Lakshay Tyagi

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Education

Indian Institute Of Technology Kanpur — *Kanpur, India*

Bachelor Of Technology, Major in Chemical and Electrical Engineering, Minor in Machine Learning — *Jul. 2017 - Jun. 2022[Expected]*

- CPI/GPA : **9.43/10.00**

Rajeev Gandhi Academy Of E - Learning — *Pune, India*

Class XII Maharashtra State Board Higher Secondary — *Jul. 2017*

- Percentage : 88.9%

DAV Public School Pune — *Pune, India*

Class X Central Board for Secondary Education — *Jul. 2015*

- CGPA 10.0/10.0

Publications

- **A. Tuladhar, *L. Tyagi*, R. Souza, ND. Forkert (2021): Federated learning using variable local training for brain tumor segmentation** Springer LNCS, Federated Tumor Segmentation Challenge at MICCAI 2021 (Accepted)
- **R. Souza, A. Tuladhar, P. Mouches, M. Wilms, *L. Tyagi*, ND. Forkert (2021): Multi-institutional travelling model for tumor segmentation in MRI datasets** Springer LNCS, Federated Tumor Segmentation Challenge at MICCAI 2021 (Accepted)
- **A Gupta*, A Pal*, B Khurana*, *L Tyagi**, A Modi: Humor@ IITK at SemEval-2021 Task 7: Large Language Models for Quantifying Humor and Offensiveness** SemEval-2021, ACL-ICJNLP 2021

** — Indicates Equal Contribution*

Internships

Federated Learning Techniques for Brain Tumour Segmentation [Publication]

Mitacs Globalink Research Internship, University of Calgary, Canada — *May 2021 - Aug. 2021*

- Developed resource efficient Novel Federated Learning Algorithms for applications in Brain Tumour Segmentation
- Worked on Parallelizing and Speeding Up the training of Federated Models on Compute Canada Clusters by utilizing multiple GPUs
- Experimented with Different Aggregation Functions for Federated Learning and proposed Novel Function Mixing Approaches
- Designed Training Techniques for Federated Models utilizing Learning Rate Decay and Early Stopping based on Validation Metrics
- Conducted Simulations to find best parameters for training Federated Models and submitted results for publication

Video Denoising using Deep Learning

Visual Intelligence Group, Samsung Research Institute - Bangalore — *May 2020 - Jul 2020*

- Implemented Kernel Prediction Networks, an Auto-Encoder based CNN architecture in Tensorflow and tested its performance
- Compared performance of four channel Bayer (Raw) and three channel RGB images for Denoising
- Experimented with combinations of VGG, L1 and Gradient Loss for Video Denoising and compared their performance
- Investigated the impact of Additional Noise estimates on Video Denoising results and their impact on Model Performance
- Achieved State of the Art SSIM (Strucutural Similarity Index) and PSNR (Peak Signal to Noise Ratio) on Samsung Burst Image Dataset

RollCam – Attendance Using Facial Recognition [Poster]

Nutanix Summer of Code, Department of Computer Science, IIT Kanpur — *May 2018 - Jul 2018*

- Worked with a team of five members to develop a Web-App with the ability to take attendance using CCTV cameras
- Performed real time facial recognition on Video Frames from CCTV camera footage using Microsoft Azure's Face API and OpenCV
- Developed a web portal using Django where new members can register and see their attendance along with the time they were absent
- Implemented E-Mail Support to send a warning to registered members if they were absent for more than a certain period of time

Research Projects

Large Language Models for detecting Humour and Offense [Publication]

Prof. Ashutosh Modi, Department of Computer Science and Engineering, IIT Kanpur — *Sep 2020 - Feb 2021*

- Utilized Deep Learning Models for rating texts based on Humor Labels, Offense Labels and Humor Controversy labels
- Tested the performance of NLP models like BERT, RoBerta, ERNIE - 2.0, DeBerta and XLNet in rating texts based on F1 score and RMSE values
- Developed a Multi Task Learning Framework to utilize auxiliary data-sets to address the problem of data scarcity
- Experimented with Multiple Model Ensembling Techniques from simple weighted averaging of outputs to using Latent Model Embeddings

Analysis of Bandit Linear Optimization Algorithms [Report]

Course Project, Convex Optimization, Prof. Ketan Rajawat, IIT Kanpur *Jan 2021 - May 2021*

