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.

3D Human Pose Estimation using Multi Camera *Feb. '20 - Ongoing*
Undergraduate Project – Prof K S Venkatesh, IIT Kanpur
- Extraction of 2D joints position using Cascaded Pyramid Network
- Estimate of 3D poses using those 2D joints position and camera parameters.

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 gym ***[GitHub]***
- Some issue fixations for gym environment library

Brain-Score ***[GitHub]***
DiCarlo Lab, MIT, USA
- Implement a new benchmark based on a visual search task

PixhawkArduinoMAVLink ***[GitHub]***
Self-Project
- Developed an Open Source Arduino library to communicate between Pixhawk and Arduino

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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
- Signals, Systems and Networks
- Digital Signal Processing [*o*]

Cognitive Science

- Foundation of Cognitive Science
- Psychology of Language
- Psychology of Adjustment
- Computational Cognitive Science
- Neurobiology
- Logic and Cognitive Science [*o*]

Mathematics and Algorithms

- Data Structures & Algorithms
- Fundamentals of Computing [*]
- Basic Statistics, Data Analysis & Inference [*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 • PsyToolkit • Git • Arduino • HTML/CSS • Jekyll

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*

REFERENCES

Prof. Gabriel Kreiman
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