Curriculum Vitae

Raghavendra Selvan

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Research Areas

Resource Efficient Machine Learning (ML), ML for Sustainability, Biomedical Image Analysis, Graph Neural Networks, Quantum-inspired ML, Approximate Inference and Multi-object Tracking Theory

Current Employment

Assistant Professor — Sep 2020 – present
Machine Learning Section (Dept. Computer Science) and Kiehn Lab (Dept. of Neuroscience)
Data Science Lab, University of Copenhagen, DK

Education

PhD, Medical Image Analysis — Oct. 2015 – Nov. 2018
Department of Computer Science, University of Copenhagen, DK

Master of Science, Communication Engineering — Sep. 2013 – June 2015
Chalmers University, Göteborg, SE

Bachelor in Engineering, Electronics and Communication — Sep. 2005 – Aug. 2009
BMS Institute of Technology, Bangalore, IN

Funding

Work Package Leader: EU Horizon 2020 project on Resource Efficient ML methods (2022) 4.3M DKK
Work Package Leader: EU Horizon 2020 project on Low Resource Big Data Pipelines (2022) 2.4M DKK
Co-applicant: UK Research & Innovation grant for Environmental sustainability in Life Sciences (2022) 890k DKK
Main Applicant: AI-Denmark Project (2022) 100k DKK
Co-applicant: UCPH Data+ Synergy Grant (2021) 3.4M DKK
Scholarship: Swedish Institute Scholarship for Masters education, Sweden (2013) 250k DKK

Scientific merits

Daily Advisor: 2 PhD Students, 3 Research Assistants, 8 MSc & 10 BSc Theses, 4 International Interns (2019–)
Co-Advisor: 2 PhD Students, 2 MSc & 1 BSc Theses (2017–)
Collaborating Advisor: 7 PhD students (including international candidates) (2019–)
Five peer-reviewed publications based on *MSc and BSc projects* in the last 12 months
Student Satellite team member of India's first pico-satellite; launched to orbit on 12 Jul 2010
Carbontracker[1]: Conceptualised & helped develop the first tool to predict the carbon footprint of training deep learning models. It has been downloaded $> 50k$ times with > 200 github stars

Professional activities

Affiliate Member of **Pioneer Centre for AI, Denmark** (2022–)
First Chair of **Sustainability and Environmental Action Research Pipelines Workgroup**, OHBM (2021–)
Datascience Consultant for FaunaPhotonics (2021)
Organizing Member of Summer School on Geometric Deep Learning (2021)
Reviewer at several high impact journals and conferences (IEEE-PAMI, MICCAI, NeurIPS, ICLR...) (2015 –)
Active Member of Free Software and Open Science groups (2008 –)

Awards

Recognized at UCPH for *Sustained scientific excellence, departmental citizenship & societal impact* 2021, 2022
Best Paper runner-up at International Conference on Medical Imaging with Deep Learning 2020
Winner of Swedish Scholarship challenge out of more than 5000 participants 2013
Limca Book of Records Award: Team Member of India's smallest satellite project - StudSat 2011
Student Member of the Year Award by Indian Society for Technical Education 2009

Previous Employment

Post-doc @ Machine Learning Section, University of Copenhagen, DK — Jan 2019 – Aug 2020
Research Assistant @ Machine Learning Section, University of Copenhagen, DK — Oct 2018 – Dec 2018
Teaching Assistant @ Chalmers University, Göteborg, SE — July 2015 – Aug 2015
Lecturer @ BMS Institute of Technology, Bangalore, IN — Aug 2011 – Jul 2013
Columnist @ The Hindu[2] (2nd largest Indian daily newspaper) and Frontline magazine[3] — Nov 2011 – Aug 2015
Network Solutions Architect @ MRO-TEK, Bangalore — Nov 2009 – Jul 2011

[1] https://github.com/lfwa/carbontracker/
[2] https://www.thehindu.com/profile/author/RaghavendraS/
[3] https://frontline.thehindu.com/profile/author/Raghavendra-Selvan/

