Tushar Semwal

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Education

- **Indian Institute of Technology Guwahati** **Guwahati, India**
  Ph.D. On Decentralising Intellgence in Cyber-Physical Systems *07/2015– 04/2019*
  - My research interests are Robotics, Internet of Things and Machine Learning. I am also intrigued with algorithms for successful *Transfer Learning* across multiple domains such as Robotics and NLP. I have recently picked up research in Federated Computing.
  - Recipient of the prestigious TCS Research Fellowship for the tenure 2015-2019.
- **Indian Institute of Technology Guwahati** **Guwahati, India**
  Master of Technology, Computer Science and Engineering *07/2013 – 06/2015*
  - Supervisor: Prof. Shivashankar B. Nair, **7.81** CPI
- **College of Engineering Roorkee** **Roorkee, India**
  Bachelor of Technology, Electronics and Telecommunication *07/2009 – 06/2013*
  - Honours degree with **75.4**%

Industry Experience

- **The University of Edinburgh and ORCA Hub** **Edinburgh, UK**
  Post-Doctoral Research Associate *01/2019 – Present*
  - Sensor and IoT based solutions for Offshore energy industries including Wind, and Oil and Gas.
  - Collaborating with industrial on-site projects (`https://orcahub.org/`).
  - Industry demonstrations at ORE Catapult in Blyth, UK.
- **The Construct** **Working Remotely**
  ROS Intern *11/2018 – 12/2018*
  - Developing ROS and Gazebo packages such as Anki Cozmo simulation.
  - Working directly with Ricardo Tellez, CEO to create Jupyter notebooks on various ROS and Gazebo tools.
  - Live class #38 [Video Link] and #39 [Video Link].
- **Project TARTARUS, IIT Guwahati** **Guwahati, India**
  Full Stack Developer *07/2015 – 12/2018*
  - A multi-agent programming platform which allows users to program and release agents into the network, see their interactions in real time and perform real-world emulation experiments.
  - Implemented multi-threaded memory garbage cleaning inside TARTARUS which increased its thread handling capacity by 35-40%.
  - Implemented APIs for sensor reading and actuation control for embedded systems such as Raspberry Pi.
  - For Github link: `https://github.com/tushar-semwal/ProjectTartarus/wiki`
- **Bixby Team, Samsung Research Institute Bangalore (SRIB)** **Bengaluru, India**
  Summer Trainee *06/2017 – 09/2017*
  - Studied and implemented Transfer Learning for Text Classification using CNN.
  - A part of work was converted into a research paper which was accepted in SIAM SDM-18, a top-tier data mining conference.

Team-work Experience

- **Head Teaching Assistant** **Guwahati, India**
  Indian Institute of Technology Guwahati *07/2017 – 10/2018*
  - Head TA for two IITG undergraduate and postgraduate courses ranging in size from 20 to 90 students. Topics included: Internet of Things, Machine Learning, Mobile Robotics and Evolutionary Computing.

- Supervised six other TAs and prepared course material which included laboratory assignments, projects designing and questionnaire evaluation.
- Supervised students for final projects.
- Recognized as one of the efficient Teaching Assistant (Reference: Prof. S. B. Nair).

Languages and Technologies

Programming Languages: Python, Embedded C, C++, Prolog
Technologies: PyTorch, PySyft, Theano, NumPy, scikit-learn, NLTK, Weka, Git
Scripting Languages: Bash, Batch
NO SQL : MongoDB (Mild proficiency)
Simulation: Gazebo, AVR Studio
Micro-controller experience: AtMega series, PIC18F26k22, PIC24FJ256GB206, ATSAMD21G18
Embedded Boards: Raspberry Pi (2 and 3), Arduino, LoPy4
Operating Systems: Ubuntu, Raspbian, ROS (meta-OS), Windows
Natural Languages: Fluency in Hindi and English

Course Projects

- **Food Annotation and Wastage Estimation using Deep Learning** *07/2016 – 06/2018*
  - Collection, annotation and analysis of food data from Indian Hostel Messes.
- **Location aware and Tracking System** *01/2016 – 06/2016*
  - Implemented a distributed and decentralized solution for tracking person(s) in a building using Raspberry Pis interfaced with a Bluetooth Low Energy (BLE).
- **Online Web Portal for Report Submission and Teacher-Student Meeting Scheduling** *09/2013 – 11/2013*
  - Developed a PHP based web application that would allow students to submit their final project report online. They can also view the PDF version of their report.
  - Features such as a basic plagiarism checker was also incorporated with the portal.
  - Scheduling of Teacher-Student meeting was also accomplished.
  - Database management was achieved through MySQL and PHP was used for interacting with the database.
- **Eye-gaze aided communication interface for ALS patients** *01/2013 – 06/2016*
  - Targeted for patients suffering from *Amyotropic Lateral Sclerosis (ALS)* to shuffle the words displayed on the screen through eye pupil movements.

