SUSHRUT THORAT

CONTACT INFORMATION

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GOAL

Understanding and building resource-constrained agents that can learn and function in the wild

RESEARCH AREAS

Recurrent computations, lifelong learning, explainable AI, neural representations of scenes

ACADEMIC TRAJECTORY

Postdoc in Machine Learning *Ongoing*
Institute of Cognitive Science, Osnabrück University, Germany
Advisor: Tim Kietzmann

Ph.D. in Cognitive Neuroscience *November, 2022*
Donders Centre for Cognition, Radboud University, The Netherlands
Thesis: Smart Search - Investigations into human visual search in structured environments
Advisors: Marius Peelen and Marcel van Gerven

M.Sc. (cum laude) in Cognitive Neuroscience *July, 2017*
Center for Mind/Brain Sciences (CIMeC), University of Trento, Italy
Thesis: Using Convolutional Neural Networks to measure the contribution of visual features to the representation of object animacy in the brain
Advisor: Marius Peelen

B.Tech. in Engineering Physics *August, 2015*
Department of Physics, Indian Institute of Technology - Bombay (IIT-B), India
Thesis: Quadcopter Flight Control using Modular Spiking Neural Networks
Advisor: Bipin Rajendran

PRE-PUB PAPERS

Thorat S, Doerig A, Kietzmann TC (2023). Characterising representation dynamics in recurrent neural networks for object recognition. *CCN 2023* (submitted).

Anthes D, Thorat S, Konig P, Kietzmann TC (2023). Diagnosing catastrophe: Large parts of accuracy loss in continual learning can be accounted for by readout misalignment. *CCN 2023* (submitted).

Gayet S, Battistoni E, Thorat S, Peelen MV (2023). Searching near and far: the attentional template incorporates viewing distance. *PsyArXiv*.

Yeh LC, Thorat S, Peelen MV (2023). Spatiotemporal associations between neural representational similarity and visual task performance. (in prep).

PEER-REVIEWED PUBLICATIONS

Thorat S, Quek GL, Peelen MV (2022). Statistical learning of distractor co-occurrences facilitates visual search. *Journal of Vision* 22(10):2.

Thorat S, Peelen MV (2022). Body shape as a visual feature: evidence from spatially-global attentional modulation in human visual cortex. *NeuroImage*: 119207.

Thorat S*, Aldegheri G*, Kietzmann TC (2021). Category-orthogonal object features guide information processing in recurrent neural networks trained for object categorization. *Shared Visual Representations in Human & Machine Intelligence Workshop @ NeurIPS*. *equal contribution.

Thorat S, Proklova D, Peelen MV (2019). The nature of the animacy organization in human ventral temporal cortex. *eLife* 8: e47142.

Thorat S*, Aldegheri G*, van Gerven MAJ, Peelen MV (2019). Modulation of early visual processing alleviates capacity limits in solving multiple tasks. *Conference on Cognitive Computational Neuroscience (CCN)*: 226-229. *equal contribution.

Thorat S, van Gerven MAJ, Peelen MV (2018). The functional role of cue-driven feature-based feedback in object recognition. *Conference on Cognitive Computational Neuroscience (CCN)*.

Thorat S, Choudhari V (2016). Implementing a Reverse Dictionary, based on word definitions, using a Node-Graph Architecture. *Proceedings of COLING 2016, the 26th International Conference on Computational Linguistics: Technical Papers*: 2797-2806.

Thorat S, Rajendran B (2015). Arithmetic computing via rate coding in neural circuits with spike-triggered adaptive synapses. *International Joint Conference on Neural Networks (IJCNN)*.

ACHIEVEMENTS/ AWARDS

- Voted **best poster/short-pitch**, among **15 posters**, in the 'Perception, Action, and Control' theme at the annual Donders Poster Session (2020).
- Recipient of the **Merit Award** (2017), awarded to students who achieve remarkable results at the end of their degree, by the University of Trento, Italy.
- Recipient of the **Abstract Award**, awarded to **5 of the 57** accepted abstracts at the Rovereto Workshop on Concepts, Actions and Objects (2017).
- Ranked **721 among 450,000** students in the Joint Entrance Examination **(JEE, 2011)** conducted towards admission to the Indian Institute of Technology (IIT).
- Recipient of the **KVPY scholarship** (2009), awarded to **215 students across India** with talent and aptitude for research, by the Dept. of Science & Technology, Govt. of India.
- Recipient of the **NTSE scholarship** (2007), awarded to **1000 students across India** with high intellect and academic talent, by the National Centre for Educational Research and Technology, Govt. of India.

