## SHASHI KANT GUPTA

Final Year Undergraduate
Dept. of Electrical Engineering
Indian Institute of Technology Kanpur

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EDUCATION

Indian Institute of Technology, Kanpur, India

Major in Electrical Engineering with Minor in Cognitive Science Aug. '16 – Jun. '20

GPA: 8.9/10.0 (Seven Semesters)

(Expected)

Mob: +917979088653

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 Neuroscience • Cognitive Psychology • Computer Vision • ML • Robotics

HONORS

**ACHIEVEMENTS** 

Founded Brain and Cognitive Society at IIT Kanpur

• 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

**PUBLICATIONS** 

Vishal Choudhary, **Shashi Kant Gupta**, Shaohui Foong, Hock Beng Lim "Distance Measurement for UAVs in Deep Hazardous Tunnels", Demo Presentation at IEEE Consumer Communications & Networking Conference (2019 IEEE CCNC), Las Vegas, USA

# RESEARCH EXPERIENCE

# Implementing Eccentricity Dependent Sampling into Deep Convolutional Neural Network Computational Models

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.
- Studying the effect of this model on different visual task and comparing it with human data.

# Introducing Spike-Timing-Dependent Plasticity in Multi-Layer Perceptron *Guidance: Prof Nisheeth Srivastava, IIT Kanpur*

Dec. '18 - Apr '19

- 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 a self-prediction-based algorithm to correct the errors in inconsistent flow calculation
- Performed various experiments to collect data samples to measure and analyse performance
- Worked on implementing **Extended Kalman Filter** to use acceleration data to improve 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**

### Brain-Score Project @ DiCarlo lab, MIT

Guided by Martin Schrimpf, MIT and Mengmi Zhang, HMS

Sep. '19 – Ongoing [Project Page]

- Implementing a new benchmark based on a **visual search task** for the project.

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

CS771A - Machine Learning, Prof Piyush Rai, IIT Kanpur

Sep. '18 - Nov. '18 [ Pres ] [ Report ]

Studied different types of **ANN** models to compare their structure and performance to realise their

- biological resemblance to the processing in the 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
- Worked on a more biologically plausible Deep Learning model (continued as a separate project)

## Real Time Human Facial Emotion Recognition

Nov. '18 - Dec' 18 [ Video ] [ Code ]

Self Project

- 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

#### **PixhawkArduinoMAVLink**

Jun. '18 [ Code ]

Self-Project

- Developed an Open Source Arduino library to communicate between Pixhawk and Arduino
- Used **MAVLink** messaging protocol to create the communication

#### **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 produces voices for the words
- Demonstrated the prototype in **Techkriti Innovation Challenge** and was awarded the **3rd prize**

# RELEVANT COURSES

#### **Machine Learning and Computer Vision**

- Introduction to Machine Learning
- CNN for Visual Recognition (Stanford AI) [#]
- Natural Language Processing [o]

 Computer Vision: Foundations and Applications (Stanford AI) [#]

### **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
- Fundamental of Computing [\*]

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

\* - Exceptional Performance

# - Online (Audit)

o - Ongoing

Languages:	C • Python • MATLAB • JavaScript TensorFlow • PyTorch • Keras • Brian (beginner) • OpenCV • NumPy • ROS (Robot OS) • Git • Arduino • HTML/CSS • Jekyll	
Software and Tools:		
[13-12-2019]	Basic ML and Deep Learning Libraries, 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 ]
Student Volur	nteer PRAYAS, IIT Kanpur	Dec. '18 – Jan. '19
Students Project Coordinator EEA, Dept. of Electrical Engineering, IIT Kanpur		Sep. '18 – Sep. '19
Technical Head Humanoid IITK Team, IIT Kanpur		May. '18 – Nov '18
<b>UG Coordinator</b> <i>EEA</i> , <i>Dept. of Electrical Engineering, IIT Kanpur</i>		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 NSS, IIT Kanpur		Aug. '16 – May. '17
	Software and Tools:  [13-12-2019] [12-12-2019] [10-12-2019] [25-10-2019] [29-05-2017]  Student Volum Students Projum Technical Head UG Coordinate Secretary Robe Student Guidents Guident Guident Guident Guident Guident Guident Guident Secretary Fine Student Guident Guide	TensorFlow • PyTorch • Keras • Brian (beginner) • OpenCV • Number of Student Volunteer PRAYAS, IIT Kanpur  Student Volunteer PRAYAS, IIT Kanpur  Students Project Coordinator EEA, Dept. of Electrical Engineering, IIT Kanpur  Secretary Robotics Club, IIT Kanpur  Student Guide Counselling Service, IIT Kanpur  Student Guide Counselling Service, IIT Kanpur  Student Guide Counselling Service, IIT Kanpur