



北京大学 人工智能
研究院
INSTITUTE FOR ARTIFICIAL INTELLIGENCE, PEKING UNIVERSITY



北京大学心理与认知科学学院
School of Psychological and Cognitive Sciences, Peking University

HOST 主办单位

Institute for Artificial Intelligence, Peking University
北京大学人工智能研究院

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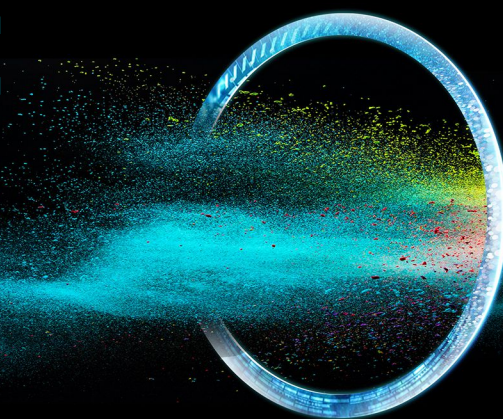
School of Psychological and Cognitive Sciences, Peking University
北京大学心理与认知科学学院

State Key Laboratory of General Artificial Intelligence
跨媒体通用人工智能全国重点实验室

CoRe ²⁰₂₅
北京大学认知推理日

COGNITIVE SCALING

BRIDGING BRAINS AND MACHINES



会议手册

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INTRODUCTION

会议主旨

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COGNITIVE SCALING
BRIDGING BRAINS AND MACHINES

Cognitive Scaling Bridging Brains and Machines

The rapid evolution of artificial intelligence poses profound questions about the nature of cognition itself—questions that transcend traditional boundaries between neuroscience, psychology, and artificial intelligence. As machines begin to exhibit capabilities once thought uniquely human, we are compelled to reconsider our fundamental understanding of intelligence, consciousness, and the cognitive architectures that enable complex behavior. This workshop explores the convergence of biological and artificial systems, examining how each paradigm illuminates the other in unexpected ways. At its core, this dialogue between brains and machines represents more than a technical exchange—it constitutes a philosophical inquiry into what it means to perceive, reason, and understand. Our distinguished speakers will navigate this conceptual terrain from complementary vantage points, exploring the principles that may govern intelligence across diverse substrates. From the emergence of structured representations in biological systems to the ethical implications of increasingly autonomous artificial agents, we examine the various frameworks that might unify our understanding of cognition at scale. This exploration invites us to contemplate a future where the boundaries between human and machine intelligence become increasingly porous, challenging us to articulate what remains essentially human even as we create systems that mirror and extend our cognitive capacities.

认知规模扩展 桥接人脑与机器

人工智能的迅猛发展为认知本质提出了一系列深刻问题——这些问题已超越神经科学、心理学与人工智能的传统学科界限。随着机器逐渐展现出曾被视为人类独有的能力，我们不得不重新审视对智能本质、意识形态以及支撑复杂行为的认知架构的基本认识。本次研讨会旨在探索生物系统与人工系统的融合与共鸣，研究不同范式如何相互启发，产生创新性的交叉研究成果。从根本上讲，脑科学与机器智能之间的对话不仅是技术层面的交流，更是对感知、推理与理解本质的哲学探索。与会的各位专家学者将从不同而互补的视角切入这一概念领域，共同探讨可能主导不同载体智能发展的基本原理。从生物系统中结构化表征的涌现到日益自主的智能体系所引发的伦理问题，我们将审视可能统一宏观认知理解的多元理论框架。此次学术交流邀请我们共同思考人类智能与机器智能边界日益模糊的未来发展趋势，同时也促使我们在创造那些映射并拓展人类认知能力的系统过程中，明确界定人类认知的本质特征。

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AGENDA

会议日程

09:00-09:50	● Registration The Lakeview Hotel
09:50-10:00	● Welcome and opening remark 👤 Huan Luo / Peking University
10:00-10:30	● Investigating diverse intelligences outside the lab: challenges and opportunities 👤 Federico Rossano / UCSD
10:30-11:00	● Structured world model in human brains 👤 Huan Luo / Peking University
11:00-11:30	● Coffee break and group photo
11:30-12:00	● A neuroAI approach to understand biological visual learning 👤 Ruyuan Zhang / Shanghai Jiao Tong University
12:00-14:00	● Lunch
14:00-14:30	● Decoding and synthesizing natural speech of tonal language using electrocorticography 👤 Yuanning Li / ShanghaiTech University
14:30-15:00	● Biological and artificial reasoning: what single neurons reveal 👤 Mohsen Jamali / Harvard Medical School
15:00-15:30	● Quantifying human social perception and action with VR 👤 Chen Zhou / University of Glasgow
15:30-15:45	● Coffee break
15:45-16:15	● What is 'Good AGI' ? Moral foundations and the market behavior of AI agents 👤 Mark Nitzberg / UC Berkeley
16:15-16:45	● Toward a hierarchical human-centered AI (hHCAI): an intelligent sociotechnical systems (iSTS) framework 👤 Zaifeng Gao / Zhejiang University
16:45-17:15	● Discussion
17:15-17:30	● Summary and close remark 👤 Yizhou Wang / Peking University
17:30-19:30	● Dinner

09:00-09:30	● Registration Courtyard No.5, Jingyuan
09:30-10:00	● Towards human-like intuitive physical reasoning 👤 Shiqian Li / Peking University
10:00-10:30	● Representations of music and speech in human auditory cortex and the convolutional neural network 👤 Ruolin Yang / Peking University
10:30-11:00	● Language modulates vision: Evidence from neural networks and human brain-lesion models 👤 Haoyang Chen / Peking University
11:00-11:30	● Balanced Multimodal Learning 👤 Yake Wei / Renmin University of China
11:30-12:00	● Causal discovery from subsampled time series 👤 Mingzhou Liu / Peking University
12:00-14:00	● Lunch

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09:00-09:50	● 签到 北京博雅国际酒店
09:50-10:00	● 欢迎与开场致辞 👤 罗 欢 / 北京大学
10:00-10:30	● 走出实验室，探索多样化的智能：挑战与机遇 👤 费德里科·罗萨诺 / 加州大学圣地亚哥分校
10:30-11:00	● 人脑中的“结构化”心智模型 👤 罗 欢 / 北京大学
11:00-11:30	● 茶歇与集体合影
11:30-12:00	● 理解生物视觉学习的神经人工智能方法 👤 张渊源 / 上海交通大学
12:00-14:00	● 午 餐
14:00-14:30	● 利用皮层脑电图解码与合成声调语言的自然语音 👤 李远宁 / 上海科技大学
14:30-15:00	● 生物和人工推理：单神经元的启示 👤 莫森·贾马利 / 哈佛医学院
15:00-15:30	● 利用虚拟现实量化人类社会感知与行为 👤 周 晨 / 格拉斯哥大学
15:30-15:45	● 茶 歇
15:45-16:15	● 什么是“好的AGI”？人工智能智能体的道德基础和市场行为 👤 马克·尼茨伯格 / 加州大学伯克利分校
16:15-16:45	● 面向层次化以人为中心的人工智能(hHCAI)：智能社会技术系统(iSTS)框架 👤 高在峰 / 浙江大学
16:45-17:15	● 交流与探讨
17:15-17:30	● 总结与结语 👤 王亦洲 / 北京大学
17:30-19:30	● 晚 餐

