Shashi Kant Gupta

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EDUCATION

Indian Institute of Technology, Kanpur, India — Jul '16 - Jul. '21
Dual Degree BT-MT Student, Department of Electrical Engineering
Minor Degree in Cognitive Sciences
Supervisors: Dr. Gabriel Kreiman, Harvard Medical School and Prof. K. S. Venkatesh, IIT Kanpur
Master GPA: 10.0/10.0 | *Bachelor GPA: 8.8/10.0*

HONORS & ACHIEVEMENTS

- Founded Brain and Cognitive Society at IIT Kanpur (An interdisciplinary student society which aims to study brain science and reverse engineer human intelligence to create more general and intelligent Artificial Intelligence) [BCS@IITK Homepage]
- Fellowship awardee for the prestigious Khorana Program for Scholars 2019, IUSSTF (only 47 students were selected all over India to conduct research in the United States)
- Selected for a Summer Internship at SUTD Singapore in the second year (2018)
- Received Academic Excellence Award twice for outstanding academic performance (awarded to top 7% of students in the institute) for the year 2016 and 2016-17
- 99.89 percentile in Joint Entrance Examination (IIT-JEE 2016) among 1.5 million students
- Secured All India Rank 842 in KVPY 2015, a fellowship exam conducted by IISc Bangalore and funded by Department of Science and Technology, Govt. of India

WORKSHOP PAPER/ STUDENT ABSTRACT (PEER-REVIEWED)

Shashi Kant Gupta "Reinforcement Based Learning on Classification Task Could Yield Better Generalisation and Adversarial Accuracy", Workshop on Shared Visual Representations in Human and Machine Intelligence (SVRHM), *Neural Information Processing Systems 2020* (NeurIPS 2020) | Also accepted for AAAI-21 Student Tracks

Shashi Kant Gupta "A More Biologically Plausible Local Learning Rule for ANNs", Beyond Backpropagation Workshop, *Neural Information Processing Systems 2020* (NeurIPS 2020)

RESEARCH EXPERIENCE

Research Assistant, Kreiman Lab, Harvard Medical School, Boston, USA — May '19 - Ongoing
Computational Modelling of Human Vision and Visual Search

- Developed a biologically inspired deep learning based computational model of human visual system.
- The developed model was used to build a computational model of visual attention that could replicate the visual search performance of humans across various visual search tasks
- Current progress: Model fine tuning and preparing a draft towards a publication

Reinforcement Based Learning on Classification Task — May '20 - Ongoing

- Developed a novel method to train deep learning models on an image classification task which yields better generalization and adversarial accuracy. Empirical evaluation was done on CIFAR 10 dataset
- Tested the robustness of the trained model against FGSM, PGD, and AutoAttack adversarial attacks

Undergraduate Project, Prof. Nisheeth Srivastava, IIT Kanpur, India — Dec '18 - Apr '19
Introducing Spike-Timing-Dependent Plasticity in Multi-Layer Perceptron

- Derived a local learning rule based on spike-timing-dependent plasticity (found in Biological Neurons) that uses the information about only neighbouring neurons to get weight updates in an ANNs
- Empirical evaluation was done using IRIS & MNIST dataset on one vs all binary classification test

Research Intern, Dr Hock Beng Lim, Centre for Smart System, SUTD Singapore — Jun '18 - Jul '18
Using Optical Flow for Localisation of UAVs in Deep Tunnel

- Worked on the Optical Flow algorithm to determine UAV position in deep tunnels (GPS denied environment). Developed a novel method to correct the errors in inconsistent flow calculation
- Implemented Extended Kalman Filter to use acceleration data to improve the accuracy of prediction
- Demo presentation accepted at IEEE CCNC, Las Vegas, USA

Team Member, Humanoid IITK, IIT Kanpur, India — Dec '16 - Apr '19
Dean of Research and Development Project — [demo] [report]

- Helped the team in designing and developing the Institute's first Humanoid Robot (AUTOMI)
- Worked on developing the bipedal walking algorithm and Object Tracking module
- Lead the technical team as a head person from May '18 to Nov '18
- Team participated at Fira Huro Cup 2019, an international athletic event for humanoid robots

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KEY PROJECTS

3D Human Pose Estimation using Multi Camera — Feb '20 - Apr. '20
Undergraduate Project, Prof K. S. Venkatesh, IIT Kanpur — [code] [report]

- Used Cascaded Pyramid Network to extract heat maps for 2D human joints position
- Extracted 2D points from two camera were solved using the camera parameters to estimate 3D points

Real Time Human Facial Emotion Recognition — Nov. '18 – Dec. '18
Self Project — [demo] [code]

- Extracts human faces (using OpenCV haar-cascade/ dnn based classifier) from a camera stream
- CNN based classifier was designed and trained on the ICML 2013 FERC dataset (test-accuracy: 65.34%)