Outreach

- **Press coverage:** Three research projects featured in Danish and International media with UCPH press releases
  1. *Students develop tool to predict the carbon footprint of algorithms* (2020)
  2. *Algorithm reveals the mysterious foraging habits of narwhals* (2021)
  3. *Insect wingbeats will help quantify biodiversity* (2022)
- **MIT Technology Review** article on *Making AI more energy efficient* (2022)
- **Expert Panelist** on *Environmental sustainability of emerging technologies* organized by International Risk Governance Center, Switzerland. (2022)
- **Social Media Manager** for the ML Section, DIKU [4] (2021–)
- **Academic Twitter** profile with sustained online engagement[5] (2018–)
- **Columnist** in Danish and International print media (2011–)

Selected Invited Talks

- *Representation Learning for Medical Image Analysis*, UK (2022)
- *Oral Presentation at Workshop on Biomedical Image Registration*, DE (2022)
- *Sustainability of AI*, Confederation of Danish Industry, DK (2021)
- *Recent Trends in Medical Image Analysis.* Guest Lecture at Jönköping University, SE (2021)
- *Graph Refinement using GNNs With a focus on Airway Extraction*, University of Iowa, US (2021)
- *Quantum Tensor Networks for Medical Image Analysis*, Cornell University, US (2021)
- *Extraction of Airways from volumetric data*, Radboud University Medical Center, NL (2021)
- *Machine learning for Medical Image Analysis*, BMS Institute of Technology, IN (2020)

Research Collaborations & Networks

Resource Efficient and Sustainable Machine Learning:

- **SustainML EU Project**: Work Package Leader in consortium with six international academic and industry partners, featuring Deutsches Forschungszentrum Fur Kunstliche Intelligenz (DE), Technische Universitat Kaiserslautern (DE), Institut National De Recherche En Informatique Et Automatique (FR), IBM Research (CH) and Sas Upmem (FR) (2022–)
- **EnrichMyData EU Project**: Work Package Leader in consortium with > 10 international academic and industry partners, featuring Philips Electronics (NL), Robert Bosch (DE), OECD (FR), Universita' Degli Studi Di Milano-bicocca (IT), Institut Jozef Stefan (SI), Sofia University (BG) and others. (2022–)
- **University of Sussex**: Active collaboration as part of a UK Research & Innovation grant for Environmental sustainability in Life Sciences and Medical Practice (2022–)
- **Neuroimaging Pipelines Workgroup**: Leading a group of international researchers from Europe, North America and Asia focused on making neuroimaging more resource efficient[6]. (2021–)
- **Erasmus Medical Center, NL**: Energy optimized ML workflow for medical image analysis. (2022–)
- **Aalto Uni. (FI) & Uni. of Toronto (CA)**: Upcoming collaborations on *Sustainable AI* (2022–)

Machine Learning for Environmental Sustainability

- **Dept. of Arctic Ecology, Aarhus Uni. (DK)**: Modeling migration patterns of Arctic Musk Ox (2022–)
- **FaunaPhotonics AS, DK**: Unsupervised quantification of insect populations from optical signals (2020-2022)
- **Greenland Inst. of Natural Resources, DK**: Foraging habits of narwhals from 1D signals (2020–2021)
- **Physics of Ice, Climate & Earth Group, UCPH, DK**: Microscope Image analysis of ice cores (2022–)
- **Freshwater Biology Group, UCPH, DK**: Lake depth estimation from satellite images (2021–)
- **Freshwater Biology Group, UCPH, DK**: Pike growth modeling with image based re-identification (2021–)
- **Dept. of Plant & Environmental Sciences, UCPH, DK**: Segmentation of roots in soil (2018–2020)

Medical Image Analysis

- **Erasmus Medical Center, NL**: Airway extraction from volumetric medical images (2015–2022)
- **University of Amsterdam, NL**: Developing graph neural network based imaging solutions (2017–2021)
- **Regional Hospital, DK**: Chest X-ray image analysis to model COVID-19 risk (2019–2022)
- **Cerebriu AS, DK**: Segmenting lungs from chest X-ray images with occlusions (2019–2020)

