Akshay K. Jagadish

Ph.D. Student in Computer Science

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Education

Ph.D. in Computer Science — *Tübingen, Germany*
University of Tübingen · Max Planck Institute for Biological Cybernetics · Helmholtz Munich — *2021 - ongoing*
Thesis: Meta-learned Models of Cognition

M.Sc. in Computational Neuroscience — *Tübingen, Germany*
University of Tübingen · Max Planck Institute for Biological Cybernetics — *2018 - 2020*
Thesis: Compositional Reinforcement Learning in Minds and Machines

B.Tech. in Electrical and Electronics Engineering — *Surathkal, India*
National Institute of Technology Karnataka · Ecole Polytechnique Federale de Lausanne — *2013 - 2017*
Thesis: Structural and Functional Correlates of Personality in Healthy Ageing and Mild Cognitively Impaired

Research Experience

Ph.D. Thesis — *Tübingen, Germany*
University of Tübingen · Max Planck Institute for Biological Cybernetics · Helmholtz Munich — *Apr. 2021 - ongoing*
Computational Principles of Intelligence Lab · Advisors: Dr. Marcel Binz and Prof. Eric Schulz

Human Cognition
· Proposed a new framework for building computational cognitive models termed as 'Meta-learned models of cognition" [PDF].
· Demonstrated that resource rational meta-learned inference explains zero-shot compositional reasoning in humans [PDF].
· Illustrated that ecologically rational meta-learned inference explains human category learning [PDF].
· Showed that humans and large-language models display symmetric belief updating [PDF].
· Developed bounded ecologically rational meta-learned inference to explore the role of bouded resources and ecological priors in human learning [In Preparation].
. Contributed towards building the first foundation model of human cognition [PDF].
· Automating congnitive modelling with large language models [In Preparation].

Machine Cognition
· Illustrated that Inducing anxiety in large language models increases exploration and bias [PDF].
· Demonstrated that narrative of traumatic experiences increases state anxiety in large language models, but using mindfulness-based techniques can help alleviate the same [PDF].
· Used sparse autoencoders to reveal temporal difference learning in large language mdels [PDF].

Graduate Research Assistant — *Tübingen, Germany*
University of Tübingen — *Nov. 2018 - Mar. 2021*
Sinz Lab · Advisors: Prof. Fabian Sinz and Prof. Edgar Walker

· Built a factor analysis model on top of a convolutional neural network, which predicts stimulus-based neural activity, to recover non-stimulus-related latent brain states [PDF].
· Developed a novel parameter-efficient readout, called a Gaussian readout, that maps nonlinear features learned by the deep convolutional network to the response of each neuron [PDF].

Graduate Research Assistant — *Tübingen, Germany*
Max Planck Institute for Biological Cybernetics — *Nov. 2019 - Feb. 2020*
Computational Neuroscience Lab · Advisor: Prof. Peter Dayan

· Conducted a literature review on the role of Dopamine in reward-based learning [PDF].
· Analyzed behavior (choices and reaction times) of monkeys, whose dopamine receptors were pharmacologically stimulated, during a rule-based categorization task [PDF].

AI Researcher — *Mumbai, India*
Wadhwani Institute for Artificial Intelligence — *May 2018 - Sep. 2018*
AI for Social Impact · Advisor: Dr. Rahul Panicker

· Developed a model based on deep-learning that predicts weight of an object from its images [NDA].

Postbaccalaureate Research Assistant *Minnesota, USA*

University of Minnesota, Twin-cities *Jul. 2017 - Feb. 2018*

Computational Visual Neuroscience Lab · Advisor: Prof. Kendrick Kay

· Developed a generative model that factors in the bottom-up, stimulus-driven, and top-down, goal-driven attentional state to characterize cortical fMRI responses for various stimuli and attentional loci combinations.

Undergraduate Thesis *Lausanne, Switzerland*

Ecole Polytechnique Federale de Lausanne *Aug. 2016 - May 2017*

Medical Image Processing Lab · Advisors: Prof. D. van de Ville and Prof. P. Giannakopoulos

· Investigated the relationship between structural and functional connectivity measures derived from MRI, and Neuroticism Extroversion Openness Personality Inventory-Revised (NEOPI) personality traits [PDF].