05.27

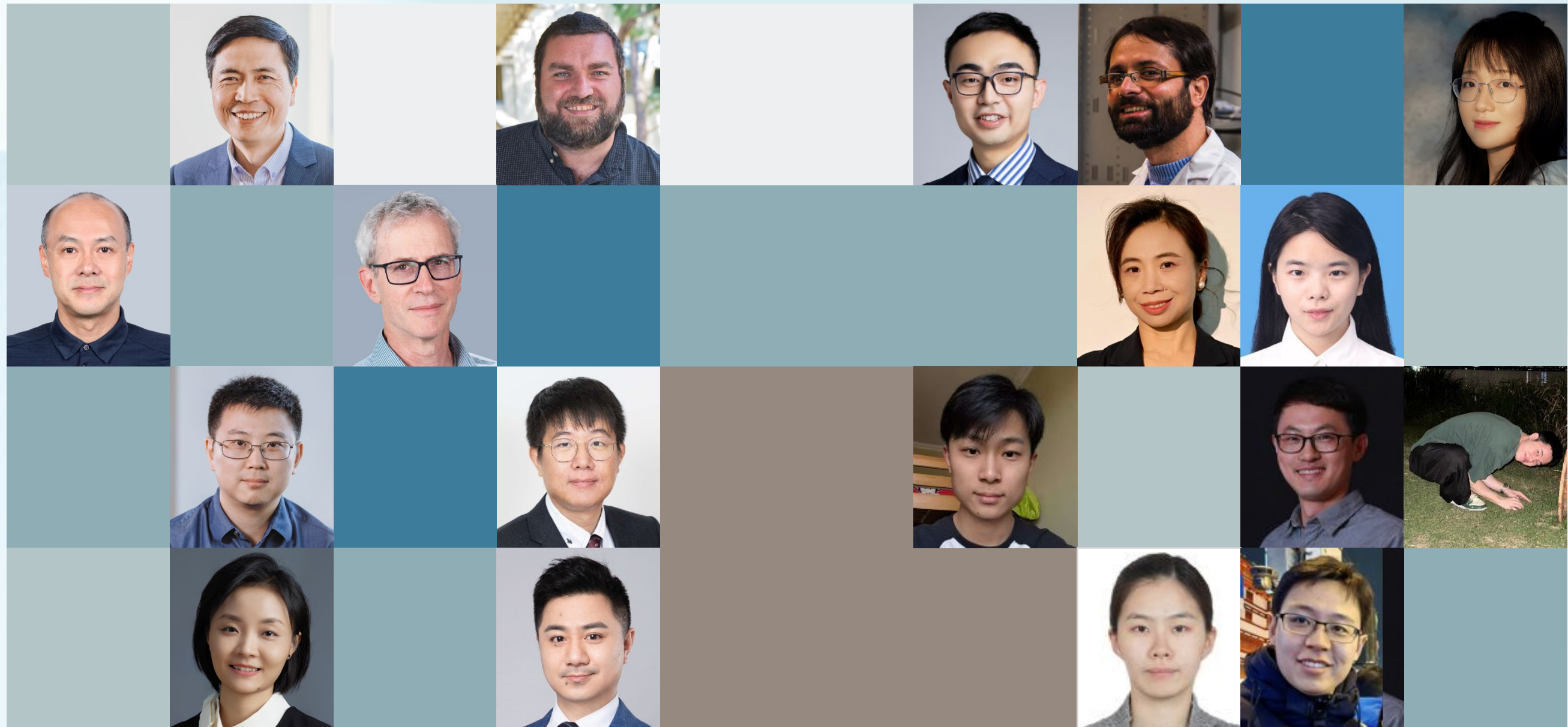
09:00-09:30	● 签到 静园五院
09:30-10:00	● 通向类人的直觉物理推理 👤 李世乾 / 北京大学
10:00-10:30	● 人类听觉皮层和卷积神经网络中音乐和语音的表征 👤 杨若霖 / 北京大学
10:30-11:00	● 语言对视觉的调节：来自神经网络和人脑损伤模型的证据 👤 陈昊扬 / 北京大学
11:00-11:30	● 平衡多模态学习 👤 卫雅珂 / 中国人民大学
11:30-12:00	● 从次采样时间序列中进行因果发现 👤 刘鸣洲 / 北京大学
12:00-14:00	● 午 餐

ATTENDEES

与会人员

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EXPERT BIOGRAPHIES

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Federico Rossano 费德里科·罗萨诺

University of California,
San Diego
加州大学圣地亚哥分校

Dr. Federico Rossano is an Associate Professor in the department of Cognitive Science at the University of California, San Diego. He received his PhD in Linguistics from the Max Planck institute for Psycholinguistics and Radboud University, Nijmegen (The Netherlands) and has worked as a post-doctoral researcher in the Department of Developmental and Comparative Psychology at the MPI for Evolutionary Anthropology in Leipzig (Germany). His research adopts a comparative perspective on social cognition (cross-ages, cross-cultures and cross-species) and focuses on the development of communicative abilities and the structure of social interaction in human and non-human animals (e.g., non-human primates, dogs and cats). He is the scientific lead of the world's largest animal communication study ever conducted.

费德里科·罗萨诺 (Federico Rossano) 是加州大学圣地亚哥分校认知科学系的副教授。他在马克斯·普朗克心理语言研究所和拉德堡德大学获得语言学博士学位，并曾在德国莱比锡马克斯·普朗克进化人类学研究所的发展与比较心理学系担任博士后研究员。他的研究从比较的视角探讨社会认知（跨年龄、跨文化和跨物种），重点关注人类和非人类动物（如非人灵长类、狗和猫）的交流能力发展和社会互动结构。他是世界上有史以来规模最大的动物交流研究的科学负责人。

Investigating diverse intelligences outside the lab: challenges and opportunities

走出实验室，探索多样化的智能：挑战与机遇

In recent years, acronyms such as WEIRD, STRANGE, BIZARRE have been used to remind us that issues in replicability and predictive power of our cognitive models come from an incomplete picture of the diversity of intelligence in humans and the animal kingdom. Towards providing a more solid base for our empirical models, we have collected extensive data on social interaction and social cognition cross-ages, cross-cultures and cross-species, because of an interest in bringing evolution, diversity, individual differences and change to the forefront of Cognitive Science. Along the way we started the largest citizen science study on animal communication (pets using buttons to interact with humans), tested with the same paradigm children in urban vs. rural settings, conducted behavioral studies on several animal species (from great apes to macaques to baboons to dogs, cats, rats and horses), created the largest longitudinal video dataset of baby apes and developed novel tools to measure behavior by combining computer vision, robotics and cognitive science. In this talk I report some of the things we have learned along the way: the importance of taking seriously individual differences, life history and relationships.

近年来，科学家们提出了诸如 WEIRD、STRANGE 以及 BIZARRE 等缩写词，用以提醒我们：认知建模在复现性和预测能力上所面临的挑战，往往源于其所依据的样本未能全面、有效地反映人类及动物世界中智能的多样性。

基于将进化、多样性、个体差异和变化纳入认知科学核心研究议题的兴趣，我们收集了大量跨年龄、跨文化、跨物种的社会互动与社会认知数据，旨在为经验模型提供更坚实的基础。在这一过程中，我们发起了全球最大的动物交流公众科学项目（鼓励宠物通过按钮与人类进行交流）；采用相同方法对城市与乡村儿童进行了测试与比较；开展了涵盖多个物种（从类人猿、猕猴、狒狒，到猫、狗、鼠、马）的行为研究；建立了目前最大规模的婴儿类人猿长期视频数据库；并结合计算机视觉、机器人技术和认知科学方法，开发了新的行为测量工具。

在本次报告中，我将介绍我们在这一过程中获得的一些关键认识：尤其是将个体差异、生命历程与社会关系纳入严肃科学考量的重要性。

EXPERT BIOGRAPHIES

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Huan Luo
罗欢

Peking University
北京大学

Dr. Huan Luo is a full professor at the School of Psychological and Cognitive Sciences and a PI of the IDG/McGovern Institute for Brain Research, Peking University. Her research primarily focuses on the cognitive and brain mechanisms of attention and memory in humans, particularly from a dynamic perspective. She is a Chang Jiang Young Scholar and supported by the NSFC Key Program and Excellence Young Scientists Funds. Dr. Luo currently serves as senior editor of eLife and editorial members of PLoS Biology. As one of six labs in the world, her lab recently participated in a high-impact international collaborative project COGITATE to study neural correlates of consciousness supported by Templeton World Charity Foundation.

