use of an EMV card in a multi-signature wallet for cryptocurrency transactions (2025)
- **US11715100B2** – Electronic system and computerized method for verification of transacting parties to process transactions (2023)
- **US11615406B2** – Method and system for providing a service at a self-service machine (2023)
- **US10535034B2** – Item delivery management systems and methods (2020)
- **US10482499B2** – Method for conducting a transaction (2019)
- **US10423949B2** – Vending machine transactions (2019)
- **US10083427B2** – Method for receiving an electronic receipt of an electronic payment transaction into a mobile device (2018)
- **US9836729B2** – Method and system for conducting a payment transaction and corresponding devices (2017)
- **US8712914B2** – Method and system for facilitating micropayments in a financial transaction system (2014)

部分待审申请

- **WO2026063867A1** – Method and system for seamless cross-network physical-digital (phy-gital) experience (2024)
- **US20260080407A1** – Method and system for seamless cross-network physical-digital (phy-gital) experience (2024)
- **WO2024058723A1** – Digitization of payment cards for web 3.0 and metaverse transactions (2022)
- **US20230059546A1** – Access control system (2021)
- **EP4356332A2** – Method and system for mediated cross ledger stable coin atomic swaps using hashlocks (2021)
- **US20210406887A1** – Method and system for merchant acceptance of cryptocurrency via payment rails (2020)
- **US20210158316A1** – Electronic system and computerized method for controlling operation of service devices (2019)
- **US20200175489A1** – Method and system for QR code originated vending (2017)
- **WO2017200643A1** – Method and system for allocating and transacting with multiple non-financial commodities (2016)
- **US20180025332A1** – Transaction facilitation (2016)

... 以及 40+项其他待审专利申请，涵盖支付技术、区块链、AI 和物联网领域。

精选论文

1. Huang, D., 等. (2026). 模型能有多小？面向金融交易商户信息抽取的 270M–8B 模型 LoRA 微调. IEEE ICDM 2026.
2. Teo, N., 等. (2026). 大语言模型常识推理综述. ACM Computing Surveys.
3. Chua, J., 等. (2026). 一种新型基于大语言模型的层级多智能体支付系统. PAKDD 2026.
4. Huang, D., 等. (2026). 任务复杂度的重要性：大语言模型情感分析推理的实证研究. PAKDD 2026.
5. Huang, D., & Wang, Z. (2025). 使用 DeepSeek-R1 的可解释情感分析. IEEE Intelligent Systems.
6. Huang, D., 等. (2025). 边缘 LLM：性能与效率评估. IJCNN 2025.
7. Huang, D., 等. (2025). RAP：平衡重复与性能的指标. NAACL 2025.
8. Wang, Z., Huang, D., 等. (2025). 中文情感分析综述：主题、方法与趋势. Artificial Intelligence Review.
9. Lin, W. B., Huang, D. H., 等. (2001). 弱相互作用大质量粒子的非热产生与亚星系结构. Physical Review Letters.

... 及其它 19 篇同行评审论文（人工智能领域共 26 篇，物理领域共 2 篇）

DR. DONGHAO HUANG

VP of R&D & Global Emerging Technology Lead at Mastercard | Executive-Scholar in AI

donghao.huang@gmail.com | Arlington, VA, USA

Singapore Citizen | Patents: 10 granted, 50+ pending

PROFESSIONAL SUMMARY

Senior technology executive with 27+ years of experience across software engineering, Web3, AI/ML/GenAI, and payments innovation. Combines elite enterprise execution with cutting-edge academic research, having recently completed a Doctor of Engineering in AI at Singapore Management University. Author of 28 peer-reviewed papers and inventor of 60+ patents, specializing in translating advanced AI breakthroughs into scalable financial infrastructure.