Undergraduate Research Assistant *Bangalore, India*

Indian Institute of Science *May 2015 - May 2017*

Computational Tomography Lab · Advisor: Prof. Kasi Rajgopal

· Developed an algorithm, called k-ABC, based on the artificial bee colony algorithm to come up with an optimal variable density sampling scheme for the compressed sensing-based reconstruction of Magnetic Resonance (MR) images [PDF].

Selected Publications

* equal contribution, # alphabetical ordering

Rmus, M., **Jagadish, A. K.**, Mathony, M., Schulz, E. (2025). Using large language models for building cognitive models . *In Preparation.*

Jagadish, A. K., Binz, M. Schulz, E. (2025). Bounded ecologically rational meta-learned inference. *In Preparation.*

Binz, M., ..., **Jagadish, A. K.**#,..., Schulz, E. (2024). Building a foundation model of human cognition. *Under Review at Nature* [PDF]

Demirican, C.*, Saanum, T.*, **Jagadish, A. K.**, Binz, M., Schulz, E. (2024). Sparse Autoencoders Reveal Temporal Difference Learning in Large Language Models. *Under Review* [PDF]

Jagadish, A. K., Thalmann, M., Coda-Forno, J., Schulz, E., Binz, M. (2024). Human-like Category Learning by Injecting Ecological Priors from Large Language Models into Neural Networks. *Proceedings of the 41st International Conference on Machine Learning (ICML)* [PDF]

Schubert, J., **Jagadish, A. K.**, Binz, M., Schulz, E. (2024). In-context learning agents are asymmetric belief updaters. *Proceedings of the 41st International Conference on Machine Learning (ICML)* [PDF]

Jagadish, A. K., Binz, M., Saanum, T., Wang, J. X., Schulz, E. (2024). Zero-shot compositional reasoning in a reinforcement learning setting. *Under review* [PDF]

Ben-Zion, Z., Witte, K.*, **Jagadish, A. K.***, Duek, O., Harpaz-Rotem, I., Khorsandian, M., ... Spiller, T. R. (2024). "Chat-GPT on the Couch": Assessing and Alleviating State Anxiety in Large Language Models. *Under review at npj Digital Medicine* [PDF]

Coda-Forno, J.*, Witte, K.*, **Jagadish, A. K.***„ Binz, M., Akata, Z., Schulz, E. (2023). Inducing anxiety in large language models increases exploration and bias. *Under review at Nature Communications* [PDF];

Binz, M., Dasgupta, I., **Jagadish, A. K.**, Botvinick, M., Wang, J.X., Schulz, E. (2023). Meta-learned models of cognition. *Behavioral and Brain Sciences, 1-38.* [PDF]

Schubert, J., **Jagadish, A. K.**, Binz, M., Schulz, E. (2023). A Rational Analysis of Optimism Bias using Meta-Reinforcement Learning. *In Conference on Cognitive Computational Neuroscience (CCN) (pp. 557-559).* [PDF]

Jagadish, A. K., Saanum, T., Wang, J. X., Binz, M., Schulz, E. (2022). Probing Compositional Inference in Natural and Artificial Agents. *In 5th Multidisciplinary Conference on Reinforcement Learning and Decision Making (RLDM) (pp. 275-279).*

Bashiri, M.*, Walker, E.*, Lurz, K. K., **Jagadish, A. K.**, Muhammad, T., Ding, Z., ... Sinz, F. (2021). A flow-based latent state generative model of neural population responses to natural images. *In Advances in Neural Information Processing Systems (NeurIPS)*, 34, 15801-15815. [PDF]

Lurz, K. K., Bashiri, M., Willeke, K. F., **Jagadish, A. K.**, Wang, E., Walker, E. Y., ... Sinz, F. (2021). Generalization in data-driven models of primary visual cortex. *In International Conference on Learning Representations (ICLR)* [PDF]

Rodriguez, C.*, **Jagadish, A. K.***, Meskaldji, D. E., Haller, S., Herrmann, F., Van De Ville, D., Giannakopoulos, P. (2019). Structural correlates of personality dimensions in healthy aging and MCI. *Frontiers in psychology, 9, 2652.* [PDF]

Honors, Awards, & Fellowships

2024 **Top Reviewer**, Top 10 % reviewer (main track) for conference on Neural Information Processing Systems (NeurIPS) — *Canada*

2024 **ELLIS Winter School on Foundation Models**, Top 40 students selected from 607 to present their research — *Netherlands*

2023 **Analytical Connectionism**, Top 35 students selected to attend the summer course at the Gatsby Computational Neuroscience Unit in University College London — *UK*