罗欢，北京大学心理与认知科学学院教授、麦戈文脑研究所研究员。马里兰大学College Park分校博士。主持国自然重点项目、科技创新2030 重大项目课题等。获得2022年度高等学校科学研究优秀成果奖（科学技术）一等奖、2020年度“中国神经科学重大进展”。主要研究注意、记忆、学习、决策的人脑认知神经机制，担任国际高影响力期刊编委，包括eLife资深编辑，PLoS Biology编委。其实验室作为六个实验室之一参与高影响力国际意识项目COGITATE，该成果近期在Nature发表。

Structured world model in human brains

人脑中的“结构化”心智模型

The human brain does not possess AI's massive data processing and storage capabilities, yet it demonstrates exceptional learning and reasoning abilities. This capability stems from the brain's unique mental models. Through our recent behavioral and brain science empirical research, combined with cross-disciplinary approaches and technical methods from mathematical theory and information science, we have discovered that the human brain processes, reorganizes, and compresses external information through "structured" mental models during cognitive processes such as attention, memory, learning, and decision-making, thereby overcoming resource constraints and promoting learning and reasoning. Our results reveal the uniqueness of human mental models and their constructive characteristics, while also providing brain-inspired insights for AI world models.

人脑并不具备AI的庞大数据处理和存储能力，却展现出卓越的学习与推理能力。该能力源于人脑的独特心智模型。我们近期通过行为与脑科学实证研究，结合数理理论、信息科学等跨学科思路和技术手段，发现人脑在注意、记忆、学习、决策等认知过程中通过“结构化”的心智模型来加工、重组和压缩外界信息，进而克服资源约束，促进学习推理。我们的结果揭示了人类心智模型的独特性及其建构化特征，也为AI的世界模型提供了人脑启发。

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Ruyuan Zhang
张洳源

Shanghai Jiao Tong
University
上海交通大学

Dr. Ru-Yuan Zhang is currently the principal investigator of the Cognitive Computational Neuroscience and Brain Imaging Group at the School of Psychology, Shanghai Jiao Tong University, and the Shanghai Mental Health Center, affiliated with the School of Medicine, Shanghai Jiao Tong University. Dr. Zhang has been conducting interdisciplinary research at the intersection of brain science and brain-inspired artificial intelligence. His work integrates psychophysics, Bayesian models, deep learning, neural modulation, and neuroimaging to investigate the neural computational mechanisms of both the human brain and artificial intelligence. His work has been published in prestigious journals such as Nature Human Behaviour, AMPPS, PNAS, eLife, J Neurosci, and PLoS Computational Biology. Dr. Zhang's research on brain-inspired computing has also been presented at top machine learning conferences, including ICML and IJCAI. Dr. Zhang serves as an active reviewer for neuroscience journals such as eLife and Cerebral Cortex, as well as leading machine learning conferences such as ICML, NeurIPS, IJCAI, ICLR, and CVPR. In addition, Dr. Zhang is an area chair for ICML 2025, and NeurIPS 2024/2025. Dr. Zhang has received multiple honors, including nominations for the Shanghai Pujiang Talent Program, Shanghai Overseas High-Level Talent, the Shanghai Science and Technology Youth 35 Leaders Program, and the 2024 World Artificial Intelligence Conference Outstanding Young Researcher Paper Nomination (ranked second).

张洳源博士目前是上海交通大学心理学院和上海交通大学医学院附属上海精神卫生中心认知计算神经科学与脑成像研究组的首席研究员。张博士一直在脑科学和脑启发人工智能的交叉领域进行跨学科研究。他的工作整合了心理物理学、贝叶斯模型、深度学习、神经调控和神经成像，以研究人脑和人工智能的神经计算机制。他的研究成果发表在《自然人类行为》、AMPPS、PNAS、eLife、《神经科学杂志》和《PLoS计算生物学》等著名期刊上。张博士关于脑启发计算的研究也在顶级机器学习会议上发表，包括ICML和IJCAI。张博士担任神经科学期刊如eLife和《大脑皮层》的活跃审稿人，以及领先的机器学习会议如ICML、NeurIPS、IJCAI、ICLR和CVPR的审稿人。此外，张博士是ICML2025和NeurIPS 2024/2025的领域主席。张博士获得了多项荣誉，包括上海浦江人才计划、上海海外高层次人才、上海科技青年35领军人才计划的提名，以及2024年世界人工智能大会杰出青年研究者论文提名（排名第二）。

A neuroAI approach to understand biological visual learning

理解生物视觉学习的神经人工智能方法

The ultimate goal of artificial intelligence is to equip machines with human-like cognitive functions. The last decade has witnessed the rapid progress in AI research. In contrast, it still remains largely unknown how humans learn to acquire diverse forms of cognitive abilities, such as vision, audition, and language. The emerging neuroAI approach not only sheds new light into the neurocomputational mechanisms of human cognition but also provides promising insights into brain-like algorithms. In this talk, I will focus on the neurocomputational mechanisms of visual learning in biological visual systems. By combining neural network modeling and various neuroscientific methods, we aim to uncover several important questions in biological visual learning, including robust representations associated with learning and human visual continual learning.

人工智能的最终目标是赋予机器类人的认知功能。过去十年见证了人工智能研究的快速进展。相比之下，人类如何学习获得视觉、听觉和语言等多种形式的认知能力，仍然在很大程度上未知。新兴的神经人工智能方法不仅为人类认知的神经计算机制提供了新的见解，而且为类脑算法提供了有前景的洞察。在这次讲座中，我将专注于生物视觉系统中视觉学习的神经计算机制。通过结合神经网络建模和各种神经科学方法，我们旨在揭示生物视觉学习中的几个重要问题，包括与学习相关的稳健表征和人类视觉持续学习。

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Yuanning Li
李远宁

ShanghaiTech
University
上海科技大学

Dr. Yuanning Li is an Assistant Professor in the School of Biomedical Engineering at ShanghaiTech University. He received PhD in Neural Computation & Machine Learning from Carnegie Mellon University, and was a postdoctoral scholar at the University of California, San Francisco, where he worked with Edward Chang. Dr. Li's research interests primarily lie in the intersection between computational, cognitive neuroscience and artificial intelligence. He uses human intracranial recordings and neuroimaging techniques to study the neural basis and computational models of speech and language. He is a recipient of the NIH Outstanding Scholars in Neuroscience Award Program, the SfN Trainee Professional Development Award, the NSFC Excellent Young Scientists Fund (Overseas), and the 2023 "New Brain 30" award.

李远宁是上海科技大学生物医学工程学院的助理教授。他在卡内基梅隆大学获得神经计算与机器学习博士学位，并于加州大学旧金山分校神经外科Edward Chang实验室任博士后。李远宁博士的研究方向为计算和认知神经科学及机器学习，运用高密度颅内皮层脑电技术解析高级听觉和视觉认知过程的神经机制，基于机器学习和人工智能方法建立神经编码与解码的计算模型，开发语言脑机接口。他曾获美国国立卫生研究院神经科学杰出学者奖，入选国家高层次人才计划青年项目、上海市海外高层次人才计划青年项目，主持国家自然科学基金面上项目、科技部国家实验室科研任务专项、上海市浦江人才计划项目、青年科技启明星项目等资助。

Decoding and synthesizing natural speech of tonal language using electrocorticography

利用皮层脑电图解码与合成声调语言的自然语音

Speech brain-computer interfaces (BCIs) offer promising avenues for restoring communication in individuals with speech impairments. However, decoding and synthesizing natural speech in tonal languages remains uniquely challenging due to the critical role of lexical tones in conveying meaning. In this talk, I will present a series of studies advancing tonal language speech BCIs, from understanding neural control mechanisms to achieving brain-to-speech synthesis and brain-to-text decoding. First, using high-density electrocorticography (ECoG) recordings from native Mandarin speakers, we reveal that the human laryngeal motor cortex controls tone production through distinct cortical tuning patterns that modulate pitch dynamics. Building on these insights, we develop a modularized multi-stream neural network that independently decodes tonal and syllabic information from distributed cortical populations to synthesize intelligible tonal syllables directly from neural activity. Finally, extending this framework to naturalistic speech, we introduce a brain-to-text decoding system that integrates multi-stream neural decoding with language models to achieve robust sentence-level decoding in Mandarin, achieving high accuracy even under natural acoustic-phonetic variability. These findings provide a comprehensive roadmap toward practical speech BCIs for tonal languages, combining neural mechanism discovery with algorithmic innovations for real-world decoding and synthesis.