EDUCATION

Aug 2023 – May 2026 Singapore Management University Singapore

Doctor of Engineering (EngD) in AI

- Doctoral dissertation: *Generative AI in Enterprises: Optimizing Applications with Large Language Models* (244 pp.). Supervisor: Prof. Zhaoxia Wang. Co-supervisor: Prof. Chong Wah Ngo.
- Awarded IMDA SG Digital Scholarship (Postgraduate) 2025
- Featured story: https://computing.smu.edu.sg/engd/community-stories/engineering-future-ai-smu-engd-powers-innovation-global-technology-leader
- Research focus: Retrieval-Augmented Generation (RAG), Edge AI, LLM and ML model optimization, multi-agent systems, sentiment analysis, reasoning LLMs
- Published 25 peer-reviewed papers at top AI conferences and journals (AAAI, AAMAS, NAACL, IJCNN, PAKDD, IEEE CAI, IEEE SSCI, IEEE ICDM, IEEE Intelligent Systems, Artificial Intelligence Reviews, ACM Computing Surveys)

Jan 2004 – Nov 2007 National University of Singapore Singapore

Master of Technology in Software Engineering

Sep 2001 – Aug 2002 Centre for Optoelectronics, NUS Singapore

Certificate, EDB Research and Training Programme

Sep 1998 – Jul 2001 Peking University Beijing, China

Master of Science in Theoretical Physics

- Published 2 peer-reviewed papers in physics journals

Sep 1989 – Jul 1995 Tsinghua University Beijing, China

Bachelor of Engineering in Engineering Physics

PROFESSIONAL EXPERIENCE

Aug 2025 – to date Mastercard (U.S.) Arlington, VA, USA

VP, R&D / Global EmTech Lead

- Lead global R&D initiatives in AI Emerging Technology (EmTech) domains

- Lead EmTech research for 5 strategic "Big Bets" projects – high-impact, confidential initiatives aimed at shaping Mastercard's next-generation payment infrastructure and AI-powered commerce solutions
- Conversational Payment Agent (CPA / ConvPayMAS) – built and led an agentic-commerce payment stack combining Google's A2A inter-agent protocol, the AP2 three-mandate chain (Intent → Cart → Payment) and MCP tool servers, with a hierarchical LangGraph supervisor routing card registration, selection, validation and charge workflows behind a PCI/PII guardrail agent. 3 papers published – PAKDD 2026 main conference, PAKDD 2026 AIDS4DF workshop, and AAMAS 2026 Demonstration Track; 3 patent applications filed.
    - Introduced the Agentic Success Rate (ASR) metric – a trajectory-fidelity measure comparing observed and expected agent transitions rather than final outcomes alone; a 90,000-instance evaluation (18 LLMs × 4 scenarios × 250 cases × 5 repeats, ~115M tokens) exposed 10 of 18 models silently skipping the payment confirmation checkpoint – a failure invisible to task-success and handoff metrics.
    - Used those diagnostics to lift payment task success on locally hosted open-weight models from 4.0% to 93.4% (Llama 3.1-8B) and 3.2% to 94.7% (Magistral-24B), closing most of the gap to GPT-4.1.
- GAIME (GenAI Merchant Enrichment) – lead the research program behind merchant information extraction and entity matching over Mastercard transaction descriptors, a production system processing millions of transactions daily. 1 paper published (PAKDD 2026 RAFDA workshop); 1 accepted (IEEE ICDM 2026); 1 under review (EACL 2027 Industry Track).
    - LoRA fine-tuned 24 model variants across four families (Gemma 3 270M–4B, Qwen 3.5 0.8B–4B, Aya 3.35B, Llama 3.1-8B) on 8,015 labeled transaction descriptors; matched the incumbent Llama-3.1-8B production baseline (96.95% F1) with a 4B model at 96.60% F1 — at half the parameter count and 1.2× faster effective inference, and deployed 14 variants as Databricks Model Serving endpoints via MLflow.
    - Benchmarked 46 LLM configurations across 8 entity-matching datasets – open-weight GPT-OSS-120B reaches 92.1 F1 at ~20× lower cost than GPT-5 at high reasoning effort – and identified local judge configurations matching the deployed production judge (F0.5 94.8) at half the latency.
- Organized and hosted SENTIRE'25 (15th Workshop on Sentiment Analysis and Linguistic Linked Data) co-located with IEEE ICDM 2025, November 13th, Washington DC.

