

# Akshay K. Jagadish

Ph.D. Student in Computer Science

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## Education

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### Ph.D. in Computer Science

University of Tübingen · Max Planck Institute for Biological Cybernetics · Helmholtz Munich  
Thesis: Meta-learned Models of Cognition

Tübingen, Germany

2021 - ongoing

### M.Sc. in Computational Neuroscience

University of Tübingen · Max Planck Institute for Biological Cybernetics  
Thesis: Compositional Reinforcement Learning in Minds and Machines

Tübingen, Germany

2018 - 2020

### B.Tech. in Electrical and Electronics Engineering

National Institute of Technology Karnataka · Ecole Polytechnique Federale de Lausanne  
Thesis: Structural and Functional Correlates of Personality in Healthy Ageing and Mild Cognitively Impaired

Surathkal, India

2013 - 2017

## Research Experience

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### Ph.D. Thesis

University of Tübingen · Max Planck Institute for Biological Cybernetics · Helmholtz Munich  
Computational Principles of Intelligence Lab · Advisors: Dr. Marcel Binz and Prof. Eric Schulz

Tübingen, Germany

Apr. 2021 - ongoing

#### 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 rational agents derived using meta-reinforcement learning explain asymmetric belief updating in humans and large-language models [PDF].
- Developed bounded ecologically rational meta-learned inference to explore the role of limited computational resources and ecological priors in function learning, decision making, and category learning [In Preparation].
- Helped build a foundation model of human cognition [Coming soon].

#### 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 models [In Preparation].

### Graduate Research Assistant

University of Tübingen  
Sinz Lab · Advisors: Prof. Fabian Sinz and Prof. Edgar Walker

Tübingen, Germany

Nov. 2018 - Mar. 2021

- 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

Max Planck Institute for Biological Cybernetics  
Computational Neuroscience Lab · Advisor: Prof. Peter Dayan

Tübingen, Germany

Nov. 2019 - Feb. 2020

- 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

Wadhvani Institute for Artificial Intelligence  
AI for Social Impact · Advisor: Dr. Rahul Panicker

Mumbai, India

May 2018 - Sep. 2018

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

## Postbaccalaureate Research Assistant

University of Minnesota, Twin-cities  
Computational Visual Neuroscience Lab · Advisor: Prof. Kendrick Kay

Minnesota, USA  
Jul. 2017 - Feb. 2018

· 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

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

Lausanne, Switzerland  
Aug. 2016 - May 2017

· 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

Indian Institute of Science  
Computational Tomography Lab · Advisor: Prof. Kasi Rajgopal

Bangalore, India  
May 2015 - May 2017

· 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].

## Publications

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\* equal contribution, # alphabetical ordering

**Jagadish, A. K.**, Binz, M., Schulz, E. (2024). 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* [Coming soon]

Demircan, 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]

Annadani, Y., Naganoor, V., **Jagadish, A. K.**, Chemmangat, K. (2016). Selfie detection by synergy-constraint based convolutional neural network. *In 2016 12th International Conference on Signal-Image Technology Internet-Based Systems (SITIS)* (pp. 335-342). *IEEE*.

**Jagadish, A. K.**, Goswami, S., Saha, P., Chakrabarty, S., Rajgopal, K. (2016). Artificial Bee Colony (ABC) based variable density sampling scheme for CS-MRI. In 2016 *IEEE Region 10 Conference (TENCON)* (pp. 1254-1257). IEEE. [PDF]

## Honors, Awards, & Fellowships

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2024	<b>ELLIS Winter School on Foundation Models</b> , Top 40 students selected from 607 to present their research	Netherlands
2023	<b>Analytical Connectionism</b> , Top 35 students selected to attend the summer course at the Gatsby Computational Neuroscience Unit in University College London	UK
2020	<b>SMARTSTART Fellowship in Computational Neuroscience</b> , Top 15 students awarded a travel budget of 1000 euros and mentorship from Prof. Peter Dayan and Prof. Fabian Sinz	Germany
2019	<b>Dean's List</b> , Top 3 performers in the summer semester for M.Sc. program in Computational Neuroscience	Germany
2018	<b>Dean's List</b> , Top 3 performers in the winter semester for M.Sc. program in Computational Neuroscience	Germany
2018	<b>Max Planck Society Scholarship</b> , Top 5 students selected to undertake M.Sc in Computational Neuroscience at the University of Tübingen	Germany
2017	<b>Harvard Young Scientist Development Program</b> , Top 25 students selected for training in neuroscience	USA   India
2016	<b>Summer Research Program</b> , Top 20 students funded to conduct research at EPFL	Switzerland
2016	<b>Summer Research Fellowship Program</b> , Top 10 % students funded to conduct research at the Indian Institute of Science	India
2013	<b>Ranked Top 0.1%</b> , Karnataka Common Entrance Test among 150,000 students	India
2013	<b>Ranked Top 0.1%</b> , COMED-K among 200,000 students	India
2011	<b>Most Consistent Performer of the Batch</b> , High school at Presidency School	India

## Invited talks

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2024	<b>Annual Meeting of the Cognitive Science Society (CogSci)</b> , Workshop on “In-context learning in natural and artificial intelligence”	Netherlands
2024	<b>Annual Meeting of the Cognitive Science Society (CogSci)</b> , Workshop on “Compositionality in minds, brains and machines: A unifying goal that cuts across cognitive sciences”	Netherlands
2024	<b>Indian Institute of Science</b> , Seminar talk at the Center for Neuroscience	India
2024	<b>Princeton University</b> , Lab meeting at Computational Cognitive Science Lab	USA
2023	<b>Helmholtz Center in Munich</b> , Joint lab retreat with Explainable Machine Learning Lab	Germany
2023	<b>University of Oxford</b> , Lab meeting at the Human Information Processing Lab	United Kingdom
2022	<b>Max Planck Institute for Human Cognitive and Brain Sciences</b> , Joint lab retreat with Doeller Lab	Germany
2021	<b>Stanford University</b> , Joint lab retreat with Human Information Processing and Causality in Cognition Lab	USA
2019	<b>University of Tübingen</b> , Workshop on “Causality in Neuroscience” at Neuroscience Conference for Young Scientists	Germany

## Organization

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2024	<b>Co-organizer</b> , “Connecting Minds and Machines a Foundation Model Approach to Learning” symposium at Helmholtz Pioneer Campus, Munich	Germany
2024	<b>Co-organizer</b> , “In-context learning in natural and artificial intelligence” workshop at CogSci-2024	Netherlands
2023	<b>Co-organizer</b> , Laboratory Retreat of Computational Principles of Intelligence Lab	Germany
2022	<b>Co-organizer</b> , Computation and Cognitive Tübingen Summer School (CaCTüS) aimed specifically at young scientists held back by personal, financial, regional or societal constraints.	Germany
2019	<b>Co-organizer</b> , “Causality in Neuroscience” Workshop at Neuroscience Conference for Young Scientists	Germany
2020	<b>Volunteer</b> , Machine Learning Summer School (MLSS) held at MPI for Intelligent Systems, Tübingen	Germany

## Supervision

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2024	<b>Co-supervisor (Master Thesis)</b> , Elif Kara on “Human decision-making in the wild” at the University of Munich	Germany
2023	<b>Co-supervisor (Master Thesis)</b> , Johannes Schubert on “Rational Analysis of Optimism Bias” at the University of Tübingen. Converted to a publication at the <i>International Conference on Machine Learning (ICML)</i> [PDF]	Germany

## Teaching

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- 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

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- 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*