Narayanan Chatapuram Krishnan

307, Department of Computer Science and Engineering,
Indian Institute of Technology Ropar, Rupnagar, PB 140001
E-Mail: ckn@iitrpr.ac.in

Research Interests

Theory: Machine Learning, Transfer Learning, Data Science
Applications: Ubiquitous Computing, Multimedia, ICT for Development

Education

Ph.D in Computer Science and Engineering **2010**
Advisor: Prof. Sethuraman (Panch) Panchanathan
Arizona State University, Tempe, AZ, USA
Dissertation Title: A Computational Framework for Wearable Accelerometer Based Activity and Gesture Recognition.
CGPA: 4.00/4.00

Masters in Technology (Computer Science) **2004**
Sri Sathya Sai Institute of Higher Learning, Prasanthi Nilayam, AP, India
CGPA: 5.00/5.00

Masters in Science (Mathematics) **2002**
Sri Sathya Sai Institute of Higher Learning, Prasanthi Nilayam, AP, India
CGPA: 4.96/5.00

Bachelors in Science Honors (Mathematics) **2000**
Sri Sathya Sai Institute of Higher Learning, Prasanthi Nilayam, AP, India
CGPA: 4.87/5.00

Work Experience

Assistant Professor **September 2014 - Present**
Department of Computer Science and Engineering
Indian Institute of Technology, Ropar

Visiting Faculty **October 2013 – August 2014**
Department of Computer Science and Engineering
Indian Institute of Technology, Ropar

Assistant Research Professor **September 2011 – July 2013**
School of Electrical Engineering and Computer Science,
Washington State University

Postdoctoral Research Associate **October 2010 – August 2011**
School of Electrical Engineering and Computer Science,
Washington State University

Graduate Research Associate **August 2007 – September 2010**
Center for Cognitive Ubiquitous Computing
School of Computing, Informatics and Decision Systems Engineering,
Arizona State University

Graduate Teaching Associate **August 2005 – May 2009**
School of Computing, Informatics and Decision Systems Engineering,

Arizona State University

Engineer Intern **February 2005 – May 2005**
MotionEase Inc, Bangalore, India

Project Associate **July 2004 – January 2005**
Department of Electrical Engineering,
Indian Institute of Science, Bangalore, India

Honors and Awards

Unrestricted Research Grant, Microsoft Research India **2016**

Nominated for best PhD Thesis Award, **2010**
School of Computing, Informatics and Decision Systems Engineering
Arizona State University

Student Project Funding **2009**
Office of Academic and Student Affairs,
Arizona State University

Invited membership to The Honor Society of Phi Kappa Phi **2007**
For academic success in graduate program
Arizona State University

The President of India Dr. A. P. J. Abdul Kalam Gold Medal **2004**
For academic excellence in Masters in Technology (Computer Science)
Sri Sathya Sai Institute of Higher Learning, India

Publications

Journal Articles

1. S Sukhija, and **N C Krishnan**, Supervised Heterogeneous Feature Transfer via Random Forests, Accepted Artificial Intelligence Journal, 2018.
2. B Das, D Cook, **N C Krishnan**, and M Schmitter-Edgecombe, One-Class Classification-Based Real-Time Activity Error Detection in Smart Homes, accepted IEEE Journal of Special Topics in Signal Processing, 10(5), 914-923, 2016.
3. B Das, **N C Krishnan**, D Cook, WRACOG: A Wrapper Approach to Oversampling for Learning from Imbalanced Class Datasets, IEEE Transactions on Knowledge and Data Engineering, 27(1), 222-234, 2015.
4. D Cook, **N C Krishnan**, Mining Smart Home data, Journal of Intelligent Information Systems, Journal of Intelligent Information Systems, 43(3):503-519, 2014.
5. **N C Krishnan**, D Cook, Activity Recognition on Streaming Sensor Data, Journal of Pervasive and Mobile Computing, 10(B), 138-154, 2014.
6. **N C Krishnan**, D Cook, Z Wellminger, Learning a Taxonomy of Predefined and Discovered Activity Patterns, Journal of Ambient Intelligent and Smart Environments, 5(6), 621-637, 2013.
7. R I Dogan, Y Gil, H Hirsh, **N C Krishnan**, M Lewis, C Meriçli, P Rashidi, V Raskin, S Swarup, W Sun, J M. Taylor, L Yeganova: Reports on the 2012 AAAI Fall Symposium Series. AI Magazine 34(1): 93-100, 2013.
8. D Cook, K D Feuz, **N C Krishnan**, Transfer Learning for Activity Recognition: A Survey, Springer International Journal on Knowledge and Information Systems, 36(3), 537-556, 2013.