- Implemented popular Online Convex Optimization Algorithms from scratch for solving the problem of Bandit Linear Optimization
- Conducted Rigorous Simulations to test these Algorithms and their sensitivity to Algorithm and Adversary Parameters
- Compared and contrasted the performance of these algorithms based on Regret Achieved, Running Time and Robustness to Parameter change
- Computed the empirical Regret and Running Time for these algorithms and contrasted it with the corresponding theoretical bounds

Full Frame Video Stabilization with respect to an Object [PPT] [Report]

Prof. KS Venkatesh, Department of Electrical Engineering, IIT Kanpur *Jan 2021 - May 2021*

- Developed a Computer Vision Algorithm to track objects in a Video and then stabilize the video with respect to the tracked objects
- Implemented YOLO based as well as Filter based tracking of objects and contrasted their results
- Stabilized the Videos with respect to the tracked object using Affine Transformation
- Implemented Naïve Video Completion of the stabilized video using a Median Frame Based Filling approach
- Utilized Spatio-Temporal Transformation Networks for Improved Deep Learning Based Completion of the stabilized video

Multipole Moments of Water Using Machine Learning [Report]

Prof. Vishal Agarwal, Department of Chemical Engineering, IIT Kanpur *Apr 2019 - Aug 2019*

- Computed the Multipole Moments for nearly 3000 dimer configurations of water via calculations in Gaussian
- Implemented Machine Learning Models like Multi-Layered Perceptron and Radial Basis Function Network for predicting Multipole Moments given input configuration of water molecules
- Trained the models on generated data to get a Machine Learning Model that can predict the Multipole Moments faster than solving complex equations using Gaussian

Topology Optimized MPI Communication

Course Project, Parallel Computing, IIT Kanpur *Jan 2021 - Apr 2021*

- Implemented Topology aware versions of MPI Collective Communication calls like BCast, Gather, Reduce and AlltoAllV
- Optimized Collective Calls for IITK csews Network Topology and performed simulations to compare performance with original MPI Calls

Reinforcement Learning

Association of Computer Activities, Department of Computer Science and Engineering, IIT Kanpur *Jan 2018 - Aug 2018*

- Studied about and implemented MDP, Monte Carlo, Dynamic Programming and Temporal Difference approaches of RL
- Implemented the Deep Q Network in Python and trained it to play pong

Awards and Honors

2021	**Ajai Agarwal Memorial Prize**, Best Academic Performance in the Department of Chemical Engineering	*IIT Kanpur*
2021	**Aedunuthula Prasad Memorial Scholarship**, Highest GPA in the Department of Chemical Engineering	*IIT Kanpur*
2021	**Mitacs Globalink Graduate Fellowship**, Awarded 15,000$ Scholarship from Mitacs for graduate studies	*Mitacs*
2019-20	**Academic Excellence Award**, Among top 10% of UG Students based on Academic Performance	*IIT Kanpur*
2017	**INSPIRE Fellowship Awardee**, Top 1% of Candidates in Class XII Maharashtra Board Examination	*Govt of India*
2017	**KVPY Scholarship Awardee**, Department of Science and Technology, Government of India	*IISC Bangalore*
2017	**National Standard Examination in Physics**, National top 1% Merit Certificate	*IAPT*

Relevant Coursework

Machine Learning : Probabilistic Modelling and Inference (A), Statistical Natural Language Processing (A), Introduction to Machine Learning (A), Convex Optimization (A*)

Computer Science : Parallel Computing , Data Structures and Algorithms (A), Computational Methods in Engineering (A), Introduction to Computing (A)

Electrical Engineering : Image Processing (A), Signals Systems and Networks (A), Digital Electronics (A), Micro-Electronics (A)

Mathematics : Probability and Statistics (A), Linear Algebra and ODEs, Multi-Variate Calculus, Real Analysis

Online Courses : Computer Hardware and Operating Systems, Sequence Models, Convolutional Neural Networks

A* - Grade given for Outstanding Performance

A - Grade given for Excellent Performance

Technical Skills

Programming Languages : Advanced : Python ; **Intermediate** : C/C++ ; **Basic** : Bash Scripting, Java, JavaScript

Softwares : MATLAB, LaTeX, MySQL, Gaussian

ML Libraries : TensorFlow, PyTorch, Keras, NumPy, Scikit-Learn, Scipy, NLTK

Others: MPI, Pandas, git, OpenCV, Matplotlib

Operating Systems : Unix/Linux, Windows