2020 **SMARTSTART Fellowship in Computational Neuroscience**, Top 15 students awarded a travel budget of 1000 euros and mentorship from Prof. Peter Dayan and Prof. Fabian Sinz — *Germany*

2019 **Dean's List**, Top 3 performers in the summer semester for M.Sc. program in Computational Neuroscience — *Germany*

2018 **Dean's List**, Top 3 performers in the winter semester for M.Sc. program in Computational Neuroscience — *Germany*

2018 **Max Planck Society Scholarship**, Top 5 students selected to undertake M.Sc in Computational Neuroscience at the University of Tübingen — *Germany*

2017 **Harvard Young Scientist Development Program**, Top 25 students selected for training in neuroscience — *USA | India*

2016 **Summer Research Program**, Top 20 students funded to conduct research at EPFL — *Switzerland*

2016 **Summer Research Fellowship Program**, Top 10 % students funded to conduct research at the Indian Institute of Science — *India*

2013 **Ranked Top 0.1%**, Karnataka Common Entrance Test among 150,000 students — *India*

2013 **Ranked Top 0.1%**, COMED-K among 200,000 students — *India*

2011 **Most Consistent Performer of the Batch**, High school at Presidency School — *India*

Invited talks

2024 **Annual Meeting of the Cognitive Science Society (CogSci)**, Workshop on "In-context learning in natural and artificial intelligence" — *Netherlands*

2024 **Annual Meeting of the Cognitive Science Society (CogSci)**, Workshop on "Compositionality in minds, brains and machines: A unifying goal that cuts across cognitive sciences" — *Netherlands*

2024 **Indian Institute of Science**, Seminar talk at the Center for Neuroscience — *India*

2024 **Princeton University**, Lab meeting at Computational Cognitive Science Lab — *USA*

2023 **Helmholtz Center in Münich**, Joint lab retreat with Explainable Machine Learning Lab — *Germany*

2023 **University of Oxford**, Lab meeting at the Human Information Processing Lab — *United Kingdom*

2022 **Max Planck Institute for Human Cognitive and Brain Sciences**, Joint lab retreat with Doeller Lab — *Germany*

2021 **Stanford University**, Joint lab retreat with Human Information Processing and Causality in Cognition Lab — *USA*

2019 **University of Tübingen**, Workshop on "Causality in Neuroscience" at Neuroscience Conference for Young Scientists — *Germany*

Organization

2024 **Co-organizer**, "Connecting Minds and Machines a Foundation Model Approach to Learning" symposium at Helmholtz Pioneer Campus, Munich — *Germany*

2024 **Co-organizer**, "In-context learning in natural and artificial intelligence" workshop at CogSci-2024 — *Netherlands*

2023 **Co-organizer**, Laboratory Retreat of Computational Principles of Intelligence Lab — *Germany*

2022 **Co-organizer**, Computation and Cognitive Tübingen Summer School (CaCTüS) aimed specifically at young scientists held back by personal, financial, regional or societal constraints. — *Germany*

2019 **Co-organizer**, "Causality in Neuroscience" Workshop at Neuroscience Conference for Young Scientists — *Germany*

2020 **Volunteer**, Machine Learning Summer School (MLSS) held at MPI for Intelligent Systems, Tübingen — *Germany*

Supervision

2024 **Co-supervisor (Research Assistant)**, Elif Kara on "Human decision-making in the wild" at the University of Münich — *Germany*

2023 **Co-supervisor (Master Thesis)**, Johannes Schubert on "Rational Analysis of Optimism Bias" at the University of Tübingen. Converted to a publication at the *International Conference on Machine Learning (ICML)* [PDF] — *Germany*

Teaching

2023 **Teaching Assistant**, "Computational Cognitive Science" course at the Graduate Training Center for Neuroscience, University of Tübingen *Germany*

2022 **Tutor**, Tutorial on "Meta-Reinforcement Learning" at the Max Planck Institute for Biological Cybernetics *Germany*

Service

2024- **Reviewer**, Neural Information Processing Systems (NeurIPS) *AoE*

2023- **Reviewer**, International Conference on Learning Representations (ICLR) *AoE*

2022- **Reviewer**, Annual Meeting of the Cognitive Science Society (CogSci) *AoE*

2023- **Reviewer**, Cognitive Computational Neuroscience (CCN) *AoE*