9. D Cook, A S Crandall, B L Thomas, **N C Krishnan**, CASAS: A Smart Home in a Box, IEEE Computers, 46(7), 62-69, 2013.
10. D Cook, **N C Krishnan**, P Rashidi, Activity Discovery and Activity Recognition: A New Partnership, IEEE Transactions on systems, man and cybernetics, 43(3), 820-828, 2013.
11. **N C Krishnan,** C Juillard, D Colbry, S Panchanathan, Recognition of hand movements using wearable accelerometers, in the Journal of Ambient Intelligent and Smart Environments, Special Issue on Wearable Computing, Vol. 1 (2), pp. 143 – 156, 2009.

Books

1. Activity Learning: Discovering, Recognizing, and Predicting Human Behavior from Sensor Data, D Cook and **N C Krishnan**, John Wiley & Sons Inc., 2015.

Book Chapters

1. B Das, **N C. Krishnan**, D J. Cook, Handling Imbalanced and Overlapping Classes in Smart Environments Prompting Dataset, Springer book on Data Mining for Service,119-219, 2014.
2. **N C Krishnan**, S Panchanathan, Body Sensor Networks for Activity and Gesture Recognition, Springer Book on Wireless Sensor Networks, 2013.
3. B Das, **N C Krishnan**, D Cook, Automated Activity Interventions to Assist with Activities of Daily Living, IOS Press book on Agent-Based Approaches to Ambient Intelligence, 137-158, 2012.
4. P Rashidi, **N C Krishnan**, D Cook, Discovering and tracking patterns of interest in security sensor streams, In Securing Cyber-Physical Infrastructures, Eds: S Das, K Kant and N Zhang, Chapter 19, 2012.

Conference and Workshop Articles

1. J Garg, S V Peri, H Tolani, and **N C Krishnan**, Deep Cross modal learning for Caricature Verification and Identification (CaVINet), ACM Conference on Multimedia, 1101-1109, 2018.
2. S Sukhija and **N C Krishnan**, Web-Induced Heterogeneous Transfer Learning with Sample Selection, Accepted to European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases, 2018.
3. S M Pandey, T Agarwal, and **N C Krishnan**, Multi-task Deep Learning for Predicting Poverty from Satellite Images, AAAI Conference on Innovative Applications of Artificial Intelligence, 7793-7798, 2018.
4. S Sukhija, **N C Krishnan**, and D Kumar, Supervised Heterogeneous Transfer Learning using Random Forests, Accepted to ACM International Joint Conference on Data Science and Management of Data, 2018.
5. A Sikka, G Mittal, D B Reddy, and **N C Krishnan**, Supervised Deep Segmentation Network for Brain Extraction, International Conference on Computer Vision, Graphics and Image Processing, 2016.
6. G Mittal, K B Yagnik, M Garg, and **N C Krishnan**, Spot Garbage: Smartphone App to Detect Garbage Using Deep Learning, ACM International Joint Conference on Pervasive and Ubiquitous Computing, 940-945, 2016.
7. S Sukhija, **N C Krishnan**, and G Singh, Supervised Heterogeneous Domain Adaptation via Random Forests, International Joint Conference on Artificial Intelligence, 2039-2045, 2016.
8. S Sukhija, and **N C Krishnan**, Supervised Heterogeneous Domain Adaptation via Random Forests, Indian Workshop on Machine Learning, 2016.
9. R Kumar, I Qamar, J S Virdi and **N C Krishnan**, Multi-label Learning for Activity Recognition, International Conference on Intelligent Environments, 152-155, 2015. (**Nominated for best paper award in Work in Progress category**)
10. B Das, **N C Krishnan**, D Cook, wRACOG: A Gibbs Sampling-Based Oversampling Technique, IEEE International Conference on Data Mining, 111-120, 2013.