TECHNICAL PROFICIENCY

Programming languages: Python, MATLAB, Javascript

Machine learning frameworks: TensorFlow, PyTorch, MatConvNet

Experimentation frameworks: PsychToolbox, jsPsych, Pavlovia

Neuro-imaging: fMRI (data acquisition and analysis), EEG (data analysis)

CONFERENCE TALKS/POSTERS

Category-orthogonal object features guide information processing in recurrent neural networks trained for object categorization
(Talk) *European Conference on Vision Perception (ECVP)*, Nijmegen, 2022
(Poster) *SVRHM @ NeurIPS*, Online, 2021
(Flash talk) *neuromatch 4.0*, Online, 2021
(Poster) *Champalimaud Research Symposium*, Online, 2021

Statistical learning of distractor regularities facilitates visual search
(Poster) *European Conference on Vision Perception (ECVP)*, Online, 2021

Body silhouettes as features in visual search: evidence from spatially-global attention modulation in visual cortex
(Poster) *Donders Poster Session*, Nijmegen, 2020
(Talk) *Neuromatch conference 3.0*, Online, 2020

The nature of the animacy organization in human ventral temporal cortex
(Poster) *Conference on Cognitive Computational Neuroscience (CCN)*, Berlin, 2019

Modulation of early visual processing alleviates capacity limits in solving multiple tasks
(Poster) *Conference on Cognitive Computational Neuroscience (CCN)*, Berlin, 2019

The functional role of cue-driven feature-based feedback in object recognition
(Talk) *Perception Day*, Nijmegen, 2018
(Poster) *Donders Discussions*, Nijmegen, 2018
([Poster](#)) *Conference on Cognitive Computational Neuroscience (CCN)*, Philadelphia, 2018

Using convolutional neural networks to measure the contribution of visual features to the representation of object animacy in the brain
(Poster) *Donders Discussions*, Nijmegen, 2017
([Talk](#) & Poster) *Rovereto Workshop on Concepts, Actions and Objects (CAOs)*, Rovereto, 2017
([Tweets](#)) *Brain Twitter Conference (brainTC)*, 2017

Arithmetic computing via rate coding in neural circuits with spike-triggered adaptive synapses
([Poster](#)) *International Joint Conference on Neural Networks (IJCNN)*, Killarney, 2015

REVIEWING WORK
Science Advances, NeurIPS workshops (SVRHM & Attention), Memory & Cognition, eLife, Monk Prayogshala, CCN

WORKSHOPS ATTENDED

IBRO-SIMONS Computational Neuroscience Imbizo (ISi-CNI) *January, 2017*
Cape Town, South Africa
[Project](#): Assessing the role of feature attention in object detection with CNNs.
Advisor: Timothy Lillicrap

Computational Approaches to Memory and Plasticity (CAMP) *June, 2015*
Bangalore, India
Project: The role of the billions of granule cells in the cerebellum.

TEACHING EXPERIENCE

– Lecturer - Topics in cognitive neuroscience (Masters course)   *Osnabrück University, 2023*
– Lecturer - Reading group at the intersection of neuroscience and   *Osnabrück University, 2023*
  machine learning (Masters course)
– Supervisor - Projects at the intersection of neuroscience and   *Osnabrück University, 2023*
  machine learning (2 students; Masters course)
– Supervisor - UG thesis (1 student)   *Osnabrück University, 2023*
– Co-supervisor - UG thesis (2 students)   *Osnabrück University, 2023*
– Project Mentor for a group (5 students; Deep learning track)   *Neuromatch Academy, 2022*
– Co-supervisor - Masters thesis (1 student)   *Radboud University, 2022*
– Teaching Assistant - Advanced Academic & Professional Skills   *Radboud University, 2020*
  (writing/reviewing research reports; Masters course)
– Guest Lecturer - Academic Skills 2 (research methods; UG course)   *Radboud University, 2019*
– Teaching Assistant - Neural Networks (UG course)   *Radboud University, 2019*
– Teaching Assistant - Advanced Academic & Professional Skills   *Radboud University, 2019*
  (writing/reviewing research reports; Masters course)
– Supervisor - Research Project 3 (3 students; UG thesis project)   *Radboud University, 2018*
– Co-supervisor - Research Project 3 (4 students; UG thesis project)   *Radboud University, 2018*
– Guest Lecturer - Academic Skills 2 (research methods; UG course)   *Radboud University, 2018*
– Teaching Assistant - Brain for AI (UG course)   *Radboud University, 2018*

OTHER WORK EXPERIENCE

General Secretary
Undergraduate division - Department of Physics, IIT Bombay   *2014-15*

Content Developer
Avanti Fellows, Delhi   *Summer 2013*