Harshvardhan

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Research Interests : Machine Learning, Optimization, Natural Language Processing, Learning Theory, Information Theory, Signal Processing, Deep Learning.

EDUCATION

INDIAN INSTITUTE OF TECHNOLOGY, KANPUR

BTech in Electrical Engineering,Minor in Artificial Intelligence
Expected Graduation in Jun 2019, CPI : 9.5/10.0

DELHI PUBLIC SCHOOL, BOKARO

AISSCE
May 2015,Overall Score : 95.4%

DELHI PUBLIC SCHOOL, BOKARO

AISSE
Grad. May 2013, CGPA: 10.0 / 10.0

PUBLICATIONS

- V. Singh, H. Vardhan, N. K. Verma and Y. Cui, "Optimal Feature Selection using Fuzzy Combination of Feature Subset for Transcriptome Data," 2018 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE), Rio de Janeiro, 2018, pp. 1-8.

ACHIEVEMENTS

- Received IIT Kanpur Academic Excellence Award for 2015-16 and 2016-17, awarded to top 10% students in a batch.
- Among top 1% in the National Standard Examination in Chemistry.
- All India Rank 263 in JEE Advanced 2015 and All India Rank 1324 in JEE Mains 2015 among 1.5 M students.
- All India Rank 341 in Kishore Vaigyanik Protsahan Yojana(KVPY) 2013 Examination
- Qualified for Indian National Mathematics Olympiad(INMO) twice(2013,2014)
- Qualified for National Talent Search Examination (NTSE) 2011

PROJECTS

CONSTRAINED STOCHASTIC COMPOSITIONAL DESCENT

Supervisor : Ketan Rajawat|August 2018 - Present | Undergraduate Project - II
Proposed 2 novel algorithms (vanilla CSCGD and accelerated CSCGD) for minimizing objective functions of the form $\mathrm{E}[f(\mathrm{E}[g(x)]]$ with constraints as $\mathrm{E}[h(x)] \leq \gamma$. Established bounds on the convergence rates as well as time-averaged constraint violation for the vanilla algorithm for constant step sizes for convex and strongly convex objectives under mild assumptions. Current work involves obtaining better bounds for the accelerated algorithm as well as simulating these algorithms to solve certain problems in queuing theory. Planning to submit a paper on this work in ICML 2019.

MYFOODREPO

Supervisor: Marcel Salathe,Martin Jaggi| May 2018 - July 2018|Summer@EPFL 2018 Research Intern
The MyFoodRepo project aims to produce accurate nutritional value estimates from images of food items. My work involved training the baseline Tortilla image classifier on a private dataset of food images, handling class imbalance in the data, setting up a coco-ui like segmentation interface on MTurk, and a webcrawler for obtaining further training data. Proposed methods to handle hierarchical classification performance.

ROBUST TRAINING FOR NEURAL NETWORKS

Supervisor: Purushottam Kar| January 2018 - April 2018 | Course project
Designed a novel alternating-optimization based training algorithm for a single hidden layer NN with ReLU activation by breaking the training procedure into 3 stages -sparse recovery for choosing the sign of weights and separate regression procedures for the positive and negative weights. Proved the rates of convergence for this algorithm under mild assumptions on the weights input.

FEATURE SELECTION USING FUZZY SETS

Supervisor: Dr Nishchal K. Verma | May 2017 – January 2018| Undergraduate Project - I

Designed a novel algorithm for cluster-sensitive feature selection which assigns fuzzy memberships to feature subsets selected by filter methods. Implemented the approach using mRMR filters and got improved cross-validation accuracy than mRMR on standard biological datasets like arcene, Prostate-GE and colon.

SMALL VARIANCE ASYMPTOTICS FOR SUBSPACE CLUSTERING

Supervisor: Piyush Rai| January 2018 - April 2018 | Course project

Analysed and implemented existing subspace clustering methods like MFA on Edward, with special emphasis on the small variance methods like MAD-Bayes and DP-Space, their applicability conditions and their deterministic interpretations.

GCNS FOR UNSUPERVISED MACHINE TRANSLATION

Supervisor: Harish Karnick| January 2018 - April 2018 | Course project

Proposed a novel algorithm for improving unsupervised translation performance using monolingual data only by incorporating Graph Convolutional Networks by Kipf et al. into the model proposed by Lample et al.

OUTLIER DETECTION USING LOGGARMA MODELS

Supervisor : Amit Mitra| August 2018- November 2018| Course Project

Implemented the GARMA(General Autoregressive Moving Averages) algorithm for exponential distributions from scratch in python. Implemented the GARMA-based outlier detection algorithm in this paper and obtained comparable results.

DIRECTION OF ARRIVAL AND SOURCE POSITION ESTIMATION

Supervisor : Rajesh Hegde|August 2018- November 2018| Course Project

Studied and implemented the papers Direction of arrival estimation based on information geometry and Source tracking using moving microphone arrays for robot audition from scratch in MATLAB, obtaining comparable results.

RECOMMEND A REVIEWER

Supervisor: Purushottam Kar| September 2017- November 2017 | Course project

Analyzed existing works on Paper-Reviewer Matching like the Toronto Paper Matching System. Implemented an Alternating Optimization approach to obtain both the weighted reviewer and paper vectors and the actual relevance matrix using a collaborative filtering approach. Proposed modelling authors of papers cited in the Experiment and Related Works Sections of the paper to be reviewed to improve reviewer selections.

TEMPORAL LOGIC MOTION PLANNING

Supervisor: Dr Indranil Saha | May 2017- October 2017 | Summer Research Project

Used LTLMoP, for synthesizing and simulating correct-by-construction reactive controllers using Linear Temporal Logic. Proposed a novel algorithm to extend this LTL controller synthesis to unmapped or incorrectly mapped environments by dynamically updating the strategy automaton.

AUTONOMOUS UNDERWATER VEHICLE

Supervisors: Dr. K.S. Venkatesh and Dr. Sachin Y. Shinde | Nov 2015-Jan 2017 | Student-run Hobby Group

Member,Electrical subsytem of AUV-IITK team which secured 2nd position on its debut attempt in NIOT-SaVe 2016. Designed and tested a battery management system for overcurrent and overdischarge protection, voltage division and measuring battery capacity for LiPo batteries. Installed and calibrated pressure sensor for depth measurement.

COURSEWORK

- Probability and Statistics
- Introduction to Machine Learning
- Probabilistic Modeling and Inference
- Statistical Signal Processing
- Game Theory and Mechanism Design
- Visual Recognition*
- Detection and Estimation Theory*
- Data Structures and Algorithms
- Learning Theory
- Digital Signal Processing
- Information Theory
- Wavelet Transforms for Image Processing
- Image Processing*
- Algorithmic Information Theory*
- Psychology of Language
- Natural Language Processing
- Digital Communication Systems
- Time Series Analysis
- Randomized Algorithms
- Computational Cognitive Sciences*
- Convex Optimization*

$* - Ongoing$

SKILLS

Programming
Matlab • Python • C++ • Bash

Simulators
Gazebo • Micro-Cap • Altium
Solidworks • LTLMoP

Frameworks
ROS •OpenCV • Arduino
Scikit-learn •PyTorch •Git

EXTRACURRICULARS

- Organized workshops, lectures and competitions and mentored students as a secretary for Robotics Club of IIT Kanpur
- Conducted remedial lectures, doubt clearing and personal mentoring sessions for freshman Mathematics courses in IIT Kanpur