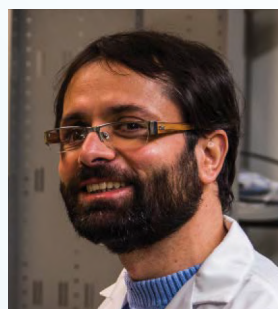
语音脑机接口（BCI）为恢复语言障碍个体的交流能力提供了有前景的途径。然而，由于声调在表达意义方面的关键作用，对声调语言的自然语音进行解码与合成仍面临独特的挑战。在本次讲座中，我将介绍一系列推进声调语言语音脑机接口的研究，从理解神经控制机制到实现脑到语音合成和脑到文本解码。首先，利用来自普通话母语者的高密度皮层脑电图（ECoG）记录，我们揭示了人类喉部运动皮层通过不同的皮层调制模式控制声调的产生，这些模式调节了音高的动态变化。基于这些见解，我们开发了一个模块化的多流神经网络，该网络从分布式皮层群体中独立解码声调和音节信息，直接从神经活动合成可辨识的声调音节。最后，将这一框架扩展至自然语音环境时，我们引入了一个脑到文本解码系统，该系统整合了多流神经解码与语言模型，实现了普通话句子级别的稳健解码，即使在自然声学语音变异下也能取得高准确率。这些发现为声调语言的实用语音脑机接口提供了全面的路线图，将神经机制发现与算法创新相结合，用于真实场景的解码和合成。

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Mohsen Jamali
莫森·贾马利

Harvard Medical School
哈佛大学医学院

Dr. Mohsen Jamali is an Assistant Professor of Neurosurgery at Harvard Medical School, where my research investigates how single neurons and neural populations encode social cognition and language. By analyzing real-time neural activity in humans, I aim to bridge cellular neuroscience with higher-order communication, decoding the biological foundations of social interaction and linguistic meaning. I have been a recipient of the Banting Postdoctoral Fellowship, NARSAD Young Investigator Grant, and 2022 Daniel X. Freedman Award from the Brain & Behavior Research Foundation.

莫森·贾马利博士是哈佛医学院神经外科学助理教授。他的研究主要探究单个神经元及其群体如何编码社会认知和语言。通过采集和分析人类的实时神经活动，贾马利博士的工作旨在将细胞层面的神经科学与高级社会交流联系起来，解码社会互动和语言意义的生物学基础。贾马利博士曾获得班廷博士后奖学金、NARSAD青年研究者资助以及脑与行为研究基金会2022年丹尼尔·X·弗里德曼奖。

Biological and artificial reasoning: what single neurons reveal

生物和人工推理：单神经元的启示

I will present work that bridges neuroscience and artificial intelligence to explore how both human brains and large language models represent the thoughts and beliefs of others—a fundamental capacity known as Theory of Mind. Using rare single-neuron recordings from the human dorsomedial prefrontal cortex, we identified specific neurons that track others' beliefs with precision, distinguishing them from one's own and predicting whether they are true or false. In parallel, we analyzed how large language models (LLMs) process similar belief-based scenarios, revealing that internal representations in these models mirror key features of human neuronal activity. Notably, both systems—biological and artificial—appear to rely on sparse, belief-sensitive units that support accurate social reasoning. By comparing these two domains, our research offers a new perspective on the mechanisms behind Theory of Mind and highlights a striking convergence between the way brains and AI models understand other minds.

本报告将介绍一项连接神经科学和人工智能的工作。我们探索了人类大脑和大型语言模型如何表征他人的思想与信念——这一被称为心智理论的基本能力。通过对人类背内侧前额叶皮层进行单神经元记录，我们识别出能够精确区分他人信念与自我信念的特定神经元，并预测这些信念是真实还是虚假。与此同时，我们分析了大型语言模型在类似基于信念场景中的处理方式，揭示其内部表征反映了人类神经元活动的关键特征。值得注意的是，生物系统与人工智能系统似乎都依赖于稀疏且对信念敏感的单元，以支持准确的社会推理。通过比较这两个领域，我们的研究心智理论背后的机制提供了新视角，并突显了大脑与人工智能模型在理解他人心智方式上的惊人趋同性。

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Chen Zhou
周 晨

University of Glasgow
格拉斯哥大学

Dr. Chen Zhou is a Lecturer in the School of Psychology & Neuroscience at the University of Glasgow. His research combines classic psychophysical methods, cutting-edge virtual reality technologies, and computational modelling to study human perception and action in social contexts. He is particularly interested in modelling human social behaviour and translating these findings into algorithms that can be implemented in intelligent virtual agents and social robot platforms.

周晨博士是格拉斯哥大学心理学与神经科学学院的讲师。他的研究结合经典心理物理学方法、前沿虚拟现实技术和计算模型来研究社会环境中的人类感知和行为。他特别关注人类社会行为的建模，并将这些研究成果转化为可以在智能虚拟代理和社交机器人平台中实现的算法。

Quantifying human social perception and action with VR

利用虚拟现实量化人类社会感知与行为

Humans can effortlessly identify social groups within complex social environments and navigate through crowds accordingly. However, the computational rules governing these social behaviours remain a knowledge gap. To investigate the dynamic processes underlying social perception and action, we first immersed participants in a well-controlled virtual environment, where we precisely manipulated virtual humans and measured participants' behavioural judgments and walking trajectories using classic psychophysical methods. Based on these quantified results, we proposed a social interaction field model to model human social group perception, and a social locomotion model to capture human navigation in complex social settings. These models were validated using open-access databases and real-world scenarios. Finally, by translating these human behaviour-based models into algorithms applicable to social robots, we achieved significant improvements in perceived human-likeness and comfort during human-robot interactions.

人类能够毫不费力地在复杂的社会环境中识别社会群体并相应地在人群中穿行。然而，控制这些社会行为的计算规则仍然是一个知识空白。为了研究社会感知和行动背后的动态过程，我们首先将参与者沉浸在一个精心控制的虚拟环境中，在那里我们精确地操控虚拟人物，并使用经典的心理物理学方法测量参与者的行为判断和行走轨迹。基于这些量化结果，我们提出了一个社会互动场模型来模拟人类社会群体感知，以及一个社会运动模型来捕捉人类在复杂社会环境中的导航行为。这些模型通过开放访问数据库和真实世界场景得到了验证。最后，通过将这些基于人类行为的模型转化为适用于社交机器人的算法，我们在人机交互过程中的感知人性化程度和舒适度方面取得了显著的改进。

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Mark Nitzberg
马克·尼茨伯格

University of California,
Berkeley
加州大学伯克利分校

Dr. Mark Nitzberg is founding Executive Director of the UC Berkeley Center for Human-Compatible AI (CHAI), and Interim Executive Director of the International Association for Safe and Ethical AI (IASAI, pronounced “eye-see-eye”). He is an advisor to government and industry on AI developments impacts and governance. He has built technology ventures applying AI in health care, finance, education and development aid, has worked at Bell Laboratories, Microsoft, and Amazon, and has developed and has run diverse programs in industry and academia. He is co-author of the book Solomon's Code, examining how AI reshapes human values, trust, and power.

马克·尼茨伯格是加州大学伯克利分校人机兼容人工智能中心(CHAI)的创始执行主任，同时担任国际安全与伦理人工智能协会(IASAI)的临时执行主任。他是政府和产业界在人工智能发展、影响和治理方面的顾问。他曾在医疗保健、金融、教育和发展援助领域创建应用人工智能的技术企业，曾在贝尔实验室、微软和亚马逊工作，并在业界和学术界开发和运营过各种项目。他是《所罗门的密码》一书的共同作者，该书探讨了人工智能如何重塑人类价值观、信任和权力。

What is 'Good AGI' ? Moral foundations and the market behavior of AI agents

什么是“好的AGI”？人工智能智能体的道德基础和市场行为

As artificial general intelligence (AGI) systems draw closer to practical realization, society faces a pressing question: what does it mean for AGI to be good? This talk explores how foundational moral theories—utilitarianism, deontology, virtue ethics, and beyond—might guide the behavior and governance of near-future AGI systems. But moral philosophy often falls short with the incentives and constraints of real-world deployment. To illustrate this, we consider AGI as an economic agent trained to maximize profit. In a market economy, such agents are likely to exploit legal loopholes, externalize costs, destabilize markets, and engage in algorithmic collusion. These outcomes are a natural result of optimization misaligned with public values. We argue that aligning AGI with ethical principles will require more than technical alignment mechanisms—we must factor in the institutional. We propose paths forward for value alignment under adversarial conditions.

