Ashish Kumar

Ph.D Applicant in Machine Learning

CONTACT INFORMATION

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RESEARCH INTERESTS

Large Scale Machine Learning Applications

CURRENT POSITION

Microsoft Research India (Jul 2015 - Present)
Research Fellow Advisors: Dr Manik Varma and Dr Prateek Jain

EDUCATION

Indian Institute of Technology Jodhpur (Jul 2011 - May 2015)
B. Tech. in Computer Science and Engineering
CGPA: 9.84/10 (*Among top 3 in CSE department*)

PUBLICATIONS

A Novel Image Inpainting Framework using Regression
Ashish Kumar, Smriti Jain, Gaurav Bhatnagar, Q.M. Jonathan Wu
In Submission to *IEEE Transactions on Systems, Man and Cybernetics*

RESEARCH EXPERIENCE

On Device Prediction for IoT Applications (May 2016 - Ongoing)
Advisors: Dr Manik Varma and Dr Prateek Jain, Microsoft Research

- Several IoT application domains (Argriculture, Walking Cane) require low latency, low battery consumption, and might have limited cloud access; necessitating prediction on device
- 2KB to 16KB of RAM are typical of low end IoT devices, limiting ML models to this range
- Proposed Bonsai, a sparse low rank tree based non-linear classifier and implemented a hard thresholding based optimization routine to jointly learn sparse low rank projection and model parameters
- Experiments on 8 datasets show that Bonsai achieves accuracy of uncompressed SVMs, Neural Nets, kNN in just 16KB; gains upto 15% within 2KB over state-of-art compressed methods

Currently, we are extending Bonsai to Anomoly Detection, Multiclass and Extreme Multilabel Classification. **This work will be submitted to *ICML 2017***

Speeding up Bing Ranker & Compressing Malware Detector (Jul 2015 - Mar 2016)
Advisor: Dr Manik Varma, Microsoft Research

- Experiments with Bing Search data and Malware data showed that only a few of the extracted features are relevant in making predictions
- Proposed a sparse ranker/classifier as an extension to LDKL (non-linear tree classifier) & implemented a thresholding based procedure to learn sparse LDKL while optimizing NDCG@k/Accuracy
- Achieved 10x speed-up and 10x compression over the currently deployed Bing Ranker; also gained compression over the current Malware Detector (which need to fit in cache memory)

We are currently working with Microsoft product groups to ship our algorithm to production pipeline of Bing Ranker and Malware Detector

A Novel Image Inpainting Framework using Regression (Aug 2014 - May 2015)
Advisor: Dr Gaurav Bhatnagar, IIT Jodhpur

- Implemented Telea FMM in MATLAB (spatial & wavelet transform domain) and used Navier Stokes from OpenCV, as baselines
- Applied block-wise regression using SVM where blocks were identified using pixel variance on the input image after applying edge extension to it
- Evaluated the proposed algorithm with PSNR, UIQ and SSIM metrics on images corrupted with Random Noise, Text Noise and Real Noise

Paper in submission to *IEEE Transactions on Systems, Man and Cybernetics*

Parallel Sparse Matrix - Sparse Vector Multiplication (May 2014 - Jul 2014)
Advisors: Prof. Dr David Bader and Dr Jason Riedy, Georgia Institute of Technology

- Implemented and compared 5 different techniques of computing sparse matrix - sparse vector product in parallel (subroutine to dynamic Page Rank)
- Implemented performance portable version of sort & merge technique in OpenMP & observed up to 2x speed-up over other methods (compared on dynamic graphs simulated in Stinger Software)

Selected Projects

Virtual Edge Detection, MIT Media Labs Design Workshop (Jan 2015)
Advisor: Dr Rahul Bhargava, MIT Media Labs

- Worked with Blind School to develop a device (Raspberry Pi) to identify printed shapes/images
- The hand held device vibrated only at the outlines of a shape when hovered over the entire page
- Used an approximate edge detection method on thresholded image for extremely low response time

Smart Traffic Analyzer, IBM National Technical Challenge (NTC) (Sep 2014)

- Developed an algorithm to locate public buses in real time without requiring any hardware on buses
- Clustered the GPS data of commuters and marked large clusters moving together as buses and tracked them to identify bus routes; used filtering techniques to avoid false positives
- Implemented it as a mobile app and tested it on synthetic data modeled on Poissons Distribution

Secured 3rd Position Nationally for our novelty and implementation

Scholastic Achievements

Qualified for ACM-ICPC 2014 Onsite Gwalior Regionals & 2013 Amritapuri Regionals

Secured 3rd position in IBM NTC 2014 out of 75 participating teams

Selected on research merit for CRUISE-14, Georgia Tech, CSE (among 8 students selected worldwide)

Attended Microsoft Research Summer School on Machine Learning (2015) and IoT (2016)

All India Rank:10 in National Science Olympiad (2006)

Talks & Seminars

ML Algorithms for On-Device Prediction, Microsoft Research Redmond (Nov 2016)
Advisor: Dr Manik Varma and Dr Prateek Jain, Microsoft Research

Model Compression and Prediction Time speed-ups, Microsoft Research India (Sep 2015)
Advisor: Dr Manik Varma, Microsoft Research

A Novel Image Inpainting Framework using Regression, IIT Jodhpur (May 2015)
Advisor: Dr Gaurav Bhatnagar, IIT Jodhpur

Parallel Sparse Matrix - Sparse Vector Multiplication, Georgia Tech. (Jul 2014)
Advisor: Prof. Dr David Bader and Dr Jason Riedy, Georgia Institute of Technology

Extra Curriculars

Working with *Make A Difference Foundation* in Education Support (Sep 2016 - Ongoing)

Innovation and Incubation Center Coordinator at IIT Jodhpur (Jul 2013 - Mar 2014)

Literature Club Coordinator at IIT Jodhpur (Jul 2013 - Mar 2014)