### SHASHI KANT GUPTA

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**EDUCATION** Indian Institute of Technology, Kanpur, India

**Major:** Electrical Engineering

Minor: Cognitive Science
Aug. '16 – Jul. '20
GPA: 8.9/10.0 (Seven Semesters)
(Expected)

Munam Public School, Hazaribagh, India

**Intermediate** 

Percentage: 91.2% April 2016

**DAV Public School,** Hazaribagh, India

Matriculation

**GPA: 10.0/10.0** April 2014

#### **INTERESTS**

AGI • Cognitive Science • Computer Vision • Deep Learning • Reinforcement Learning • Robotics

# 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
- Won 3rd prize in Techkriti Innovation Challenge, conducted by Techkriti IIT Kanpur (2017).
- 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

#### RESEARCH EXPERIENCE

# Implementing Eccentricity Dependent Sampling into Deep Convolutional Neural Network

May. '19 - Ongoing

Dr Gabriel Kreiman, Harvard Medical School

- Implemented eccentricity dependent sampling (i.e., high acuity in the fovea, with decreasing acuity towards the visual periphery) into deep CNN models.
- The complete model was developed in **python** using **TensorFlow** module.
- Developed a computational model of vision and studying the effect on different visual tasks and comparing them with human performances.
- Presently, working on preparing a paper for the results that we found.

### Introducing Spike-Timing-Dependent Plasticity in Multi-Layer Perceptron

Dec. '18 - Apr '19

Guidance: Prof Nisheeth Srivastava, IIT Kanpur

- Derived a local learning rule based on spike-timing-dependent plasticity (aka STDP, assumed to be found in Biological Neurons) which uses the information about only neighbouring neurons to get weight updates in an ANN network.
- An empirical evaluation was done using **IRIS** and **MNIST** dataset on One Vs All binary classification test.

#### **Optical Flow for Localisation of UAVs in Deep Tunnel**

Jun. '18 - Jul. '18

Summer Internship, Dr Hock Beng Lim, Centre for Smart System, SUTD Singapore

- Worked on the Optical Flow algorithm based on SAD block matching to determine UAV position in deep tunnels i.e. GPS denied environment (coded in python, for actual prototype PX4FLOW was used)
- Developed an algorithm to correct the errors in inconsistent flow calculation
- Worked on implementing Extended Kalman Filter to use acceleration data to improve the accuracy
- Demo Presentation at IEEE Consumer Communications & Networking Conference, Las Vegas, USA

Humanoid IITK Dec. '16 – Apr '19

Team Member, Dean of Research and Development Project, IIT Kanpur

[ Video ]

- Helped the team in designing and developing the Institute's first Humanoid Robot (AUTOMI)
- Worked on developing the **bipedal walking algorithm**, designed a MATLAB simulation for the same
- Worked on Object Tracking using various computer vision algorithms in OpenCV
- Team participated at Fira Huro Cup 2019, an international athletic event for humanoid robots.
- Served as **Tech Head** for the team from *May. '18 Nov '18*

#### **KEY PROJECTS**

#### tf\_deepRL: RL library for TensorFlow

Mar. '20 - Ongoing

Self-Project

- Developing an RL library for python for easy building of deep RL model with TensorFlow as blackened.
- Features implemented: Vanilla policy gradient agent, continuous visualization of reward vs. epoch curve during training, custom environment creation, gym compatible, run environment without any actual display.

#### **How Close are Artificial Neural Networks to the Brain?**

Sep. '18 - Nov. '18

CS771A - Machine Learning, Prof Piyush Rai, IIT Kanpur

[Pres] [Report]

- Studied different types of **ANN** models to compare their structure and performance to realise their biological resemblance to the processing in the human brain
- Trained several neural network models on MNIST dataset to play with modelling of CNN and RNN.
- Tried explaining how a rate-based neuron in conventional NN can be realised as spiking neuron in SNN
- Studied variational EM method as explained by (Yoshua Bengio et al., 2015) on the biological plausibility of deep learning.