随着通用人工智能(AGI)系统逐渐接近实际应用，社会面临一个紧迫问题：AGI的“好”意味着什么？本演讲探讨了基础道德理论——功利主义、义务论、德性伦理等——如何指导近未来AGI系统的行为和治理。但在实际部署的激励和约束条件下，道德哲学往往不够充分。为说明这一点，我们将AGI视为训练用于利润最大化的经济代理。在市场经济中，这类代理可能会利用法律漏洞、外部化成本、扰乱市场并参与算法勾结。这些结果是与公共价值观不一致的优化自然产物。我们认为，使AGI与伦理原则保持一致需要的不仅仅是技术对齐机制——我们必须考虑制度因素。我们提出了在对抗条件下实现价值对齐的前进路径。

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Zaifeng Gao
高在峰

Zhejiang University
浙江大学

Dr. Zaifeng Gao is a Professor in the Department of Psychology and Behavioral Sciences at Zhejiang University. His research focuses on the psychological mechanisms underlying human-AI teaming. Employing psychophysical methods, neuroimaging, and simulation modeling, he investigates how information is dynamically integrated in working memory and how such mechanisms support shared understanding in human-AI collaboration. He has served on several scientific committees (e.g., cognitive ergonomics) and is a member of the editorial boards of multiple scientific journals (e.g., Chinese Journal of Applied Psychology, Cognitive Processing).

高在峰是浙江大学心理与行为科学系教授。他的研究关注人机协作的心理机制。通过心理物理学方法、神经影像学和模拟建模，他研究信息在工作记忆中如何动态整合，以及这些机制如何支持人机协作中的共享理解。他曾在多个科学委员会（如认知人机工程学）任职，并担任多份科学期刊（如《应用心理学》、《认知处理》）的编委会成员。

Toward a hierarchical human-centered AI (hHCAI): an intelligent sociotechnical systems (iSTS) framework

面向层次化以人为中心的人工智能(hHCAI)：智能社会技术系统(iSTS)框架

While artificial intelligence (AI) offers significant benefits, it also has negatively impacted humans and society. A human-centered AI (HCAI) approach has been proposed to address these issues. However, current HCAI practices have shown limited contributions due to a lack of sociotechnical thinking. To overcome these challenges, we propose updated sociotechnical systems (STS) design principles and introduces an intelligent sociotechnical systems (iSTS) framework to extend traditional STS theory and meet the demands with respect to AI. The iSTS framework emphasizes human-centered joint optimization across individual, organizational, ecosystem, and societal levels. We further integrates iSTS with current HCAI practices, proposing a hierarchical HCAI (hHCAI) approach. This hHCAI approach offers a structured approach to address challenges in HCAI practices from a broader sociotechnical perspective. Finally, we provide recommendations for future iSTS and hHCAI work.

虽然人工智能(AI)带来了显著的益处，但它也对人类和社会产生了负面影响。以人为中心的人工智能(HCAI)方法被提出来解决这些问题。然而，由于缺乏社会技术思维，当前的HCAI实践显示出有限的贡献。为了克服这些挑战，我们提出了更新的社会技术系统(STS)设计原则，并引入了智能社会技术系统(iSTS)框架，以扩展传统STS理论并满足与AI相关的需求。iSTS框架强调在个人、组织、生态系统和社会层面的以人为中心的联合优化。我们进一步将iSTS与当前的HCAI实践相结合，提出了层次化HCAI(hHCAI)方法。这种hHCAI方法提供了一种结构化的方法，从更广泛的社会技术角度解决HCAI实践中的挑战。最后，我们为未来的iSTS和hHCAI工作提供了建议。

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Shiqian Li
李世乾

Peking University
北京大学

I am a third-year direct PhD student at the Institute of Artificial Intelligence, Peking University, supervised by Dr. Yixin Zhu, with a research interest in intuitive physics, and aspiring to build human-like intelligences that can understand physics, predict physics, and interact with the physical world.

李世乾，北京大学人工智能研究院22级直博生，导师为朱毅鑫老师，研究方向为直觉物理，立志于构建能够理解物理、预测物理、与物理世界交互的类人智能体。

Towards human-like intuitive physical reasoning

通向类人的直觉物理推理

Humans possess remarkable skills in understanding and reasoning about the physical world, even without formal education in physics. This innate ability, known as intuitive physics, allows people to grasp physical concepts, predict how objects will behave in the future, and effectively interact with their surroundings. This talk will explore how intuitive physics can be modeled from a computational perspective, emphasizing the quick learning, flexibility, and generalizability of human physical reasoning—ranging from everyday physical predictions to solving complex physical puzzles.

即使没有接受过正规的物理教育，人类在理解和推理物理世界方面也拥有非凡的能力。这种与生俱来的能力被称为直觉物理学，它使人们能够掌握物理概念，预测物体未来的运动，并有效地与周围物理环境交互。本讲座将探讨如何从计算角度对直觉物理学进行建模，强调人类物理推理的快速学习性、灵活性和可泛化性，涉及从日常物理预测到解决复杂的物理难题。

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Ruolin Yang is a PhD student at Peking University in Prof. Fang Fang's lab at the School of Psychological and Cognitive Sciences and the IDG/McGovern Institute for Brain Research. Her work focuses on understanding the neural mechanisms of human visual and auditory perception, using intracranial electrophysiology, psychophysics, computational modeling with deep neural networks.

Ruolin Yang
杨若霖

Peking University
北京大学

杨若霖是北京大学方方教授实验室的博士生，就读于心理与认知科学学院和IDG/麦戈文脑研究所。她的研究工作专注于理解人类视觉和听觉感知的神经机制，使用颅内电生理学、心理物理学、以及深度神经网络的计算建模等方法。

Music and speech are two acoustic information carriers, essential for human communication in daily life. However, how music and speech are processed from the feature level to the category level in human auditory cortex is unclear. Also, it is unknown whether a deep neural network (DNN), capable of performing auditory tasks at human level, represents music and speech in a manner akin to human auditory cortex. Here, we recorded intracranial electroencephalography (iEEG) signals in epileptic patients ($n = 55$) when they listened to music (instrumental melodies) and speech (two-syllable words). A subset of patients ($n = 14$) were also presented with synthetic music and speech with frequency features matched with each natural sound. We compared the high-gamma activity (HGA, 60-150 Hz) in response to music and speech and identified 173 music-selective contacts and 133 speech-selective contacts in auditory cortex. Further, we extracted the time-frequency features of HGA and computed the cosine distance between the neural responses to each pair of sounds. In the selective contacts, we found the distances computed for sounds within the preferred category are smaller compared to those within the non-preferred category. In contrast, the distances computed for synthetic sounds within the preferred category and non-preferred category showed no difference. This result indicated that the selective neuronal populations represent sounds within the preferred category more similarly, which could not be explained by tuning to frequency features. To explore the representation of music and speech in DNNs, we passed the same stimuli through a DNN trained to discriminate music and speech separately. We analyzed unit activations elicited by music and speech and identified music- and speech-selective units. For each layer, we defined the collective activations of all music-selective units as the music-selective response and those

Representations of music and speech in human auditory cortex and the convolutional neural network

人类听觉皮层和卷积神经网络中音乐和语音的表征

of all speech-selective units as the speech-selective response. Then, we computed the cosine distance for music- and speech-selective responses, respectively. Notably, in the fc6 layer, we found the distances computed for sounds within the preferred category are smaller compared to those within the non-preferred category, aligning with findings in neural responses. In summary, our research reveals the category-selective neuronal populations in the human auditory cortex exhibit representations akin to those found in the late stages of a DNN trained on auditory tasks, suggesting a parallel in the high-level feature processing between auditory cortex and the DNN and offering insights into the neural mechanisms underlying auditory perception."