May 2022 – Jul 2025 Mastercard Asia/Pacific Pte Ltd Singapore

VP, R&D / Global EmTech Lead

- Lead global R&D initiatives in Emerging Technology (EmTech) domains: AI / Machine Learning / Generative AI and Web3.
- **AI/LLM/GenAI Initiatives:**
    - Led EmTech research for Mastercard Assistant Platform (MAP)**,** a suite of digital assistants designed to simplify the customer onboarding process for Mastercard products
        - Built the initial Retrieval-Augmented Generation (RAG) prototype using LangChain, FAISS vector databases, and HuggingFace embeddings to power enterprise-grade knowledge systems.
        - Conducted early benchmarking of open-source LLMs (Llama 2, Orca 2) on NVIDIA A40 and L40 GPUs (48GB each), demonstrating 24-49% inference speed improvement on L40 vs A40.

- Developed a novel Repetition-aware Performance (RAP) evaluation framework for LLM quality assessment, now fully deployed in the MAP production environment.
- Led research on edge-aware LLM deployment using the Ollama framework across diverse hardware platforms (NVIDIA RTX A6000, NVIDIA RTX 4090, NVIDIA Jetson AGX Orin, Apple M-series—directly informing MAP's deployment strategy.

- Pioneered enterprise GenAI applications using LLMs (GPT-4/5, Claude, Llama, Qwen) for payments/commerce automation
  - Fine-tuned 70B+ parameter models (Llama-3.1-70B, Qwen2-72B) using QLoRA on multi-GPU setups (4× NVIDIA L40 GPUs) for Chinese-English translation and logical reasoning
  - Developed multi-agent systems for invoice reconciliation achieving 99.9% accuracy using edge-deployed LLMs (qwen2.5:32b)
  - Developed hierarchy multi-agent systems for conversational payment agent (HMASP) - first LLM-based multi-agent system to implement end-to-end agentic payment workflows, enabling external AI agents to converse and complete payments using natural language with minimal integration overhead
  - Developed CMAS4G2, a cooperative multi-agent system for automated Gherkin acceptance test generation using Microsoft's AutoGen Swarm framework; demonstrated open-weight models on consumer hardware (NVIDIA RTX 4090, 24GB VRAM) approach proprietary performance (GPT-OSS 20B: 87.6% success vs Claude Sonnet 4: 90.4%)
  - Created LLM-as-a-Judge (LAJ) evaluation framework achieving 47× cost reduction vs GPT-5 with negligible accuracy loss for automated test coverage assessment
  - Evaluated reasoning LLMs (DeepSeek-R1, Qwen3, GPT-OSS) for sentiment analysis with cross-platform performance benchmarking on NVIDIA H100, NVIDIA GeForce RTX 4090, Apple M3 Max
  - Developed energy efficiency metrics (Energy per Inference, Performance-to-Power Ratio) for sustainable AI deployment

- **Classical ML, Predictive & Risk Modeling Initiatives:**
  - Built financial decisioning pipelines combining classical ML models (Logistic Regression, SVM, Random Forest, XGBoost) with engineered and LLM-derived features — using grid-search hyperparameter tuning, 5-fold cross-validation, sequential feature selection, and log-loss probability calibration to drive risk-sensitive, Kelly-criterion bet sizing
  - Developed ensemble predictive models for ICO / crypto-project success (Naïve Bayes, SVM, Logistic Regression, Random Forest, CatBoost, neural networks) with sentiment- and engagement-based feature engineering
  - Benchmarked the full modeling spectrum — traditional ML (Random Forest, SVM with TF-IDF), deep learning (CNN, RNN, LSTM), and transformers (BERT, RoBERTa) — for fake-news detection and automated maritime risk classification, introducing a novel output-reliability metric, Ratio of Valid Categories
- **Web3 Initiatives:**
  - Developed Mastercard Tokenized Card NFT solution, enabling seamless tokenization of payment cards as Soul Bound Tokens (SBTs) into Web3 wallets
    - Enables users to store credit cards securely as non-transferable NFTs, providing publicly verifiable digital identity for web3 wallet addresses
    - Integrates with crypto exchanges, merchant partners, and payment acquirers through smart contract architecture

- Simplifies Web3 user onboarding by eliminating the need to switch between multiple applications and cumbersome digital wallet funding processes

- Developed DigiPay, a Web3 micropayment stablecoin solution leveraging Layer 2 blockchain and ERC-4337 account abstraction
  - Implemented Digicents smart contract token with high TPS, low-latency blockchain for fast, efficient, and affordable transactions
  - Built smart contract wallet accounts with auto-top-up and auto-withdrawal features, eliminating manual on-ramp/off-ramp processes
  - Integrated with Tokenized Card NFT for secure funding and transaction authentication within the Digicents ecosystem