11. B Das, **N C Krishnan**, D Cook, Handling Class Overlap and Imbalance to Detect Prompt Situations in Smart Homes, IEEE International Conference on Data Mining Workshop on Data Mining in Bioinformatics and Healthcare, 2013.
12. N Darnall, **N C Krishnan**, J D Carlson, D R Greely, J Mark, M Schmitter-Edgecombe, D C Lin, Identifying the presence of Dyskenisa in patients with Parkinson's disease from accelerometer data, ASME Summer Bioengineering Conference 2013.
13. S Dernbach, B Das, **N C Krishnan**, B L Thomas, D Cook, Activity Recognition on Smart Phones, IEEE International Conference on Intelligent Environments, 214-221, 2012.
14. A Crandall, L Zulas, K Feuz, **N C Krishnan**, D Cook, Visualizing Your Ward: Bringing Smart Home Data to Caregivers, ACM CHI workshop on Emerging Technologies for Healthcare and Aging, 2012.
15. Yasamin Sahaf, **N C Krishnan**, D Cook, Defining Activity Complexity, AAAI workshop on Activity and Context Representation, 2011.
16. R Chattopadhyay, **N C Krishnan**, S Panchanathan, Hierarchical domain adaptation for SEMG signal classification across multiple subjects, submitted to 33rd IEEE Conference on Engineering in Medicine and Biology, USA 2011.
17. **N C Krishnan** Scalable Activity Recognition, NSF workshop on Pervasive Computing at Scale, **Lead** on *Machine Learning, Behavior Modeling and Data mining*, USA, 2011.
18. R Chattopadhyay, **N C Krishnan**, S Panchanathan, Topology preserving domain adaptation for addressing subject based variability in SEMG signal, AAAI spring symposium on Computational Physiology, Palo Alto, USA, 2011
19. Prasanth Lade, **N C Krishnan**, S Panchanathan, Task prediction in cooking activities using hierarchical state space Markov chain and object based task grouping, IEEE International symposium on Multimedia workshop on multimedia for cooking and eating activities, Taichung, Taiwan, 2010.
20. Ashok Venkatesan, **N C Krishnan**, S Panchanathan, Cost sensitive boosting for concept Drift, accepted to European Conference on Machine learning workshop on handling concept drift in Adaptive Information systems, Barcelona, Spain, 2010.
21. **N C Krishnan**, L Prasanth, S Panchanathan, Activity gesture spotting using a threshold model based on Adaptive Boosting, International Conference on Multimedia and Expo, Singapore, 2010
22. **N C Krishnan,** G N Pradhan, S Panchanathan, Recognizing short duration hand movements from accelerometer data, ICME workshop on Multimedia Aspects in Pervasive Health Care 2009. (*Invited Paper*)
23. S Krishna**, N C Krishnan,** S Panchanathan**,** Detecting Stereotype body rocking behavior through embodied Motion sensors, accepted in Rehabilitation Engineering and Assistive Technology Society of North America Annual Conference, 2009
24. S Panchanathan, **N C Krishnan**, S Krishna, T McDaniel, V Balasubramanian, Enriched human-centered multimedia computing through inspirations from disabilities and deficit centered computing solutions, ACM MM 3rd Workshop on Human Centered Computing, Vancouver, Canada, 2008.
25. **N C Krishnan,** D Colbry, C Juillard, S Panchanathan, Real time human activity recognition using tri-axial accelerometers, Sensors Signals and Information Processing Workshop, Sedona, USA, 2008.
26. **N C Krishnan,** S Panchanathan**,** Analysis of low resolution accelerometer data for human activity recognition, International Conference on Acoustic Speech and Signal Processing, ICASSP Las Vegas, USA 2008
27. S Krishna, V Balasubramanian**, N C Krishnan**, C Juillard, T Hedgpeth, S Panchanathan, A wearable wireless RFID system for accessible shopping environments, 3rd Intl Conference on Body Area Networks (BodyNets'08), Tempe, USA, 2008
28. S Krishna, V Balasubramanian**, N C Krishnan,** T Hedgpeth, The iCARE Ambient Interactive Shopping Environment, California State University, Northridge, Center on Disabilities' 23rd Annual International Technology and Persons with Disabilities Conference (CSUN 2008), Los Angeles, USA, 2008.

