CHIRAG GUPTA

Research Fellow, Microsoft Research India

t-chgupt@microsoft.com — https://aigen.github.io/

RESEARCH INTERESTS

I am interested in studying foundational aspects of machine learning, broadly including topics in optimization, learning theory, statistics and causality.

EDUCATION

Year	Degree	Institution (Board)	CGPA/%
2016	B. Tech, Computer Science & Engineering	Indian Institute of Technology, Kanpur	9.4/10 (distinction)
2012	XII	Delhi Public School, Pune (C.B.S.E)	95.6%
2010	X	Delhi Public School, Pune (C.B.S.E)	10/10 CGPA

PAPERS

· **ProtoNN: Compressed and Accurate kNN for Resource-scarce Devices**
Gupta, C., Suggala, A. S., Goyal, A., Simhadri, H. V., Paranjape, B., Kumar, A., Goyal, S., Udupa, R., Varma, M. & Jain, P.
International Conference on Machine Learning [ICML '17]
http://proceedings.mlr.press/v70/gupta17a.html
(patent filed and pending)

· **An Online Latent Perceptron Algorithm for Weakly Supervised Object Detection**
Gupta, C., Namboodiri V. & Kar P.
Internal technical report
https://aigen.github.io/online-latent-perceptron-object-detection.pdf

· **A Perceptron Algorithm for Latent Variables**
Gupta, C., Namboodiri V. & Kar P.
Internal technical report
https://aigen.github.io/perceptron-algorithm-latent.pdf

· **A Framework for Reduce Set Methods using Random Features**
Gupta, C., Muandet K. & Tolstikhin I. Schölkopf B.
Internal technical report
https://aigen.github.io/framework-reduce-set.pdf

ACHIEVEMENTS

· B.Tech in Computer Science and Engineering with distinction from IIT Kanpur.
· 3rd out of about 250 teams in ACM-ICPC Amritapuri Regionals, 2015 (team: tarjanhorse). Top team from IIT Kanpur in 2015, 2014 and 2013.
· Among ten teams selected from India for the Xerox Research Innovation Challenge, 2015-16.
· Selected as tutor for the introductory programming course ESC101 at IIT Kanpur (first semester, 2015-16).
· DAAD WISE scholar 2015 to the Max Planck Institute for Intelligent Systems, Tübingen, Germany.
· Joint Entrance Exam, 2012: Ranked 242 (top 0.05%) among 506,484 candidates across India.
· All India Engineering Entrance Exam, 2012: Ranked 13 (top 0.001%) among 1,137,256 candidates across India.
· Among 4 selected to represent India at the International Olympiad in Informatics, Italy in 2012.
· Stood 2nd all over India in the Indian National Mathematics Olympiad, 2010 and selected for International Mathematics Olympiad Training Camp (IMOTC), India.

RELEVANT COURSES

Data Structure and Algorithms - I and II — Theory of Computation — Statistical Techniques in AI and Data Mining — Cognitive Science — Machine Learning for Computer Vision — Computational Number Theory and Algebra — Topics in Linear Programming — Discrete Mathematics — Abstract Algebra — Introduction to Game Theory — Fourier Analysis — Principles of Programming Languages — Probabilistic Machine Learning — Online Learning and Optimization — Principles of Database Systems

RESEARCH PROJECTS

ProtoNN: Compressed and Accurate kNN for Resource-scarce Devices   link to ICML'17 paper
with Prateek Jain at Microsoft Research, India   *July'16 - Feb'16*

· Ideated and engineered a supervised learning algorithm with model sizes as small as just 1 kB of RAM.
· Small model-size enables millions of embedded devices to make prediction locally on the edge without relying on the cloud, thus resolving issues of privacy, latency, bandwidth and battery.

EdgeML: An ML library for machine learning on the Edge   link to repository
with Harsha Vardhan Simhadri at Microsoft Research, India   *Nov'16 - Aug'16*

· Implemented an efficient version of ProtoNN for large datasets with upto 100,000 labels like Wiki, Amazon.
· Uses completely parallelized Intel MKL calls for level 2 and level 3 blas routines.
· Engineered CILK calls at other bottlenecks. Fast memory mapped I/O to read large data/model files.
· Careful attention to vectorization, cache, memory alignment, storage assumptions, page table size.