Aug 2011 – May 2022 Mastercard Asia/Pacific Pte Ltd Singapore

VP, R&D / Head of Singapore R&D

- Found and lead Singapore R&D team in Mastercard Foundry (previously known as Mastercard Labs) – Mastercard's global innovation and R&D division; managing a high performing R&D team based in Singapore.
- Work on innovation and R&D in payment/commerce domains across lots of latest and cutting-edge technologies, including but not limited to, EMV Chip technologies, Internet of Things, QR Payments, Connected Car, Humanoid Robots, Conversational AI, AR/VR, Blockchain and Digital Assets, Web3, NFT, DeFi, Metaverse and so on
- Drive complex initiatives from idea through to commercialization hand-over; facilitate the transition of initiatives into Mastercard commercialization process
- As a champion for Technological Innovation, collaborate with various partners (internal departments, external partners, universities) to ensure Mastercard attains a reputation for technological excellence in the Payments space
- **Key Commercialized Projects**
  - Nov 2021: Mastercard partners with city of New Orleans and MoCaFi to announce Crescent City Card program: https://www.mastercard.com/news/press/2021/november/mastercard-partners-with-city-of-new-orleans-and-mocafi-to-announce-crescent-city-card-program/
  - Sep 2020: Mastercard partners with Samsung, Airtel and Asante to drive digital inclusion in Africa through Pay-on-Demand services: https://newsroom.mastercard.com/mea/press-releases/mastercard-partners-with-samsung-airtel-and-asante-to-drive-digital-inclusion-in-africa-through-pay-on-demand-services/
  - Oct 2018: Mastercard, Centenary Bank and M-KOPA Solar roll-out first of its kind energy solution in Uganda: https://newsroom.mastercard.com/mea/press-releases/mastercard-centenary-bank-and-m-kopa-solar-roll-out-first-of-its-kind-energy-solution-in-uganda/
  - Feb 2018: Mastercard Uses Facebook Messenger To Help Small Businesses Go Digital: https://newsroom.mastercard.com/press-releases/mastercard-uses-facebook-messenger-help-small-businesses-go-digital/
  - Sep 2017: SPH Buzz Partners With Mastercard To Launch New Hybrid Store Concept: https://newsroom.mastercard.com/asia-pacific/press-releases/sph-buzz-partners-with-mastercard-to-launch-new-hybrid-store-concept/
  - Feb 2017: BharatQR – World's first interoperable QR code acceptance solution launched in India: https://newsroom.mastercard.com/asia-pacific/press-releases/bharatqr-worlds-first-interoperable-qr-code-acceptance-solution-launched-in-india/

- May 2016: MasterCard Powers First Commerce Application within SoftBank Robotics' Humanoid Robot "Pepper": https://newsroom.mastercard.com/press-releases/mastercard-powers-first-commerce-application-within-softbank-robotics-humanoid-robot-pepper/
- Sep 2015: MasterCard Transforms Aid Distribution (video: https://youtu.be/W2XIyqeP5w4): https://newsroom.mastercard.com/press-releases/mastercard-transforms-aid-distribution/
- Aug 2012: StarHub unveils 'SmartWallet', in collaboration with DBS, EZ-Link and MasterCard: https://www.starhub.com/about-us/newsroom/2012/august/starhub-unveils-smartwallet--in-collaboration-with-dbs--ez-link-.html

Jul 2008 – Aug 2011 PayPal Singapore Development Centre Singapore

Senior Software Engineer / Team Lead

- Lead a team of software developers, working on a pipeline of projects related to Brazil to cater to this fast growing market
- Subject Matter Expert in limits / verification / compliance domain
- **Key Commercialized Projects**
  - Led 12-developer team delivering largest EU compliance project (EU KYB Receiving Limit) in 8 months
  - Built China UnionPay (CUP) integration enabling real-time transaction processing

Oct 2007 – Jul 2008 Streaming21 (Singapore) Pte Ltd Singapore

Software R&D Manager

- Established an R&D centre and led development of Media Relay Server, a leading IPTV streaming server.