29. **N C Krishnan,** B Li, S Panchanathan, Detecting and classifying frontal, back and profile views of humans, International conference on Vision theory and applications (VISAPP 2007), Barcelona, Spain, 2007
30. J A Black, S B Braiman, **N C Krishnan,** S Panchanathan, The role of eye movement signals in dorsal and ventral processing, SPIE Conference on Human Vision and Electronic Imaging (HVEI 2007), San Jose, USA, 2007
31. K Kahol, **N C Krishnan,** V Balasubramanian, S Panchanathan, M Smith, J Ferrara, Measuring movement expertise in surgical tasks, ACM Multimedia Conference, Santa Barbara, USA, 2006.
32. B S Raghavendra**, N C Krishnan,** G Sita, A G Ramakrishnan, M Sriganesh, Prototype learning methods for online handwriting recognition, International Conference on Document Analysis and Recognition (ICDAR 2005), Seoul Korea, 2005
33. P Saravanan**, N C Krishnan,** P V S S Prakash, G V P Rao, Techniques for video mosaicing, World Enformatika Conference, Istanbul, Turkey, 2005
34. **N C Krishnan**, M C Prakash, G V P Rao, High-level feature extraction in JPEG compressed domain, SPIE International symposium on optical science and engineering, USA, 2004.

Other

1. **N C Krishnan**, Study on audio correlates of stress and team performance during code blue in ICU**,** Work conducted in collaboration with Dr. Bhavesh Patel from Mayo Clinic, Phoenix, 2010
2. **N C Krishnan**, A Venkatesan, R Chattopadhyay, S Panchanthan, Accelerometric feature analysis for movement pattern recognition, Technical Report, TR_CUBIC2010.
3. **N C Krishnan**, G. Pradhan, S. Panchanathan, Cognitive Orthotic for Prompting Tasks in Complex ADL, Arizona Alzheimer's Research Consortium, Annual Conference, 2009.
4. **N C Krishnan,** D Colbry, C Juillard, S Panchanathan Real time human activity recognition using tri-axial accelerometers Poster in symposium on Co-Adaptive Learning: Adaptive Technology for the Aging, Arizona State University, 2009
5. **N C Krishnan**, Low resolution accelerometer data for human activity recognition, Research in Engineering & Applied Sciences (REAS) Symposium, Arizona State University, 2007
6. **N C Krishnan**, S Balasubramaniam, G V P Rao, Image processing in the JPEG compressed domain, symposium on emerging trends in Computer Science Technology, Rajiv Gandhi Memorial Institute of Technology, India, 2004

Invited Talks and Tutorials

- Kernel Methods for Machine Learning, NIT Calicut, 2017.
- Activity Learning for Real-World Applications – Washington State University, 2014.
- Human Activity Recognition in the Real World – Tata Consultancy Services Innovation Labs, Bangalore 2013.
- Human Activity Recognition - Indian Institute of Technology Ropar, 2013.
- Machine Learning for Pervasive Computing Applications, Research Seminar, School of Electrical Engineering and Computer Science, Washington State University, 2012.
- Sensor Based Human Activity Recognition – Tutorial Presentation at International Conference on Multimedia and Expo, 2010.
- Sensor Based Human Activity Monitoring – Sri Sathya Sai Institute of Higher Learning, 2010.
- A Computational Framework for Wearable Accelerometer Based Gesture and Activity Recognition, NSF-IGERT Seminar, Washington State University, 2010.
- Recognition of Short Duration Hand Movements through Wearable Accelerometers, ICME workshop on Multimedia Aspects in Pervasive Health Care, 2009.