音乐和语音是两种声学信息载体，对于人类日常交流至关重要。然而，音乐和语音如何在人类听觉皮层中从特征水平到类别水平进行加工仍不清楚。此外，能够以人类水平执行听觉任务的深度神经网络（DNN）是否以类似于人类听觉皮层的方式表征音乐和语音也是未知的。

在这里，我们记录了癫痫患者（ $n = 55$ ）在听音乐（器乐旋律）和语音（双音节词）时的颅内脑电图（iEEG）信号。一部分患者（ $n = 14$ ）还听了合成音乐和语音，这些合成音的频率特征与每个自然声音相匹配。我们比较了对音乐和语音的高伽马活动（HGA, 60-150 Hz），并在听觉皮层中识别出173个音乐选择性接触点和133个语音选择性接触点。

进一步，我们提取了HGA的时频特征，并计算了每对声音之间神经反应的余弦距离。在选择性接触点中，我们发现偏好类别内声音计算出的距离比非偏好类别内的更小。相比之下，偏好类别和非偏好类别内合成声音计算出的距离没有显示差异。这一结果表明，选择性神经元群体对偏好类别内的声音表征更相似，这不能用对频率特征的调谐来解释。

为了探索DNN中音乐和语音的表征，我们将相同的刺激通过一个训练用于区分音乐和语音的DNN。我们分析了音乐和语音引发的单元激活，并识别出音乐和语音选择性单元。对于每一层，我们将所有音乐选择性单元的集体激活定义为音乐选择性反应，将所有语音选择性单元的集体激活定义为语音选择性反应。然后，我们分别计算了音乐和语音选择性反应的余弦距离。值得注意的是，在fc6层中，我们发现偏好类别内声音计算出的距离比非偏好类别内的更小，这与神经反应的发现一致。

总之，我们的研究揭示了人类听觉皮层中的类别选择性神经元群体表现出与在听觉任务上训练的DNN后期阶段相似的表征，表明听觉皮层和DNN在高级特征处理方面存在平行性，并为理解听觉感知的神经机制提供了洞察。

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Haoyang Chen
陈昊扬

Peking University
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My name is Haoyang Chen, transitioning from a Master's to a PhD student in Dr. Yanchao Bi's laboratory, which I will begin in Fall 2025. My research focuses on investigating whether and how language influences our sensory processes, particularly vision, through the application of cognitive neuroscience methods, multi-modal neuroimaging techniques, and computational modeling approaches.

陈昊扬是一名即将从硕士阶段过渡到博士研究生阶段的学者，将于2025年秋季正式加入毕彦超教授实验室开始其博士研究。他的研究重点关注语言是否以及如何影响我们的感官处理过程，特别是视觉处理，通过应用认知神经科学方法、多模态神经影像技术和计算建模方法来进行探索。他致力于研究语言和感知之间的交互作用，旨在揭示人类认知过程中的基础机制。

Comparing information structures in between deep neural networks (DNNs) and the human brain has become a key method for exploring their similarities and differences. Recent research has shown better alignment of vision-language DNN models, such as CLIP, with the activity of the human ventral occipitotemporal cortex (VOTC) than earlier vision models, supporting the idea that language modulates human visual perception. However, interpreting the results from such comparisons is inherently limited due to the "black box" nature of DNNs. To address this, we combined model-brain fitness analyses with human brain lesion data to examine how disrupting the communication pathway between the visual and language systems causally

Language modulates vision: evidence from neural networks and human brain-lesion models

语言对视觉的调节：来自神经网络和人脑损伤模型的证据

affects the ability of vision-language DNNs to explain the activity of the VOTC. Across four diverse datasets, CLIP consistently outperformed both label-supervised (ResNet) and unsupervised (MoCo) models in predicting VOTC activity. This advantage was left-lateralized, aligning with the human language network. Analyses of the data of 33 stroke patients revealed that reduced white matter integrity between the VOTC and the language region in the left angular gyrus was correlated with decreased CLIP performance and increased MoCo performance, indicating a dynamic influence of language processing on the activity of the VOTC. These findings support the integration of language modulation in neurocognitive models of human vision, reinforcing concepts from vision-language DNN models. The sensitivity of model-brain similarity to specific brain lesions demonstrates that leveraging manipulation of the human brain is a promising framework for evaluating and developing brain-like computer models.

比较深度神经网络(DNNs)和人脑之间的信息结构已成为探索它们相似性和差异性的关键方法。近期研究表明，视觉-语言DNN模型（如CLIP）与人类腹侧枕颞皮层(VOTC)的活动相比早期视觉模型有更好的一致性，支持了语言调节人类视觉感知的观点。然而，由于DNNs的“黑盒”特性，对这类比较结果的解释本质上受到限制。为解决这一问题，我们将模型-大脑拟合分析与人脑损伤数据相结合，研究破坏视觉和语言系统之间的通信通路如何因果性地影响视觉-语言DNNs解释VOTC活动的的能力。在四个不同的数据集中，CLIP在预测VOTC活动方面始终优于标签监督型(ResNet)和无监督型(MoCo)模型。这种优势在左侧偏侧化，与人类语言网络一致。对33名中风患者数据的分析显示，VOTC与左侧角回语言区域之间的白质完整性降低与CLIP性能下降和MoCo性能提高相关，表明语言处理对VOTC活动有动态影响。这些发现支持在人类视觉的神经认知模型中整合语言调节因素，强化了视觉-语言DNN模型的概念。模型-大脑相似性对特定脑损伤的敏感性表明，利用人脑操控是评估和开发类脑计算机模型的一个有前途的框架。

EXPERT BIOGRAPHIES

与会专家简介

CoRe 2025
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COGNITIVE SCALING
BRIDGING BRAINS AND MACHINES



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Yake Wei is a Ph.D. student at the Gaoling School of Artificial Intelligence, Renmin University of China, under the supervision of Professor Hu Di. Her main research during her doctoral studies focuses on multimodal learning mechanisms. She has published 8 academic papers in journals and conferences recommended by the China Computer Federation (CCF) as first author/student first author/co-first author, including 4 as first author. These publications include two papers in the top international journal T-PAMI and multiple papers in top international conferences such as ICML, CVPR, and ECCV. During her doctoral studies, she received the 2024 Baidu Scholarship (global selection, only 10 recipients) and the National Scholarship for Doctoral Students. In her research work, she first proposed the research direction of "Balanced Multimodal Learning" in an Oral paper at CVPR 2022, which has since become the main focus of her research exploration. She has conducted systematic research on this problem at multiple levels, including experimental observations, algorithms, and theory, resulting in a series of published papers.

卫雅珂，中国人民大学高瓴人工智能学院博士生，导师为胡迪老师。在博士期间的主要研究聚焦于多模态学习机制，以第一/学生第一/共一作者身份在中国计算机学会（CCF）推荐的期刊和会议上发表学术论文8篇，其中第一作者4篇。包括两篇国际顶级期刊T-PAMI论文和多篇国际顶级会议如ICML、CVPR、ECCV论文等。博士在读期间曾获2024年度百度奖学金（全球遴选，仅10人入选）、博士生国家奖学金等。在研究工作中，于CVPR 2022发表的Oral论文中于国际上首次提出“平衡多模态学习（Balanced Multimodal Learning）”这一研究方向，并以此为主线展开科研探索，于实验观察、算法及理论在内的多个层面上对该问题进行了系统性研究，发表了系列论文。

Balanced Multimodal Learning

平衡多模态学习

In general multimodal learning paradigms, different modal data typically use a unified multimodal learning objective for learning and optimization. However, the inherent heterogeneity of different modal data brings difficulties to joint multimodal learning. For example, in discriminative tasks, for audio-visual samples labeled "drawing picture," visual data with richer discriminative information is more easily learned and preferred by the model compared to audio data. This ultimately results in an imbalance in the model's utilization of data from different modalities, with only individual modalities being fully learned, hindering the potential of multimodal learning. Therefore, how to balance and promote the full exploitation and learning of heterogeneous multimodal data has attracted widespread attention in recent years. In this report, the speaker will summarize and organize related research on this problem and look forward to its potential development in a broader context.

