Bhadra S Kumar

Phone: **+44 7935690943|** Email: bhadra.edu@gmail.com **|** LinkedIn: https://www.linkedin.com/in/bhadrask/

SUMMARY

- An electronics engineer turned neuroscientist with more than 7 years of research experience. Completed PhD in Computational Neuroscience from Indian Institute of Technology Madras. The first author of three publications in peer-reviewed journals and eight conference presentations. The team leader of the Neurovascular group at IIT Madras for 5 years.

RELEVANT SKILLS

- Analytical skills which enabled leading four projects from the conceptual stage until the publication stage
- Sound knowledge of Computational Neuroscience and Artificial Intelligence
- Expertise in coding languages, MATLAB and Python
- Excellent writing and presentation skills
- Good communication skills
- Experienced in working with an interdisciplinary team

EDUCATION

PhD	Computational Neuroscience (July 2015–June 2022)	M.Tech│ Electronics (August 2011-July 2013)	B.Tech│ Electronics and Communication (October 2006-May 2010)
Indian Institute of Technology Madras (IITM), Chennai, India	Cochin University of Science and Technology (CUSAT), Kochi, India	Govt. College of Engineering Kannur, Kerala, India
(CGPA - 9.2)	(CGPA – 8.84)	(First class with Honours)

WORK EXPERIENCE

Indian Institute of Technology Madras (IITM), Chennai, India   **July 2020– February 2022**
Research Associate

- Led the team which explored the energy dependency of neural computation using machine learning concepts.
- Convinced the funding agency to extend the grant period of one of our projects by one year with my presentation and communication skills.
- Managed the funding/grant-related paperwork in addition to the role as team leader of the neurovascular team

Indian Institute of Technology Madras (IITM), Chennai, India   **July 2015– July 2020**
Team Leader of Neurovascular Team (Computational Neuroscience Lab, IIT Madras)

- Designed and implemented four projects from the conceptual stage
- Acquired experience in applying machine learning to neuroscience
- Actively collaborated with the members of the Neurovascular Team and experts in the field
- Published three journal articles, and the fourth one is under review.

Teaching Assistant

- Subjects Handled: Computational Neuroscience, Principles of Neuroscience, MOOC on 'Demystifying the Brain'(Offered by NPTEL), Life science

National Institute of Technology Calicut (NITC), Kozhikode   **July 2013 – May 2014**
Lecturer

- Subjects Handled: Signals and Systems, Electronic Instrumentation (Undergraduate course), Digital Signal Processing Laboratory (Undergraduate Laboratory)

LEADERSHIP EXPERIENCE

Neurovascular Team, CNS Lab, IIT Madras (∞ https://nvsteam.github.io/)   **January 2017 – Present**
Team Leader

- Mentored two undergraduate students, four interns, and two PhD students
- The team achieved three publications in peer-reviewed journals and seven conference proceedings

AWARDS & ACHIEVEMENTS

Honour/Awards

- Best Paper Presentation Award at 3rd Annual Conference of the Association for Cognitive Science (ACCS), at Indian Institute of Technology, Gandhinagar (October 2016)   **October 2016**

- Only candidate from India to receive the Giersch Foundation travel grant **September 2018**
  to attend Giersch International Symposium at FIAS, Frankfurt Germany
- Half Time Teaching/Research Assistantship (HTRA), Ministry of Human Resource **July 2011- July 2013**
  Development (MHRD), Government of India. **& July 2015- June 2020**
- Awarded the Kerala Govt. merit scholarship for securing **October 2006 – May 2010**
  7th rank in the state for secondary school

Certifications
- Machine Learning (Stanford University) **February 2021**
- Neural Networks and Deep Learning (Deeplearning.AI) **March 2021**
- Improving Deep Neural Networks (Deeplearning.AI) **April 2021**
- Structuring Machine Learning Projects (Deeplearning.AI) **April 2021**

PhD RESEARCH SUMMARY

Neurovascular coupling is often described as a unidirectional influence from the neural to the cerebrovascular system. Despite the known dependence of the neural system on the vascular system for metabolic substrates, the reverse influence in the so-called "vasculo-neural" direction is often ignored. Through my thesis, we proposed a modelling framework for bidirectional connectivity in neurovascular coupling and instantiated it in four different computational models.