Grant Proposals

- DST-SERB International Travel Support to attend ACM Multimedia 2018.
- Unrestricted Research Gift from Nvidia in the form of GPU hardware, 2017.
- Unrestricted Research Gift from Nvidia in the form of GPU hardware, 2016.
- Activity Learning in Smart Environments, DST, Young Scientist Scheme, Role: PI, Rs.18 Lakhs 2016-2019.
- Human Activity Modeling in Smart Environments, ISIRD Grant, IIT Ropar, Role: PI, Rs 8.2 Lakhs, 2014-16.
- AAAI Fall Symposium 2012: AI for Gerontechnology – Student Travel Fund, NSF IIS-SHB program, Role: PI, 2012.
- Smart Environment Technology for Longitudinal Behavior Analysis and Intervention, NIBIB Program on Technologies for Independent Living, PI – Diane J. Cook, Role: Research Associate, 2012.
- The iCare Ambient Interactive Shopping Environment, NSF-IIS Exploratory Grant 739774, PI – Terri Hedgepeth, Role: Co-Author, 2007.
- Participated in writing proposals to NSF and SOCOM (2007-2010) while a research associate at the Center for Cognitive Ubiquitous Computing.

Administrative Service

- Department of Computer Science and Engineering, IIT Ropar
    - Academic Coordinator for Post Graduate Program (2014-2016)
    - Member, Sponsored Research and Industry Consultancy Committee (2014-2016)
- JEE-Advanced Cell
    - Chairman (2018-2020)
    - Vice Chairman (2016-2018)
- Enterprise Resource Planning Software Committee – Member
- Institute Library Committee - Member
- Institute Intellectual Property Rights Cell – Member
- Institute Central Workshop Facility - Member

Professional Service

- Indo-French Center for the Promotion of Advanced Research – Research Proposal Reviewer - 2015
- Israel Science Foundation - Research Proposal Reviewer – 2014.
- National Science Foundation-CISE Panelist 2013
- Alzheimer's Association International Research Grant Reviewer 2013.
- **Co Chair**, AAAI Fall Symposium on AI for Gerontechnology, 2012
- **Publicity Chair**, International Symposium on Haptic Audio-Visual Environments and Games (HAVE), 2010.
- **Program Committee Member:**
    - IEEE International Conference on Pervasive Computing 2015, 2016
    - International Workshop on Computer Vision and Machine Learning, SSSIHL, 2012, 2014.

- International Workshop on Situation, Activity and Goal Awareness, (Part of UbiComp) 2011, 2012
- Activity and Context workshop at AAAI, 2012.
- International Workshop on AI Techniques for Ambient Intelligence, 2011, 2015
- ACM International Conference on Information and Knowledge Management, 2011
- International Workshop on Machine Learning for Human Behavior Understanding and Assisted Living (Part of ICMLA), 2011

- **Reviewer:**
  - Journals
    - MIT Press
    - Alzheimer's and Dementia
    - Journal of Pervasive and Mobile Computing
    - IEEE Pervasive Computing
    - ACM Transactions on Intelligent Systems and Technology
    - ACM Transactions on Interactive, Multimedia, Wearable and Ubiquitous Technologies
    - IEEE Transactions on Human-Machine Systems
    - IEEE Transactions on Knowledge and Data Engineering
    - Journal of Visual Communication and Image Representation
    - Expert Systems
    - Sensors Journal
    - International Journal of Telemedicine and Applications
    - Journal on Transportation Research Part C: Emerging Technologies
    - International Journal of Ad-Hoc and Ubiquitous Computing
    - Pattern Recognition Letters
  - Conferences
    - International Conference on Computer Vision and Pattern Recognition, 2019
    - ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp) 2012, 2013, 2015, 2016, 2017
    - International Symposium on Wearable Computing 2015.
    - International Conference on Pervasive Computing Technologies for Health Care, 2013.
    - AAAI Workshop on Space, Time and Ambient Intelligence, 2013.
    - Assisted in reviewing papers submitted to ICIP (2007-08), ICME (2007-10), ICPR (2008, 2010), ICGVIP (2008), ICASSP (2008-10) and BSN (2008).
- Member: ACM, AAAI