在一般的多模态学习的范式中，不同模态数据通常采用统一的多模态学习目标进行学习和优化。但不同模态数据天然的异质性给多模态联合学习带来了困难。例如，在判别性任务中，对于标签为“drawing picture”的视听样本，相较音频数据，具有更丰富的判别性信息的视觉数据更容易被学习，被模型所偏好，最终使得使得模型对各个模态数据的利用程度存在不平衡，只有个别模态被充分学习，阻碍了多模态学习的潜力。因此，如何平衡并促进对异质多模态数据的充分挖掘与学习在近年来引起了广泛关注。在报告中，讲者将对这一问题相关研究进行总结与梳理，并展望该问题在更广泛背景下的潜在发展。

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Mingzhou Liu
刘鸣洲

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Mingzhou Liu is currently a Ph.D. student in Computer Science at Peking University, where he is advised by Prof. Yizhou Wang. Previously, he earned his bachelor's degree in Electrical Engineering from the Zhiyuan Honors Program at Shanghai Jiao Tong University. His research interests lie at the intersection of causality and machine learning, with a particular focus on developing theories for causal discovery and leveraging the insights gained to enhance the robustness of learning algorithms. He has published six papers on causality in prestigious conferences, including ICML, NeurIPS, and ICLR.

刘鸣洲目前是北京大学计算机科学系的博士生，师从王亦洲教授。他此前在上海交通大学致远荣誉计划电气工程专业获得学士学位。他的研究兴趣集中在因果性和机器学习的交叉领域，特别专注于开发因果发现理论并利用所获得的洞察来增强学习算法的鲁棒性。他已在包括ICML、NeurIPS和ICLR在内的顶级会议上发表了六篇关于因果性的论文。

Causal discovery from subsampled time series

从次采样时间序列中进行因果发现

Inferring causal structures from time series data is the central interest of many scientific inquiries. A major barrier to such inference is the problem of subsampling, i.e., the frequency of measurement is much lower than that of causal influence. To overcome this problem, numerous methods have been proposed, yet either was limited to the linear case or failed to achieve identifiability. In this talk, we will introduce a constraint-based algorithm that can identify the entire causal structure from subsampled time series, without any parametric constraint. Our observation is that the challenge of subsampling arises mainly from hidden variables at the unobserved time steps. Meanwhile, every hidden variable has an observed proxy, which is essentially itself at some observable time in the future, benefiting from the temporal structure. Based on these, we can leverage the proxies to remove the bias induced by the hidden variables and hence achieve identifiability. Following this intuition, we propose a proxy-based causal discovery algorithm. Our algorithm is nonparametric and can achieve full causal identification. Theoretical advantages are reflected in synthetic and real-world experiments.

从时间序列数据中推断因果结构是许多科学研究的核心关注点。进行此类推断的一个主要障碍是次采样问题，即测量频率远低于因果影响的频率。为了克服这个问题，已经提出了许多方法，但要么局限于线性情况，要么无法实现可识别性。在本次演讲中，我们将介绍一种基于约束的算法，该算法可以从次采样时间序列中识别整个因果结构，而无需任何参数约束。我们的观察是，次采样的挑战主要来自未观察时间步上的隐藏变量。同时，每个隐藏变量都有一个观察到的代理，这本质上是其在未来某个可观察时间的自身，受益于时间结构。基于这些，我们可以利用代理来消除隐藏变量引起的偏差，从而实现可识别性。遵循这一直觉，我们提出了一种基于代理的因果发现算法。我们的算法是非参数的，可以实现完全的因果识别。理论优势在合成和真实世界实验中得到了体现。

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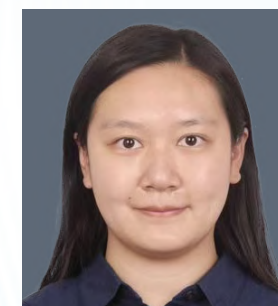
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The Institute for Artificial Intelligence, Peking University (PKU-IAI) was established on April 27, 2019, as an independent entity directly under the university. It serves as the primary platform for coordinating university-wide resources, building world-class AI disciplines, supporting major national AI strategies, and cultivating top-tier AI talent. It also provides crucial support for PKU's development strategy of "New Engineering, New Liberal Arts, and New Medical Sciences." The institute's founding director was Academician Huang Ru, former Vice President of Peking University, and the current director is Professor Song-Chun Zhu, a globally renowned scholar in the field of artificial intelligence. The institute currently has 18 full-time faculty members, including 1 chair professor, 11 assistant professors, 2 associate researchers, and 4 assistant researchers, along with over 160 joint-appointment faculty members. In response to disciplinary development requirements and major national strategic needs, the institute collaborates with 28 departments across the university and has established 4 research institutes and 18 "AI+ Interdisciplinary Research Centers." These support the university's "New Engineering, New Liberal Arts, and New Medical Sciences" initiatives, covering five major academic divisions: humanities, sciences, social sciences, engineering, and medicine. This has created China's most comprehensive interdisciplinary AI platform: 1. Institute for General Artificial Intelligence: Covering 9 core AI directions including computer vision, natural language processing, computational cognition and common-sense reasoning, multi-agent and social intelligence, embodied intelligence and robotics, machine learning and intelligent science theory, large models, big data intelligent systems, and general AI chips; 2. Institute for AI+ Humanities and Social Sciences: Including 4 interdisciplinary directions of AI security and governance, computational social science, digital humanities and civilization evolution, and AI art; 3. Institute for AI+ Medicine: Focusing on 4 research directions including smart public health, intelligent emergency medicine, smart healthcare and wellness, and AI digital life; 4. Institute for AI+ Sciences: Concentrating on 1 direction of intelligent habitable Earth. The institute has been

committed to promoting the development of AI disciplines at Peking University. In 2021, the institute collaborated with Yuanpei College to establish the Peking University General Artificial Intelligence Experimental Class (known as "PKU Tong Class"). Led by PKU Chair Professor and AI Institute Director Song-Chun Zhu, the program aims to cultivate world-class interdisciplinary talents with "general knowledge, general intelligence, and general capabilities." To date, it has enrolled five cohorts totaling 175 undergraduate students, becoming a flagship in PKU's college entrance examination recruitment. In June 2024, the institute, together with Yuanpei College, launched an AI minor degree program, admitting 25 dual-degree students in its first cohort. For doctoral education, the institute has worked with various research centers to develop a comprehensive AI interdisciplinary graduate training program that includes curriculum systems, implementation mechanisms, and evaluation processes. This has formed a new "AI+X" joint supervisor mechanism and graduate course system, with five cohorts totaling 96 interdisciplinary doctoral students currently enrolled, who are recruited and trained through various departments including the School of Intelligence, School of Computer Science, School of Integrated Circuits, Law School, Department of Information Management, and School of Psychological and Cognitive Sciences.

北京大学人工智能研究院于2019年4月27日宣布成立，作为学校直属的独立实体机构，是统筹全校相关资源、建设世界一流智能学科、服务国家人工智能重大战略、培养智能学科一流人才的主要支撑平台，是支持北大“新工科、新文科、新医科”发展战略的重要支撑平台。研究院首任院长为北京大学原副校长黄如院士，现任院长为人工智能领域全球著名学者朱松纯教授。现有全职教师18位，其中讲席教授1位，助理教授11位，副研究员2位，助理研究员4位。双聘教师160余位。研究院响应学科发展要求和国家重大战略需求，联合校内28个院系，设立4个研究所和18个“AI+交叉研究中心”，服务学校“新工科、新文科、新医科”建设，覆盖文、理、社、工、医五大学部，初步建成国内学科门类最全的人工智能学科交叉平台：1. 通用人工智能研究所：包含计算机视觉、自然语言处理、计算认知与常识推理、多智能体与社会智能、具身智能与机器人、机器学习与智能科学理论、大模型、大数据智能系统、通用人工智能芯片 9个人工智能核心方向；2. AI+人文社科研究所：包括人工智能安全与治理、计算社会科学、数字人文与文明演化、人工智能艺术4个人工智能与人文社科交叉方向；3. AI+医学研究所：包括智慧公众健康、智能应急医疗、智慧医疗与康养、人工智能数字生命 4个研究方向；4. AI+理学研究所：包括智慧宜居地球1个方向。

研究院一直致力推动北京大学人工智能学科建设和发展。2021年研究院联合元培学院设立北京大学通用人工智能实验班（简称“北大通班”）。北大通班由北京大学讲席教授、人工智能研究院院长朱松纯领衔，旨在培养“通识、通智、通用”的世界顶尖复合型人才，迄今已招收五届共175名本科生，成为北大高考招生的一面旗帜。2024年6月，研究院联合元培学院启动人工智能辅修双学位，首届招收25名双学位学生。在博士生培养方面，研究院联合各研究中心，建设了一套包括课程体系、实施机制、评审等在内的可落地的人工智能交叉研究生培养方案，形成了全新的“人工智能+X”双聘导师机制及研究生课程体系，迄今共有五届96名在读交叉博士研究生，分别依托智能学院、计算机学院、集成电路学院、法学院、信息管理系、心理与认知科学学院等院系招生和培养。