(i) By connecting an unsupervised neural network to vascular network, explored how vascular feedback influences neural plasticity in normal and hypoxic conditions.

(ii) Using bidirectionally coupled unsupervised neural network investigated the possibility of lateral connectivity and somatotopic map formation in the vascular network

(iii) Explored the need for training and plasticity in the vascular network using supervised neural network model connected to a trainable vascular network, and finally,

(iv) Implemented an algorithm to simulate the vascular tree growth from the embryo stage to the adult stage in the murine cortex using unsupervised learning

JOURNAL PUBLICATIONS

- Kumar, Bhadra S., Menon, Sarath., et al. "The Influence of Neural Activity and Neural Cytoarchitecture on Cerebrovascular Arborization: A Computational Model." Frontiers in Neuroscience (2022): 933.
- Kumar, B.S., Mayakkannan, N., *et al.* "Artificial neurovascular network (ANVN) to study the accuracy vs. efficiency trade-off in an energy dependent neural network". *Nature Scientific Reports* **11,** 13808 (2021).
- Kumar, Bhadra S., Khot, Aditi., et al. "A network architecture for bidirectional neurovascular coupling in rat whisker barrel cortex." *Frontiers in Computational Neuroscience* 15 (2021): 51

CONFERENCE PAPERS

- Kumar, B.S., Menon,S., *et al.* "A computational model to simulate vascular arborization based on neuron cytoarchitecture", SFN 2021 (Online), November 2021
- Kumar, B.S., Mayakkannan, N., *et al.* "Attractor Dynamics in the Energy - Accuracy Space in an Artificial Neurovascular Network", Bernstein conference (Online), September 2020
- Kumar, B. S., A. Khot, *et al.* "Modelling the effects of stages of hypoxia ischemia on plasticity of whisker barrel cortex." Journal Of Cerebral Blood Flow and Metabolism. Vol. 39. Sage Publications, 2019,
  Brain and Brain PET 2019, Yokohama Japan, July 2019
- Kumar, B.S., Mayakkannan, N., *et al.,* "Do tuned responses in cerebral microvessels imply lateral interactions among vessels? A computational study", SFN 2019, Chicago, IL
- Kumar, B.S., Mayakkannan, N., *et al.,* "Encoding Temporal Relations using Complex-Valued Synapses", ACCS 2019, BITS PILANI Goa Campus, India
- Kumar,B.S., Kori, A., *et al.,* "Phase and Amplitude Modulation in a Neural Oscillatory Model of the Orientation Map", ICONIP 2018, Cambodia

EXTRA-CURRICULAR ACTIVITIES

- Winner of story writing competitions in secondary and senior secondary school (2003,2004,2005)
- Winner in public speaking competitions in secondary and senior secondary school (2003,2004,2005)
- Trained in classical dance (Bharatanatyam) for ten years
- Part of the team to secure second place in state-level Thiruvathira dance in senior secondary (2006)
- Anchored the annual day function of Triveni dance school, Chennai (2017)

HOBBIES & INTERESTS

- Choreography, Journaling, and Cooking

REFERENCES

1. Dr. V. Srinivasa Chakravarthy
    Professor,
    Department of Biotechnology,
    Bhupath and Jyothi Mehta School of Biosciences
    Indian Institute of Technology Madras (IITM)
    Chennai 600036, India
    Phone: +91-44-2257 4115
    Email: schakra@ee.iitm.ac.in

2. Dr. S.Pushpavanam
    Professor,
    Chemical Engineering Department
    Indian Institute of Technology Madras (IITM)
    Chennai 600036, India.
    Phone : +91-44-2257 4161
    Email : spush@iitm.ac.in

3. Dr. G. Abhilash
    Associate Professor
    Department of Electronics and Communication
    National Institute of Technology Calicut (NIT-C),
    Kozhikode- 673601, India.
    Email : abhilash@nitc.ac.in
    Ph: +91-495-2286707