Relating Artificial Neural Networks with Brain — Sep. '18 – Nov. '18
Course Project, CS771 Machine Learning, Prof. Piyush Rai, IIT Kanpur — [pres]

- Literature review on biological plausibility of artificial neural networks
- Provided a mathematical explanation and simulation of how a rate-based neuron in conventional neural networks can be realised as a spiking neuron

Cooperative Localization Using Posterior Linearization Belief Propagation — Sep. '18 – Nov. '18
Course Project, EE602 Statistical Signal Processing, Prof. R. M. Hegde, IIT Kanpur — [code]

- Learned about and implemented Statistical Linear Regression using unscented transform on a chosen sets of sigma points to linearize the proposed non-linear model of sensor network
- Implemented the Belief Propagation algorithm to infer marginals for different sensor nodes

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PROJECTS MENTORED

Do Deep Nets Capture Color Based Emotions? — May '20 - Ongoing
Brain and Cognitive Society, IIT Kanpur
Students - Shivi Gupta

Comparing DNN Features with Psychological Representations — May '20 - Aug '20
Brain and Cognitive Society, IIT Kanpur — [poster]
Students - Abhishek Jain, Aditya Jindal, Amartya Dash, Sahithi Macharla, Sanket Agrawal

The Omniglot Challenge — May '20 - Aug '20
Brain and Cognitive Society, IIT Kanpur — [poster]
Students - Som Tambe, Nikita Chauhan, Anmol Pabla, Mohit Kulkarni

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OPEN SOURCE PROJECTS

jsPsychSheet — [24 Fork] [GitHub]

- Developed a JavaScript library to store online behavioral experiments data in Google Sheet

PixhawkArduinoMAVLink — [5 Fork] [GitHub]

- Developed an Open Source Arduino library to communicate between Pixhawk and Arduino

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TEACHING

EE604A Image Processing, *Sep 01, 2020 - Present* — [Link]

- Serving as teaching assistant for Image Processing course at IIT Kanpur. Responsible for developing a set of programming assignments for the course, grading assignments and test papers [120 students]

Brain and Cognitive Society Workshop, *Mar 28, 2020 - Apr 20, 2020* — [Workshop Page]

- Organised an introductory workshop on Basic Machine Learning, Computational Modelling, Psychophysics, Data Analysis and Experiment Design at IIT Kanpur [around 150+ participants]

Technical Skills

Languages: C • Python • Matlab • Javascript

Software and Tools: TensorFlow • PyTorch • Keras • Pyro (Beginner) • OpenCV • NumPy/SciPy • scikit-learn • jsPsych • PsyToolkit • ROS (Robot OS) • Git • Arduino • HTML/CSS • Jekyll

Relevant Courses

Cognitive Sciences
Foundation of Cognitive Science • Computational Cognitive Science • Neurobiology • Cognitive Neuroscience [o]

ML and Computer Vision
Introduction to Machine Learning • CNN for Visual Recognition [#] • Computer Vision: Foundations and Applications [#] • Optimization in Big Data [o] • Deep Learning Specialisation [o] [c] • Reinforcement Learning Specialisation [o] [c]

Signal Processing
Image Processing • Statistical Signal Processing • Digital Signal Processing • Signals and Systems

Mathematics and Algorithms
Basic Statistics, Data Analysis and Inference • Data Structures and Algorithms • Probability and Statistic • Fundamental of Computing • Linear Algebra

o - Ongoing | *# - Online Audit* | *c - Link to online certificates*

Talks and Tutorials

Artificial and Biological Neural Networks, *BCS @IITK*	[Link] **[Dec 12, 2019]**
Talk on Role of Brain Science in AI, *BCS @IITK*	[Link] **[Oct 25, 2019]**
Introduction and Quick Start to ROS, *Robotics Club, IITK*	[Link] **[May 29, 2017]**

Leaderships and Activities

Coordinator, *Brain and Cognitive Society, IIT Kanpur*	Oct '20 - Jul '20
Student Volunteer, *PRAYAS, IIT Kanpur*	Dec '18 - Jan '19
Technical Head , *Humanoid IITK Team, IIT Kanpur*	May '18 - Nov '18
UG Coordinator, *EEA, Dept. of Electrical Engineering, IIT Kanpur*	Aug '17 - Aug '18
Secretary, *Robotics Club, IIT Kanpur*	Apr '17 - Mar '18
Secretary, *Fine Art Club, IIT Kanpur*	Apr '17 - Mar '18
Student Guide, *Counselling Service, IIT Kanpur*	Aug '17 - Jul '18
Student Volunteer, *National Service Scheme, IIT Kanpur*	Aug '16 - May '17