GAURAV KUMAR

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EDUCATION

Indian Institute of Technology, Kanpur *July 2014 - June 2018*
Bachelor in Technology **GPA: 9.0/10**
Department of Electrical Engineering **Minor: 9.2/10**
Minor in Machine Learning (Computer Science)

Chinmaya Vidyalaya, Bokaro steel City *2014*
All India Senior School Certificate Examination (Grade XII) **Percentage: 95.4** %

RESEARCH INTEREST

Computer Vision, Natural Language Processing, Machine Learning, Image Processing

WORK EXPERIENCE

Research Engineer, Samsung Research Centre, Bangalore, India July 2018 - Present
Member of Natural Language Processing Team

- Worked on building an End to End Dialogue Management System with focus on chit chat based systems.
- Designed a multi stream deep learning architecture leveraging techniques such as Graph Convolution Networks, Memory Networks and BERT to enrich the vector representation of a query. Reached 85% accuracy on Next Sentence Prediction Task with improved performance on the Precision@1 metric. Working on a research paper for a part of this work.
- Build a GAN based network along with an autoencoder for detecting out of domain utterances in a task oriented setting for social robot NLU. Improved upon existing baselines and integrated it in the complete ASR pipeline.

Research Internship, University of Tuebingen, Germany May 2018 - July 2018
Understanding physical properties of objects by visual cues using neural networks

- Worked on varying cloth videos to understand their material properties based on certain external parameters.
- Experimented with CNN+LSTM networks, 2 stream, multi loss networks along with optical flow for feature extraction
- Proposed **triplet loss function** for videos similar to FaceNet paper to get their low dimension representation.
- Results showed strong correlation between human perception of physical properties and neural networks in case of motion with the perceptual graph being logarithmic. Work published in Journal of Vision 2019.

Summer Internship, Samsung R&D Institute, Bengaluru, India May 2017 - July 2017
Secure Folder Automation Using Deep Learning

- Objective was to identify sensitive and confidential content in a document image by reading text inside the image and move them to a secure folder based on confidentiality of the content
- Applied various **segmentation techniques** to preprocess the input image and extracted image features to be fed sequentially as an input to a recurrent neural network. Deployed the model efficiently on Samsung phones

RESEARCH PROJECTS

Robust Principal Component Analysis and its applications January 2018 - April 2018
Term Paper, Convex Optimization *Supervised by Dr. Ketan Rajawat*

- Utilized Robust PCA to perform foreground-background separation in videos and image impainting
- Worked on methods such as alternating projections, IALM, gradient descent for extracting low rank and sparse components in a matrix. Used CVX Toolbox and ProPack Package in MATLAB to perform the experiments.

Converting Handwritten Mathematical equations to LaTeX January 2018 - April 2018
Course project, Image Modeling Techniques *Supervised by Dr. Tanaya Guha*

- Developed a deep learning based pipeline to convert handwritten mathematical equations to LaTeX from scratch.
- Incorporated edge detectors, Hough Transform along with other segmentation methods for pre-processing the image and built a novel tree structure based algorithm to identify multilevel superscripts and subscripts.

- Trained multiple classifiers including SVM's, CNN, Random Forests for symbol recognition and reached accuracies close to 98% even on complex trigonometric symbols. Awarded best project out of 20 others.

Machine Learning Techniques, Course Project, IIT Kanpur August 2017 - Nov 2017
Captcha Breaking *Supervised by Dr. Purushottam Kar*

- Objective was to build an efficient algorithm to break online squirrel mail client captchas using neural networks
- Performed feature engineering methods such as **clustering**, dominating color based **segmentation** to remove heavy noise and orthogonal cluttering through captcha text before feeding it to a character recognizer.
- Implemented variants of CNN models from scratch for character recognition and reached 98% accuracy. Entire Captcha breaking reached 85% accuracy for very noisy captchas and 98% for less noisy captchas.

Natural Language Processing, Course Project, IIT Kanpur January 2018 - April 2018
Detecting Semantically Similar Question Pairs *Supervised by Dr. Harish Karnick*

- Goal was to detect duplicate question pairs on Quora Question Dataset based on sentence semantics & structure.
- Experimented with Siamese LSTM's and attention based methods along with varied embedding approaches. Incorporated features from dependency tree to model syntactic information which improved the performance.
- Multiple such models with minor variations when used in ensemble generated accuracies close to 82%

Photo Editing Software, Image Processing, IIT Kanpur August 2017 - Nov 2017
Photo Editing Software *Supervised by Dr. Tanaya Guha*

- Built a photo editing software **using Matlab** to perform various image processing functionalities
- Operations such as red eye correction, auto enhancement, selective blur were successfully implemented in GUI
- Implemented **algorithms** such as **Non Local means**, **bilateral filtering**, **autoencoder**, **object detection**

ACADEMIC ACHIEVEMENTS

- Received **Academic Excellence Award** for exceptional academic performance in 2015-16 session at IIT Kanpur
- Secured **All India Rank 519** in IIT-JEE Advanced 2014 out of 1,50,000 eligible candidates
- Achieved **99.91 percentile** in JEE Mains Examination 2014 among 13,50,000 students
- Bagged **All India Rank 174** in KVPY-2013 organized by Department of Science and Technology, India
- Selected among **Top 225 in India** in SCRA examination 2014 conducted by UPSC among 0.28 million students
- Stood in National **Top 1.1** % in CBSE Senior School Certificate Examination 2014
- **Distinction** in All India Talent Search Examination 2010 organized by Children's Education Trust, New Delhi

TECHNICAL STRENGTHS

Computer Languages	C, C++, Python, Matlab, R, Javascript, Java
Software & Tools	Git, Keras, TensorFlow, TfLite, Vim, Bash, PyTorch, LaTeX, Android Studio
Operating Systems	Windows, Linux, Android

RELEVANT COURSES TAKEN

- **Computer Science:** Natural Language Processing, Machine Learning, Image Modeling Techniques, Data Structure & Algorithms, Design & analysis of algorithms, Principles of Database Systems, Fundamentals of Computing, Data Mining
- **Mathematics:** Partial Differential Equations, Linear Algebra, Probability & Statistics, Game Theory, Complex Variables, Calculus, Convex Optimization Techniques
- **Electrical Engineering:** Image Processing, Digital Signal Processing, Principles of Communication Systems, Digital Electronics, Control Systems Analysis, Information Theory

EXTRA CURRICULAR ACTIVITIES

- Got certified from Pracheen Kala Kendra, Chandigarh in **Tabla with distinction** in Theory and Practical
- Worked as **Executive** in **Alumni Contact program**, IIT Kanpur to raise alumni funds for institute
- Received **NCC cadet training** at 2-UP Regiment which involved various physical, social, and mental activities
- Designed and built a **car race game** on bread board using LED's, IC's, flipflops, counters and other components