Akash Kannan

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Education

Carnegie Mellon University (CMU) **Pittsburgh, PA**
Master of Science in Machine Learning, GPA: 4.33/4.33 (Major), 4.33 (Overall) Dec 2023
- Courses: Advanced Machine Learning, Convex Optimization, Statistics, Statistical ML, Graphical Models, ML for Large Datasets, Deep Reinforcement Learning (Ongoing)

Indian Institute of Science (IISc) **Bangalore, India**
Bachelor of Science in Mathematics, GPA: 8.93/10 (Major), 8.63 (Overall) May 2022
- Courses: Probability and Statistics, Stochastic Models, Machine Learning, Linear Algebra, Multi Variable Calculus, Real Analysis, Complex Analysis, Advanced Algorithms, Differential Equations

Awards

Competitions IIT (India Rank 453/1.2M (Main) 2018); GATE Mathematics (India Rank 10/19K, 2022); KVPY Exam (India Rank 143/50K, 2018)

Olympiads International Mathematics Olympiad & International Astronomy Olympiad (IMO 2016, IAO 2016, selected for nationals)

Fellowships

KVPY Fellow Earned the KYPY Fellowship, conferred by the Department of Science and Technology, Govt. of India, in recognition of performance in an aptitude test, interview, and consistent academic performance during undergraduate studies. Leveraged the fellowship to secure a fully funded B.S. (Research) undergraduate degree at IISc.

Research Projects

Unsupervised Domain Adaptation (Ongoing Project) **CMU**
- Developing provably working methods to perform optimally under Relaxed Label Shift type of distribution shift
- Provably shown sub-optimality of some existing unsupervised domain adaptation methods (like FixMatch) by constructing a general counter example impossible to be adapted optimally to due to information theoretic limitations of the methods

Graph Neural Networks **Graphical Models, CMU**
- Identified that graph node label assignments by GNNs tend to be non-smooth wrt the topology and that this can be a severe limitation in graphs where neighbors tend to be similar (Eg: citation graphs)
- Corrected by training two learnable models, one learns a suitable label propagation to predict soft labels and the other uses these soft labels together with node features to do end prediction
- Implemented in Python using PyTorch and tested on Cora and Citeseer. Deployed Graph Convolutional Networks (GCN) and Graph ATtention networks (GAT) as base models
- Established correctness of the method by decreasing the MAD metric which measures final feature distance between same class neighbouring nodes by 30-50% and observed strong correlation with accuracy
- Improved node classification accuracy by 5% over vanilla models. For low resource settings improvements were $>10\%$

Continual Test Time Adaptation **Visual Learning, CMU**
- Developed a novel method which uses Student Teacher Networks and Diffusion process to enhance predictions on out of distribution data
- Modified the ILVR technique to further preserve low level features to ensure retention of label information during diffusion process
- Implemented in Python using PyTorch and tested on Cifar10-C and a subset of ImageNet-C
- Improved by 2% (mean over 15 data shifts) compared to state of the art (CoTTA) on Cifar10-C and by 5% on ImageNet-C

Mixing Times of Markov Chains **IISc**
- Interpreted, documented theorems pertaining to mixing times of asymmetric simple exclusion process
- Simulated the Markov chain such that the additional space required scales logarithmic in number of states. Implemented in Python using only the NumPy library
- Verified and disproved conjectures pertaining to mixing time and other asymptotic properties using simulation
- Devised an efficient novel metric capable of indicating convergence to stationarity

Skills

Languages (*Intermediate*) Python, (*Familiar*) C++, SQL, MATLAB, LaTeX
Tools/Frameworks Pytorch, Pandas, Numpy, Tensorflow, Git, PySpark