Jan 2006 – Sep 2007 Schmidt Electronics (S.E.A.) Pte Ltd Singapore

Leader, Software Development

Feb 2005 – Dec 2005 Unaxis Singapore Pte Ltd Singapore

Software Engineer

Sep 2002 – Feb 2005 ASM Technology Singapore Pte Ltd Singapore

Software Engineer

Aug 1995 – Aug 1998 Beijing Zhida Technology Pte Ltd Beijing, China

Software Engineer

SPEAKING & PANELS

- Invited speaker, IMDA Technical Sharing Session on AI Agents, Singapore (23 April 2026) — alongside Prof Bo An, AAAI Fellow and President's Chair Professor at NTU. https://www.imda.gov.sg/activities/activities-catalogue/technical-sharing-session-with-ai-agents
- Invited speaker, InnoAI 2026 Global Summit on Innovating the Future of Artificial Intelligence — listed alongside speakers from JPMorgan Chase, Google, NVIDIA, and eBay. https://innoaisummit.com/experts
- Workshop Chair, SENTIRE'25 — 15th Workshop on Sentiment Analysis and Linguistic Linked Data, co-located with IEEE ICDM 2025, Washington DC, November 2025

- Invited speaker, SuperAI Singapore 2025, Marina Bay Sands (19 June 2025) — "Optimizing and Benchmarking Open-Source LLMs for Enterprise Applications." https://www.superai.com/superai-sessions/optimizing-and-benchmarking-open-source-llms-for-enterprise-applications
- Invited panelist, IEEE Conference on Artificial Intelligence (IEEE CAI 2024), Marina Bay Sands, Singapore (June 2024) — panel moderated by Simon See (Director, NVIDIA AI Technology Centre), alongside Prof Masashi Sugiyama (Director, RIKEN Center for Advanced Intelligence Project). 800+ global attendees. https://www.linkedin.com/posts/donghao-huang_invited-to-participate-in-the-ieee-cai-panel-ugcPost-7211296805160968192-e25K/
- Solo session speaker and panelist, CALM SUMMIT '24 (Rasa), October 2024 — "Optimizing and Benchmarking Open-Source LLMs for Conversational AI" plus panel "Benefits of Scalable Language Models." https://calmsummit24.com/agenda/
- Keynote speaker, Token 2049 — WSPN Stable Rise, Singapore (September 2024) — "Building Trust & Seamless Commerce Experience: Leading the Future of Web3 Payments" — presented Mastercard's Tokenized Card NFT and DigiPay solutions.
- Invited speaker, FCon 2023 Global FinTech Conference, Shanghai, China (2023) — representing Mastercard Labs — "The Future of Commerce in the Web3 Era" (Web3 时代的商业未来). Video: https://www.infoq.cn/video/3UlpCdtmzxz5OwRjd6j9
- Invited speaker, Upbit Developer Conference (UDC) 2022, Busan, South Korea (September 2022) — "Mastercard is getting ready for Web3 and the metaverse," representing Mastercard alongside speakers including Justin Sun (Tron, Founder), Sebastien Borget (The Sandbox, COO & Co-Founder), Bryan Pellegrino (LayerZero Labs, CEO), and Leemon Baird (Hedera/Swirlds Labs, Co-CEO). Featured in the official UDC 2022 Report: https://udc-static.dunamu.com/reports/UDC_2022_Report_EN.pdf
- Paper presentations at PAKDD 2024/2025/2026 (Taipei/Sydney/Hong Kong), ICDSAAI 2026 (May 2026, Chengdu, China), AAMAS 2026 (May 2026, Paphos, Cyprus), IEEE ICDM 2025 (Nov 2025, Washington DC), IJCNN 2025 (Jun 2025, Rome, Italy), NAACL 2025 (Apr 2025, Albuquerque, NM), IEEE SSCI 2025 (Mar 2025, Trondheim, Norway), IEEE CAI 2024 (Jun 2024, Marina Bay Sands, Singapore)