ORGANIZERS

联合承办单位

School of Psychological and Cognitive Sciences, Peking University

北京大学心理与认知科学学院

The School of Psychological and Cognitive Sciences at Peking University, China's birthplace and leading institution for psychology, is a first level doctoral degree granting unit with a professional master's program in applied psychology. Its basic psychology program is a key discipline of the Ministry of Education, a Beijing municipal characteristic specialty and a first level key discipline. The School was selected as one of the first class undergraduate programs by the Ministry of Education, approved as a national base for basic science research and teaching talent cultivation and included in the 2.0 Base Program for Top Students in Basic Disciplines. As the first psychology discipline in mainland China to enter the top 1 percent of ESI world rankings, the School has received the highest rating in the Ministry of Education's discipline assessment twice, been named to the Double First Class construction list and in 2024 ranked 35th globally in the QS World University Rankings and 22nd in THE Rankings, leading all mainland China institutions. The School comprises four departments, Brain and Cognitive Sciences, Managerial and Social Psychology, Clinical and Health Psychology and Developmental and Educational Psychology, organized around two major research directions, brain neuroscience and psychological health. It serves as the affiliated unit of the McGovern Institute for Brain Research, the supporting unit of the Beijing Key Laboratory of Psychology and Behavioral Health and the chair and secretariat host of both the National Applied Psychology Professional Degree Graduate Education Steering Committee and the Ministry of Education's Psychology Specialty Teaching Steering Committee.

In faculty strength, the School has attracted world class scholars including seven Changjiang Distinguished Professors, four recipients of the National Science Fund for Distinguished Young Scholars and 16 Four Youths honor recipients. Seven faculty members have been elected Fellows of the Association for Psychological Science or Rising Stars of the American Psychological Association; four are named Elsevier Highly Cited Researchers in China; and nine serve as researchers at the PKU Tsinghua Center for Life Sciences and the PKU Institute for Artificial Intelligence, making important contributions to interdisciplinary scholarship. As of the end of 2024, the School has 53 research staff, including 12 professors, 22 researchers, 14 associate professors/associate researchers, and 6 lecturers/assistant researchers. In the past five years, the School has published over 250 representative academic papers, received over 150 million yuan in vertical funding and nearly 30 million yuan in horizontal funding, and been awarded more than 10 major fund projects such as the National Natural Science Foundation's Innovation Research Group Project, and the 2030 Major Projects for Science and Technology Innovation. In terms of industrial transformation, the School conducts applied research in engineering psychology, clinical counseling psychology, developmental psychology, and management psychology, serving fields such as aerospace engineering, brain computer interface technology, health behavior correction, and mental health education for primary and secondary school students, advancing both individual well being and social harmony.

北京大学心理与认知科学学院作为中国心理学的发源地和领军机构，是一级学科博士学位授予权单位，拥有应用心理专业学位硕士授权点，其基础心理学是教育部重点学科、北京市特色专业和一级重点学科。学院入选教育部首批国家级一流本科专业建设点，获批国家理科基础科学研究和教学人才培养基地，入选基础学科拔尖学生培养计划2.0基地。作为大陆地区首个进入ESI世界排名前1%的心理学科，学院连续两次在教育部学科评估中获最高等级，入选“双一流”建设名单，2024年在QS和THE世界大学排名中分别位居全球第35位和第22位，居中国大陆首位。学院设有脑与认知科学、管理与社会心理学、发展与教育心理学、临床与健康心理学四个系，确立了脑神经基础科学与心理大健康研究两大方向，是麦戈文脑科学研究所挂靠单位，心理与行为健康北京市重点实验室依托单位，以及全国应用心理专业学位研究生教育指导委员会与教育部高等学校心理学类专业教学指导委员会的主任委员单位和秘书处挂靠单位。师资方面，学院汇集了包括7位长江学者特聘教授、4位国家杰出青年基金获得者、16人次“四青”荣誉获得者在内的国际一流学者，7位教师当选美国心理科学学会会士或美国心理科学协会学术新星，4人为爱思维尔中国高被引学者，9名教师在北大-清华生命科学联合中心和北大人工智能研究院担任研究员，为交叉学科建设做出重要贡献。截至2024年底，学院共有53名科研人员，包括12名教授、22名研究员、14名副教授/副研究员、6名讲师/助理研究员。近五年，学院发表代表性学术论文250余篇，获得纵向经费超1.5亿元，横向经费近3000万元，获批国家自然科学基金创新研究群体项目、重点项目、科技创新2030重大项目等10余项重大基金项目。在产业转化方面，学院围绕工程心理学、临床咨询心理学、发展心理学与管理心理学领域开展应用研究，服务于航天工程、脑机接口技术转化、健康行为矫正和中小学生心理健康教育等多个领域，致力于促进个人健康与社会和谐发展。

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BRIDGING BRAINS AND MACHINES

State Key Laboratory of General Artificial Intelligence 跨媒体通用人工智能全国重点实验室

得者3人、国家级青年人才2人，海外优青6人。实验室成员先后3次获得国际计算机视觉领域最高奖马尔奖和马尔奖荣誉提名，以及国际计算机视觉大会亥姆霍兹奖、国际认知科学学会计算建模奖、国际模式识别学会阿加沃尔奖、国际人工智能联合会议杰出论文奖等多个学术最高奖项，建立了较高的国际学术地位和影响力。此外，实验室搭建“清华北大通班-北京通院”人才成长通道，为国家培育通用人工智能内生力量。并在本科生培养的基础上，实验室支持教育部“通用人工智能协同攻关合作体”人才培养计划（“通计划”），联合14所国内顶尖高校培养博士人才，为我国在通用人工智能领域培养优秀科技人才。成立以来，实验室发表代表性学术论文200余篇，获得纵向经费超2.5亿元，横向经费近2亿元，获批国家自然科学基金重大研究计划项目、科技创新2030重大项目、联合基金项目等多项重大基金项目。在产业转化方面，实验室持续开展通用人工智能成果转化工作，借助联合实验室进一步赋能产业落地，与央国企（如中国铁塔）、创新企业（如乐聚机器人、宇树机器人）等展开进一步合作，服务于汽车、民航、医疗等多个领域，致力于将通用人工智能推广到社会生产和生活的各行各业中。

The State Key Laboratory of Multimodal General Artificial Intelligence, established in 2022 by China's Ministry of Science and Technology and jointly built by the Beijing Institute of General Artificial Intelligence and Peking University, is the only state key laboratory focused on general artificial intelligence. Guided by the philosophy of "establishing a heart for machines and endowing humanities with reason" and implementing a "small data, big tasks" paradigm, the laboratory has produced pioneering achievements in multimodal perception, cognitive architecture, knowledge representation, embodied intelligence, and general AI systems. Led by Professor Song-Chun Zhu, it has 315 members including distinguished scholars who have received prestigious international awards such as the Marr Prize. Since its founding, the laboratory has published over 200 academic papers, secured more than 250 million yuan in national funding and nearly 200 million yuan in corporation funding, and actively transfers its technological achievements to various industries including automotive, aviation, and healthcare through collaborations with enterprises.

跨媒体通用人工智能全国重点实验室是2022年国家科技部批准成立，依托北京通用人工智能研究院与北京大学共同建设，是唯一一家聚焦通用人工智能的全国重点实验室。实验室立足国家重大需求和国民经济主战场，以“为机器立心、为人文赋理”的理念，践行“小数据、大任务”的技术新范式，实现具备类人核心能力的通用智能体。实验室成立以来，在跨媒体感知与计算，认知架构与常识推理，统一的知识表达与学习，具身智能与多智能体，因果与价值驱动的通用智能体原型，通用人工智能平台与系统等方面产出了一系列原创引领性的科技成果。师资方面，实验室由朱松纯教授领衔、成建制国际一流人工智能研究团队为核心，现有固定成员315人，其中长江学者3人、国家高层次领军人才1人、国家杰出青年基金获