Teaching Experience

- Fall 2018
  - Machine Learning, CSL503/603
  - Advanced Machine Learning, CSL712
- Spring 2018
  - Artificial Intelligence, CSL302/612
- Fall 2017
  - Machine Learning, CSL603
- Spring 2017

  - Artificial Intelligence
  - Advanced Machine Learning
- Fall 2016
  - Machine Learning, CSL465/603 (68)
- Summer 2016
  - Machine Learning, CSL465
- Spring 2016
  - Artificial Intelligence, CSL452 (41)
  - Software Systems Laboratory, CSP203 (along with Prof. Balwinder Singh Sodhi)
- Fall 2015
  - Advanced Machine Learning, CSL603 (3)
  - Data Structures, CSL201 (71)
- Spring 2015
  - Introduction to Database Systems, CSL451 (80)
- Fall 2014
  - Machine Learning, CSL407 (56)
- Spring 2014
  - Artificial Intelligence, CSL302 (64)
- Fall 2012
  - Machine Learning, CptS 570-01 (20), School of Electrical Engineering and Computer Science, Washington State University.
- Co-Instructor, CptS 580, Advanced Topics in Machine Learning, Fall 2011, School of Electrical Engineering and Computer Science, Washington State University.
  - Classroom Lectures on Dimensionality Reduction, Feature Selection and Transfer Learning
  - Designed and evaluated the homework on dimensionality reduction and feature selection.
- Teaching Associate, Department of Computer Science and Engineering, Arizona State University
  - Courses:
    - CSE 181 – Applied Problem Solving with Visual BASIC (2005-06)
    - CSE 360 – Introduction to Software Engineering (2006-07)
    - CSE 485/486 – Computer Science Capstone Project (2007-2009)
  - Role: Administrative responsibilities over other TAs and graders, Office hours to interact with students on course work, Issues related to Grading (design criteria, solutions and addressing student queries) and Assist in examination sessions.

Student Mentoring

- Graduate Students:
  - PhD
    - Vidhyakamakshi (2018-,)
    - Sanatan Sukhija (2015-, Heterogeneous Domain Adaptation)
    - Barnan Das (co mentored with Prof. Diane Cook, WSU 2014)
  - MS/MS Research
    - Akanksha Paul (2017-, Transfer and Zero-shot Learning)
    - Ashok Venkatesan, (co mentored with Prof. Sethuraman Panchanathan, ASU, 2011)
  - MTech

- 2017- Sujit Rai, Prateek Munjal, Sagarika Sharma, and *Rohit Chaudhary (with Dr. Mukesh Saini)*

- Undergraduate Students:
  - 2019
    - Abhishek Chowdhry, Shivam Mittal, Rajat Sharma, Pratham Gupta, Koustav Das, Prateek Chhajer, and *Sai Srinadhu Katta (with Dr. Deepti Bathula Reddy)*
  - 2018
    - Mayank Kumar, Snehil Ameta, **Devendra Pratap Yadav (President's Gold Medalist)**, Skand Viswanath Peri, Himanshu Tolani, and Jatin Goyal
  - 2017
    - **Tushar Agarwal (President's Gold Medalist)**, and Shailesh Mani Pandey
  - 2016
    - **Gaurav Mittal (President's Gold Medalist), Kaushal Yagnik Bhupesh, Mohit Garg (Team Spot Garbage, Microsoft Imagine Cup India Winners in the World Citizenship Category, INAE Student Project of the Year Award),** Deepak Chawla, Aniket, and Thipparthy Jagadeesh Chandra
  - 2015
    - Jaskaran Singh Virdi, Rahul Kumar, Imroj Qamar, Sahil Dabra, Gurasis Singh, *Prikishit Kumar, Pankaj Kumar, and Parmeet Singh* (*with Dr. Junghyun Jun*)
  - Colin Juillard, 2008
  - Sean Phillip, 2009