#### **Real Time Human Facial Emotion Recognition**

Nov. '18 - Dec' 18

Self Project

[Video] [Code]

- Extracts human faces (using OpenCV haar-cascade/ dnn based classifier) from a camera stream and classifies them into 7 different moods i.e. Angry, Disgust, Fear, Happy, Sad, Surprise and Neutral
- CNN classifier (with ensemble) was designed, which was trained on the **ICML 2013** dataset of Facial Expression Recognition Challenge on Kaggle to achieve an accuracy of ~**65.34%** on the private test data

#### **Cooperative Localization Using Posterior Linearization Belief Propagation**

Sep. '18 - Nov '18

EE602A – Statistical Signal Processing, Prof R. M. Hegde, IIT Kanpur

[Code] [Report]

- Implementation of a research paper, which presents the **PLBP** algorithm for cooperative localization
- Learned about and implemented **Statistical Linear Regression** using **unscented transform** on a chosen sets of **sigma points** to linearize the proposed non-linear model.
- Implemented the **Belief Propagation** algorithm to infer the marginals for different sensor nodes.

#### **Achieving CRLB in Sensor Network Estimation**

Sep. '18 - Nov '18

EE602A – Statistical Signal Processing, Prof R. M. Hegde, IIT Kanpur

[ Code ]

- Implementation of a research paper, which proposes a general framework to achieve CRLB bounds
- Successfully implemented the proposed method in MATLAB to produce the results

#### **SL-COM (Sign Language Communication)**

Mar. '17

Robotics Club, IIT Kanpur

- Patterns were generated using different hand gestures to produce different letters
- Produced letters were sent to a Chat-App, were a text2speech engine was used to produce voices
- Demonstrated the prototype in **Techkriti Innovation Challenge** and was awarded with the **3rd prize**

# OPEN SOURCE CONTR.

### jsPsychSheet

[ GitHub ]

Self-Project

Developed a simple JavaScript library for running behavioral experiments online

Open AI gymSome issue fixations for gym environment library

[ GitHub ]

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[ GitHub ]

DiCarlo Lab, MIT, USA

- Implement a new benchmark based on a visual search task

#### **PixhawkArduinoMAVLink**

[ GitHub ]

Self-Project

**Brain-Score** 

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

## RELEVANT COURSES

#### Machine Learning and Computer Vision

- Introduction to Machine Learning
- CNN for Visual Recognition (Stanford AI) [#]
- Reinforcement Learning Specialisation (Coursera University of Alberta) [o] [c]
- Computer Vision: Foundations and Applications (Stanford AI) [#]
- Deep Learning Specialisation (Coursera deeplearning.ai) [o] [c]

#### **Signal Processing**

- Statistical Signal Processing
- Image Processing

#### **Cognitive Science**

- Foundation of Cognitive Science
- Psychology of Language
- Psychology of Adjustment

#### **Mathematics and Algorithms**

- Data Structures & Algorithms
- Fundamentals of Computing [\*]
- Basic Statistics, Data Analysis & Inference [o]

- Signals, Systems and Networks
- Digital Signal Processing [o]
- Computational Cognitive Science
- Neurobiology
- Logic and Cognitive Science [o]
- Probability and Statistics
- Linear Algebra and ODE

\* - Exceptional Performance

c – Link to online course certificates

# - Online (Audit)

o - Ongoing

TECHNICAL SKILLS	Languages:	C • Python • MATLAB	
	Software and Tools:	TensorFlow • Keras • OpenCV • NumPy • ROS (Robot OS) • jsPsych Arduino • HTML/CSS • Jekyll	• PsyToolkit • Git •
LECTURES/ TALKS / TUTORIALS	[28-03-2020] to [20-04-2020]	Brain and Cognitive Society workshop covering topics on Basic Machine Learning, Computational Modelling, Psychophysics, Data Analysis and Experiment Design [BCS @IITK] [Around 150+ participations]	[Link]
	[13-12-2019]	Basic ML, Deep Learning Libraries and Google Colab [BCS @IITK]	[Link]
	[12-12-2019]	Artificial and Biological Neural Networks [BCS @IITK]	[Link]
	[10-12-2019]	Python, NumPy, SciPy, Matplotlib Tutorial [BCS @IITK]	[Link]
	[25-10-2019]	Talk on Role of Brain Science in AI [BCS @IITK]	[Link]
	[29-05-2017]	Introduction and Quick Start to ROS [Robotics Club, IITK]	[ Link ]
LEADERSHIP & ACTIVITIES	Founder and Coordinator Brain and Cognitive Society, IIT Kanpur		Jan. '20 – Now
	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