Projects Supervised

- Crowdsourced Road Mapping System
- Pokemon Go (game)
- Smart Rack
- Real-World Counter-Strike (game)
- Hand-Gesture based Control for Home Appliances
- Dual-axis Solar Tracking Device
- Dancing Prey: Shoot and Dance (game)
- IoT for Automated Home based on Intel Galileo
- 2-wheel Self Balancing Robot
- Interactive Maze (game)
- Automated Gardening System
- Driving Assistant System

**References: Prof. S. B. Nair (Dept. of CSE, IIT Guwahati)

Certificates and awards

- TCS Research Fellowship for the tenure of 4 years starting from 2015. *2015*
- Microsoft Travel Grant for SIAM SDM 2018. *2018*
- Science and Engineering Research Board Travel Grant for international conference. *2018*

- Travel Grant for AAMAS Summer School on Multi-Agent Systems. *2016*
- First prize in Working Project Prototype Competition held in College Fest. *2013*
- Second prize in Autonomous Intelligent Line Following Robot competition held in College Fest. *2013*

Publications

- **Robotics, Embodied Evolution, Machine Learning**

1. **Tushar Semwal**, Shivashankar B. Nair (2019). A decentralized Artificial Immune System for solution selection in Cyber–Physical Systems. *Applied Soft Computing, Elsevier Journal*.
2. Ishita Ishita, Divya D Kulkarni, **Tushar Semwal**, Shivashankar B. Nair (2019). On Securing Mobile Agents using Blockchain Technology. In *Proceedings of 2019 Second International Conference on Advanced Computational and Communication Paradigms (ICACCP)*.
3. **Tushar Semwal**, Divya D Kulkarni, Shivashankar B. Nair (2018). On an Immuno-inspired Distributed, Embodied Action-Evolution cum Selection Algorithm. In *Proceedings of Genetic and Evolutionary Computation Conference (GECCO) 2018*, Kyoto, Japan. [Video]. arXiv: [1806.09789]
4. Rahul Mishra, **Tushar Semwal**, Shivashankar B. Nair (2018). A Distributed Epigenetic Shape Formation and Regeneration Algorithm for a Swarm of Robots. In *Workshop of Genetic and Evolutionary Computation Conference (GECCO) 2018*, Kyoto, Japan. [Video]
5. **Tushar Semwal**, Shashi Shekhar Jha, Shivashankar B. Nair (2017). On Ordering Multi-Robot Task Executions within a Cyber Physical System. *ACM Transactions on Autonomous and Adaptive Systems (ACM TAAS)*. [Video]. arXiv: [1803.04781]
6. Nikhil S., **Tushar Semwal**, Shivashankar B. Nair (2016). Immuno-Inspired Behaviour Adaptation in Multi-Robot Systems. In *Proceedings of Systems, Man & Cybernatics (SMC) 2016*, Budapest, Hungary. [Video]

- **Transfer Learning, NLP, Deep Learning**

1. **Tushar Semwal**, Gaurav Mathur, Promod Yenigalla, Shivashankar B. Nair (2018). A Practitioners' Guide to Transfer Learning for Text Classification using Convolutional Neural Networks. In *Proceedings of SIAM Conference on Data Mining (SDM) 2018*, San Diego, USA. arXiv: [1801.06480]

- **Cyber-Physical Systems, Multi-Agent Systems, Robotics, Internet of Things**

1. **Tushar Semwal**, Shivashankar B. Nair (2018). MAVNet: A Mobile Agent based framework for Vehicular Networks [Accepted]. In *Proceedings of third International Conference On Internet of Things: Smart Innovation and Usages (IoT SIU 2018)*, Nainital, India.
2. Nitu Gangwar, **Tushar Semwal**, Shivashankar B. Nair (2017). CARE: An IoT based System for Passenger Service and Comfort in Railways. In *Proceedings of* 9^{th} *International Conference on COMmunication Systems & NETworkS (COMSNETS) 2017*, Bengaluru, India. [Video]
3. **Tushar Semwal**, Shivashankar B. Nair (2016). AgPi: Agents on Raspberry Pi. *Special Issue of the Journal – Electronics: "Raspberry Pi Technology", MDPI Open Access*.
4. **Tushar Semwal**, Nikhil S., Shashi Shekhar Jha, Shivashankar B. Nair (2016). TARTARUS: A Multi Agent Platform for Bridging the gap between Cyber and Physical Systems. In *Proceedings of 2016 Autonomous Agents and Multi Agent Systems Conference (AAMAS)*, Singapore. [Video]
5. **Tushar Semwal**, Manoj Bode, Vivek Singh, Shashi Shekhar Jha, Shivashankar B. Nair (2015). Tartarus: A Multi-Agent Platform for Integrating Cyber-Physical Systems and Robots. In *Proceedings of 2015 Conference on Advances In Robotics (AIR)*, Goa, India. [Video]

Certified Courses

- Neural Networks for Machine Learning; *Geoffrey Hinton, University of Toronto, Coursera, June 22, 2017*. [View Certificate]
- C Programming for Embedded Applications; *LinkedIn, September 2018*. [View Certificate]

Talks

- Invited talk at The student conference on The Future of Intelligent Sensing and Measurement, October 2019: *Sensing and Robotics Opportunities in Offshore Industries*.
- Invited talk at the Workshop on Advances in Electronics & Communication held at the Rajiv Gandhi University, Itanagar, March 2017: *Machine Learning and Deep Learning*.
- Invitation for a hands-on session at the workshop on Design and Deployment of Cyber-Physical Systems held at NIT Silchar, Assam, September 2018: *Tartarus: Deploying CPS*.