AWARDS & RECOGNITIONS

- IMDA Singapore Digital Scholarship (Postgraduate), 2025 — Competitive Singapore government scholarship awarded to senior technology professionals pursuing advanced research
- 1st Prize, SMU Libraries "Generate Your L(AI)brary" Hackathon, 2023 — Won first place at Singapore Management University's AI hackathon (26–27 August 2023). GitHub: https://www.linkedin.com/posts/donghao-huang_yesterday-our-team-won-1st-prize-in-smu-library-ugcPost-7101786441805926400-LW0S/
- Smart Sentosa Challenge Winner, 2016 — Mastercard Asia-Pacific's Smart City Engine won the Smart Sentosa challenge, a Singapore government smart-city innovation competition

SELECTED MEDIA COVERAGE

- "Engineering the Future of AI: SMU EngD Powers Innovation for a Global Technology Leader" — SMU School of Computing and Information Systems, February 2026. https://computing.smu.edu.sg/engd/community-stories/engineering-future-ai-smu-engd-powers-innovation-global-technology-leader

- Token 2049 Side Event Coverage — Investing.com, September 2024. https://hk.investing.com/analysis/article-110563
- “支付科技与安全交易” Panel — Sina Finance, March 2018. https://finance.sina.cn/blockchain/2018-04-02/detail-ifysvnxn1920535.d.html
- “零距离感受万事达卡的支付黑科技” — Sina / Payment Industry Network, November 2017. https://k.sina.cn/article_6007803312_16617cdb0001001wwd.html
- “不换手机和掏不起钱的人，怎样才能用上新支付技术？” — China E-Banking Network / cnBeta, November 2017. https://www.cebnet.com.cn/20171127/102444564.html
- “亞洲最大！萬事達卡支付科技創新，9 間實驗室擺腰” — Business Next (數位時代), November 2017. https://www.bnext.com.tw/article/47137/mastercard-innovation-lab

VOLUNTEERING EXPERIENCE

Nov 2025 – to date — Bao Yan (Singapore) Education Society
President

Jun 2016 – Jun 2020 — Peking University Alumni Association (Singapore)
Vice President

Jan 2015 – Jan 2019 — Startupbootcamp FinTech — Singapore
Mentor

Mar 2011 – Dec 2015 — ConneXions International — Singapore
IT and Payment Consultant

Nov 2006 – Jul 2008 — St. Andrew’s Autism Centre — Singapore
Technology Consultant

TECHNICAL SKILLS

- **AI/ML/GenAI:** LLMs (GPT-4, GPT-5, Claude, Gemini, Llama, Qwen, DeepSeek-R1, Mistral, Magistral, Phi, Nemotron), PyTorch, Transformers, LLM/ML Model Fine-tuning and Optimization, PEFT, LoRA/QLoRA Fine-tuning, LlamaFactory, Unsloth, RAG, LangChain, LangGraph, Autogen, Ollama, LM Studio, Vector Databases, FAISS, Chroma, Prompt Engineering, Few-shot Learning, NLP, Sentiment Analysis, Agentic AI, OpenClaw, NemoClaw, Edge AI Deployment, Energy-efficient Inference
- **GPU/Hardware:** NVIDIA H100, L40, A40, RTX 4080, RTX 4090, RTX A6000, Jetson AGX Orin, DGX Spark; Apple M-series
- **Languages & Frameworks:** Python, C/C++, Java, NodeJS, React, Vue, Spring Boot/Cloud, Solidity
- **Cloud & Infrastructure:** AWS, Azure, Heroku; Microservices, CI/CD, Docker
- **Web3/Blockchain:** Blockchain, Smart Contract, IPFS, NFT, DeFi

PATENTS

(10 granted, 50+ pending — all assigned to Mastercard)

Granted Patents

- **US12417452B2** – Smart chip payment acceptance (2025)
- **US12217246B2** – Method and system for use of an EMV card in a multi-signature wallet for cryptocurrency transactions (2025)
- **US11715100B2** – Electronic system and computerized method for verification of transacting parties to process transactions (2023)
- **US11615406B2** – Method and system for providing a service at a self-service machine (2023)
- **US10535034B2** – Item delivery management systems and methods (2020)
- **US10482499B2** – Method for conducting a transaction (2019)
- **US10423949B2** – Vending machine transactions (2019)
- **US10083427B2** – Method for receiving an electronic receipt of an electronic payment transaction into a mobile device (2018)
- **US9836729B2** – Method and system for conducting a payment transaction and corresponding devices (2017)
- **US8712914B2** – Method and system for facilitating micropayments in a financial transaction system (2014)