Data Science Collaborations within UCPH

- **Kiehn Lab, Dept. of Neuroscience**: ML tools for understanding mammalian locomotion (2019–)
- **Allodi Lab, Dept. of Neuroscience**: ML based models of neuro-degenerative diseases in mice (2022–)
- **Kermen Lab, Dept. of Neuroscience**: ML models of neurological resilience to stress in zebrafish (2022–)
- **Nano Group, Dept. of Chemistry**: Nanomaterial characterisation using deep latent models (2019–)
- **Functional Genomics Group, Dept. of Biology**: Nuclei segmentation from microscope images (2021–)
- **ICE CUBE project, Dept. of Physics**: Graph neural networks for sub-atomic particle detection (2022–)

Chalmers University, SE (2014–2015)
MSc Thesis on Bayesian Tracking of Multiple Point Targets using Expectation Maximization with Lennart Svensson with opportunities for new collaborations

Indian Space Research Organization (ISRO), IN (2008–2010)
Member of student satellite (StudSat) team responsible for design, development and testing of the on-board computer flown on the pico-satellite (weighing 0.95kg). It was launched into a low-earth orbit on 12 Jul. 2010.

[4] https://twitter.com/MLSectionUCPH
[5] https://twitter.com/raghavian
[6] https://neuropipelines.github.io/

Teaching Experience

University of Copenhagen, DK

- Course Responsible: *Introduction to Python* (2019 - 2022)
- Teacher: PhD course on *Machine Learning and Imaging Methods* (2019–2022)
- Teacher: PhD course on *Machine Learning and Projects* (2019–2022)
- Guest Lecturer: PhD course on *Animal models of disease and behavioral analysis* 2022
- Guest Lecturer: PhD course on *Bioimaging* 2019, 2022
- Guest Lecturer: Bachelor course on *Elements of Machine Learning* (2020 - 2021)
- Guest Lecturer: Masters course on *Machine Learning* (2017)
- Teaching Assistant: Masters course on *Machine Learning* (2015 - 2017)

Chalmers University, SE June 2015 – September 2015
Teaching Assistant in Master course on Sensor Fusion

BMS Institute of Technology, Bangalore, IN Aug. 2011 – Jul. 2013
Course Responsible: Bachelor courses on Digital Image Processing (2012), High Performance Communication Networks (2012), Antennas (2012), Electromagnetic Field Theory (2011) and Signals & Systems (2011),

Pedagogical Courses Completed

- Universitetspædagogikum Course, UCPH 2021–2022
- Introduction to University Pedagogy, UCPH 2018
- Learning how to learn (MOOC), Coursera 2016
- Introduction to PhD course, UCPH 2015

Bibliographic Overview

- 12 journal articles and 18 peer-reviewed conference/workshop proceedings articles.
- First author of 15 articles
- Last or corresponding author of 6 articles
- Total 460 citations (since 2017), of which 433 citations are since 2020
- H-index [7] of 10
- Most cited article (117 citations since 2020) – *Carbontracker: Tracking and Predicting the Carbon Footprint of Training Deep Learning Models*. LFW Anthony, B Kanding, R Selvan. ICML Workshop on Challenges in Deploying and monitoring Machine Learning Systems.

Skills

- Advanced Programming[8]: Python, C/C++, Bash
- Scientific computation tools: Pytorch, GNU Octave/Matlab
- Proficient in English, Tamil, Kannada, Hindi
- Beginner Danish and Swedish

Other Interests

- Blogging[9] and Freelance writer
- Hacktivism
- Trail Running

Personal details

- Citizenship Indian
- Date of birth 2nd September, 1987
- Place of birth Bangalore, India

References

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[7] Based on Google Scholar (28/08/2022) https://scholar.google.com/citations?user=R9VBQ54AAAAJ&hl=en
[8] https://github.com/raghavian
[9] http://blog.sarvajna.in