Sparse linear regression   (in progress)
with Praneeth Netrapalli and Prateek Jain at Microsoft Research, India   *Sep'17 - now*

· Recovered bound from "On Iterative Hard Thresholding Methods for High-dimensional M-Estimation" [Jain et al, NIPS '14] with a simpler proof.
· Proposed an accelerated version of the hard-thresholding based gradient descent algorithm. Empirically verified to work better than state-of-the-art.
· Hypothesis: Better dependence of convergence on condition number, leading to better generalization.

A perceptron algorithm for learning latent variables   Technical report
with Purushottam Kar and Vinay Namboodiri, IIT Kanpur   *Jan'15 - Apr'16*

· Developed a perceptron-like algorithm to optimize the latent SVM surrogate [Yu and Joachims, ICML '15].

Reduced Set Methods in Kernel Machines using Random Features   Technical report
with Bernhard Schölkopf at the Max Planck Institute for Intelligent Systems, Tübingen   *May'15 - July'15*

· Explored an algorithm for reducing/compressing existing kernel expansions using Random Features [Rahimi and Recht, NIPS '07].

Analytics over Problem Management Records (PMRs) for automatic complaint resolution
IBM, India Research Labs, Delhi   *May'14 - July'14*

· Explored NLP and ML techniques for intelligent routing of complaint logs to the correct support team

RELEVANT COURSE PROJECTS

Stochastic Gradient Langevin Dynamics for MCMC sampling   Project report
CS772: Probabilistic Machine Learning   *Semester 8, under Prof. Piyush Rai*

· Proposed an improvement to the SGLD framework [Welling and Teh, ICML '11] with a Variance Reduction layer (SVRG).

Active learning for optimizing prec@k   Project report
CS773: Online learning and Optimization   *Semester 8, under Prof. Purushottam Kar*

· Proposed a natural extension to [Kar et al., ICML '15] for *actively* optimizing precision@k.
· Explored various sampling schemes empirically to determine which points to query for.

Transfer Learning using Self-Learning   Presentation
CS681: Machine Learning for Computer Vision   *Semester 6, under Prof. Vinay Namboodiri*

· Extended ideas from paper - 'Online Domain Adaptation From a Pre-Trained Cascade of Classifiers'.
· Explored efficacy of self-taught-learning. Self-learning uses a model trained on a supervised domain to tag data in another unsupervised, related domain, and uses the given tags to train a new classifier.

TECHNICAL KNOWLEDGE

Machine Learning	Iterative optimization, online learning, Bayesian inference, causal inference,
Learning Theory	PAC framework, Rademacher averages, VC-dimension, concentration inequalities
Algorithms	Computational algebra, quantum computation, randomized analysis
Mathematics	Probability and statistics, Fourier analysis, linear algebra, abstract algebra
Programming	C++, Python, Octave/Matlab, CILK, Intel MKL, gdb, bash

PARTICIPATION AT CONFERENCES AND SEMINARS

· International Conference on Machine Learning, Sydney, 2017
· IKDD Conference on Data Science, Pune, 2016
· Machine Learning Summer School, Tübingen, 2015
· Symposium on Learning, Algorithms and Complexity, IISc Bangalore, 2015

POSITIONS OF RESPONSIBILITY

· **Research Fellow Social Chair**, Microsoft Research (2016)
· **Coordinator**, Special Interest Group, Machine Learning, IIT Kanpur (2015 - 2016) [website]
· **Tutor** for ESC101, the introductory programming course at IIT Kanpur (2015)
· **Helper**, during Machine Learning Summer School (MLSS), Tübingen (2015)
· **Coordinator**, Association for Computing Activities (student body of CSE department) (2014-15)
· **Coordinator**, Card and Board Games Hobby Group, IIT Kanpur (2014-15)
· **Student representative**, Student Undergraduate Council (SUGC), IIT Kanpur (2013-14)
· **Senator**, Students' Senate, IIT Kanpur (2012-13)