Selected Pending Applications

- **WO2026063867A1** – Method and system for seamless cross-network physical-digital (phy-gital) experience (2024)
- **US20260080407A1** – Method and system for seamless cross-network physical-digital (phy-gital) experience (2024)
- **WO2024058723A1** – Digitization of payment cards for web 3.0 and metaverse transactions (2022)
- **US20230059546A1** – Access control system (2021)
- **EP4356332A2** – Method and system for mediated cross ledger stable coin atomic swaps using hashlocks (2021)
- **US20210406887A1** – Method and system for merchant acceptance of cryptocurrency via payment rails (2020)
- **US20210158316A1** – Electronic system and computerized method for controlling operation of service devices (2019)
- **US20200175489A1** – Method and system for QR code originated vending (2017)
- **WO2017200643A1** – Method and system for allocating and transacting with multiple non-financial commodities (2016)
- **US20180025332A1** – Transaction facilitation (2016)

… *and 40+ additional pending patent applications across payment technology, blockchain, AI, and IoT domains.*

RESEARCH PAPERS

(papers at top-tier venues are highlighted in yellow; full texts are accessible via the hyperlinked paper titles)

Artificial Intelligence

1. Huang, D., Drietomský, T., Barrett, B. & Wang, Z. (2026). How Small Can You Go? LoRA Fine-Tuning 270M–8B Models for Merchant Information Extraction in Financial Transactions. Accepted for publication in *2026 IEEE International Conference on Data Mining (ICDM 2026)*, Shenyang, China.
2. Teo, N., Huang, D. & Wang, Z. (2026). A Survey of Commonsense Reasoning in LLMs. ACM Computing Surveys, vol. 58, no. 14, pp. 1–34 (2026).
3. Chua, J. K., Huang, D. & Wang, Z. (2026). A Novel Hierarchical Multi-agent System for Payments Using LLMs. In *Advances in Knowledge Discovery and Data Mining. PAKDD 2026. Lecture Notes in Computer Science, vol. 16598*, pp. 28–39. Springer, Singapore.
4. Huang, D., & Wang, Z. (2026). Task Complexity Matters: An Empirical Study of Reasoning in LLMs for Sentiment Analysis. In *Advances in Knowledge Discovery and Data Mining. PAKDD 2026. Lecture Notes in Computer Science, vol. 16600*, pp. 288–299. Springer, Singapore.
5. Huang, D., Chua, J. K., & Wang, Z. (2027). Beyond Task Success: Measuring Workflow Fidelity in LLM-Based Agentic Payment Systems. In *Trends and Applications in Knowledge Discovery and Data Mining. PAKDD 2026. Lecture Notes in Computer Science, vol. 16603*, pp. 357–362. Springer, Singapore.
6. Huang, D., Pai, P., & Wang, Z. (2027). Entity Matching with LLMs at Scale: Accuracy, Cost, and Reasoning Effects. In *Trends and Applications in Knowledge Discovery and Data Mining. PAKDD 2026. Lecture Notes in Computer Science, vol. 16603*, pp. 112–124. Springer, Singapore.
7. Huang, D., Chew, S., & Wang, Z. (2027). CMAS4G2: A Locally Deployed Cooperative Multi-agent System for Gherkin Acceptance Test Generation. In *Trends and Applications in Knowledge Discovery and Data Mining. PAKDD 2026. Lecture Notes in Computer Science, vol. 16603*, pp. 156–167. Springer, Singapore.
8. Huang, D. & Pandey, M. (2026). An Agentic Voice-Based Assistant for Interactive Conversation and Guidance in Real-World Environments. In *Proceedings of the 25th International Conference on Autonomous Agents and Multiagent Systems (AAMAS '26)*, Paphos, Cyprus, pp. 4167–4169. International Foundation for Autonomous Agents and Multiagent Systems, Richland, SC.
9. Chua, J. K., Tse, C. H., Huang, D., & Wang, Z. (2026). ConvPayMAS: Conversational Payment Multi-Agent System with Agent-to-Agent Protocol and Three-Mandate Verification. In *Proceedings of the 25th International Conference on Autonomous Agents and Multiagent Systems (AAMAS '26)*, Paphos, Cyprus, pp. 4071–4073. International Foundation for Autonomous Agents and Multiagent Systems, Richland, SC.
10. Huang, D., Malwe, G., & Wang, Z. (2026). When Agents Fail to Act: A Diagnostic Framework for Tool Invocation Reliability in Multi-Agent LLM Systems. *2026 9th International Conference on Artificial Intelligence and Big Data (ICAIBD)*, Chengdu, China, pp. 492–497. IEEE.
11. Huang, D., Chew S., Dutkiewicz A., & Wang, Z. (2026). LLM-as-a-Judge for Scalable Test Coverage Evaluation: Accuracy, Operational Reliability, and Cost. Presented at *AAAI 2026 Workshop on Next-Gen Code Development with Collaborative AI Agents.*
12. D. Huang, N. Teo, A. Chekuru, E. Deutschman and Z. Wang, "Deploying Reasoning LLMs for Sentiment Analysis: Architecture Trade-offs on Consumer Hardware," 2025 IEEE International Conference on Data Mining Workshops (ICDMW), Washington, DC, USA, 2025, pp. 2048-2055.
13. S. Samuel, D. Huang, J. T. Y. Hong and Z. Wang, "Integrating LLM Sentiment Analysis into Machine Learning for Soccer Betting," 2025 IEEE International Conference on Data Mining Workshops (ICDMW), Washington, DC, USA, 2025, pp. 2156-2164.
14. D. Huang and Z. Wang, "Explainable Sentiment Analysis With DeepSeek-R1: Performance, Efficiency, and Few-Shot Learning," in *IEEE Intelligent Systems*, vol. 40, no. 6, pp. 52-63, Nov.-Dec. 2025.
15. Huang, D., Ng, D., Pen, H., Wang, Z., & Cambria E. (2025). Evaluating the Impact of LLM-Manipulated Content on Fake News Detection. In: Yuan, S., Malliaros, F., Zheng, X. (eds) *Trends and Applications in Knowledge Discovery and Data Mining. PAKDD 2025*. Lecture Notes in Computer Science, vol. 15835, pp. 375–386. Springer, Singapore.

16. Teo, N., Huang, D., Cambria, E., Wang, Z. (2025). Large Language Models for Logical Fallacy Detection. In: Yuan, S., Malliaros, F., Zheng, X. (eds) *Trends and Applications in Knowledge Discovery and Data Mining. PAKDD 2025*. Lecture Notes in Computer Science, vol. 15835, pp. 387–398. Springer, Singapore.
17. D. Huang and Z. Wang, "LLMs at the Edge: Performance and Efficiency Evaluation with Ollama on Diverse Hardware," *2025 International Joint Conference on Neural Networks (IJCNN)*, Rome, Italy, 2025, pp. 1-8.
18. Huang, D., Nguyen, T. S., Liausvia, F., & Wang, Z. (2025, April). RAP: A Metric for Balancing Repetition and Performance in Open-Source Large Language Models. In *Proceedings of the 2025 Conference of the Nations of the Americas Chapter of the Association for Computational Linguistics: Human Language Technologies (Volume 1: Long Papers)* (pp. 1479-1496).
19. Huang, D., Malwe, G., Varshney, R., Tse, A., & Wang, Z. (2025, March). Scalable Invoice Reconciliation for SMEs: Edge-Deployed LLMs in Multi-Agent Systems. In *2025 International Conference on Data Science, Agents & Artificial Intelligence (ICDSAAI), Chennai, India*(pp. 1-6). IEEE.
20. D. Huang and Z. Wang, "Optimizing Chinese-to-English Translation Using Large Language Models," *2025 IEEE Symposium on Computational Intelligence in Natural Language Processing and Social Media (CI-NLPSoMe)*, Trondheim, Norway, 2025, pp. 1-7.
21. D. Huang and Z. Wang, "Logical Reasoning with LLMs via Few-Shot Prompting and Fine-Tuning: A Case Study on Turtle Soup Puzzles," *2025 IEEE Symposium on Computational Intelligence in Natural Language Processing and Social Media (CI-NLPSoMe Companion)*, Trondheim, Norway, 2025, pp. 1-5.
22. Wang, Z., Huang, D., Cui, J. et al. (2025). A review of Chinese sentiment analysis: subjects, methods, and trends. Artif Intell Rev 58, 75 (2025).
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