

EDUCATION

Year	Degree & Institution	CGPA
2012 — ?	Ph.D candidate, Machine Learning applications, Computer Science & Engineering, University of Michigan	4.0/4
2016	M.S, Computer Science & Engineering, University of Michigan Data Mining Certificate, Michigan Inst. of Computational Discovery & Engineering, University of Michigan	4.0/4
2012	M.Tech, Electrical Engineering, Indian Institute of Technology (IIT) Madras Thesis on Learning Theory applied to Bandit problems in Reinforcement Learning	9.12/10 Rank – 1
2011	B.Tech, Electrical Engineering, Indian Institute of Technology (IIT) Madras (Minor: Operations Research)	9.12/10

PROFESSIONAL INTERESTS

- Design, build, deploy Machine Learning applications to solve real-world problems empirically
- Experience with varied forms of practical data, including Image, Speech, Text, Video, Motion-capture & other high-dimensional data

PATENTS & PUBLICATIONS

- **Publication:** "*Fractional Moments on Bandit Problems*". Ananda Narayanan B & Ravindran B. In the Proceedings of the 27th Conference on **Uncertainty in Artificial Intelligence** 2011 [[Paper1](#)]
- Master's Thesis: "*Control of Sample Complexity and Regret in Bandits using fractional moments*". Ananda Narayan. M.Tech. Thesis, Indian Institute of Technology (IIT) Madras, Apr 2012 [[Paper2](#)]
- **Patent:** "*Database Collection for Illumination Invariant Object Recognition*". Ananda Narayanan B, P Baheti, A Swaminathan, M Chari and S Diaz, to be submitted for US patent, Aug 2010 Affiliation: *Qualcomm* [[Patent1](#)]

ENGINEERING RESEARCH & PROFESSIONAL EXPERIENCE

- Long Short-Term Memory Recurrent Neural Networks (LSTM RNNs) learnt using **Deep Learning** techniques applied to Problem X ([ask for details](#))
- **LSTM RNNs** applied to Problem Y ([ask for details](#))
- LSTM RNNs applied to Problem Z ([ask for details](#))
- Deep Learning for Student Course Recommendation [[Medium article](#)] (Summer-Fall '15)
 - Formulated the given **Machine Learning** problem as 5 different optimization problems
 - LSTM RNNs performed best among all, try our production system at oversoul.eecs.umich.edu
- Improving Fraud Detection using Digital Links at **Amazon, Seattle** (Summer '14)
 - Scaled up **Machine Learning** pipelines: **4600** processors, **35000 GB** memory achieving 5-minute execution
 - Designed a new Machine Learning pipeline to replace existing prod: AUC perf. increase from **83%** to **90%**
 - Handled 2+ TB data with graphs upto 130 GB (50M nodes, 100M edges) using single-node in-disk scaling
- [Teaching] Taught graduate course Machine Learning (EECS 545) with prof. Satinder Singh Baveja (Winter '15)
- [Teaching] Taught Data Structures and Algorithms (EECS 281) with prof. Paoletti & prof. Darden (Fall '14)
- Predicting high-dimensional time-series data (Winter '13)
 - Developed a **Machine Learning test-bed** with **24** different model learning and feature learning algorithms
 - By thorough systematic search, demonstrated performance surpassing the state-of-the-art (**deep learning**)
 - Upto **10 times** more accurate predictions over existing state-of-the-art algorithms
- Time-series predictions for modeling text (Summer-Fall '13)
 - Developed in-disk, huge (100GB+), highly complex **Machine Learning** models
 - Demonstrated performances comparable to other state-of-the-art deep learning models

- Automated Diagnosis of Blood Loss during Accidents (Fall '12)
 - Applied **Machine Learning** algorithms to diagnose blood loss from vital signs (ECG, HF, GSR, etc.)
 - Demonstrated performances of **94.6%** on par with state-of-the-art models used in industry
- Master's Thesis – [Paper2] (Fall '11)
 - Proposed a unique model-free **Machine Learning** algorithm, for learning in a probabilistic framework with applications in contextual online advertising (Google Ads) & finance (Auctions, Pricing, Trading)
 - Proved the algorithm achieves the theoretically least possible regret – $O(\log(t))$ – as envisioned in 1985
 - Upto **20 times** faster learning over existing state-of-the-art algorithms in the literature
 - First algorithm in literature to introduce parametric control on learning for conflicting optimality criteria
- Wireless **Health Monitoring** System with Emergency Response [End-product Design] (Spring '11)
 - Designed a **Machine Learning** based life-saving ECG monitoring system that performs intelligent diagnosis alerting 8 most common cardiac abnormalities – National Contest Winner, Awarded \$6500
 - Examined the literature on QRS complex detection and ECG Classification algorithms
 - Devised a novel machine learning algorithm for classification of ECG abnormalities
- **Publication** springing up from a coursework, **Reinforcement Learning** – [Paper1] (Winter '10)
 - Proposed a novel *Machine Learning* algorithm using fractional moments; theoretically proved convergence
 - Proved the algorithm achieves theoretically least possible complexity ever attainable – $O(n)$
 - Demonstrated performance surpassing state-of-the-art techniques introduced in 2006 and 2010
- Research Internship at **Corporate R&D, Qualcomm, San Diego** – [Patent1] (Summer '10)
 - Employed object recognition & information theory in **Computer Vision** for augmented reality applications
 - Analyzed SIFT feature descriptors and their resilience to changes in illumination
 - Introduced new algorithms & demonstrated upto **10%** improvement in Object Recognition performance
- **Multi-Lane Speed Detection** using optical links [Press] (Winter '08)
 - Devised and implemented a Vehicle Speed Detector using low-power LEDs and field-tested for robustness
 - National Highways Authority (Govt. of India) is evaluating the design for installations across the country
 - IIT Madras has installed the speed detectors across the institute for permanent speed limit enforcement
- Research Internship at **University of Montreal, Canada** (Summer '11)
 - Developed & tested *feature tracking* algorithms for Intelligent Transportation Systems [**Computer Vision**]
 - Implemented modular design for grouping and tracking of vehicles with extensions to different features
- **Thread-Density Estimator** (Winter '09)
 - Designed a low cost thread-density estimator to ease handloom weavers' tiresome manual counting
 - Devised different **Image processing** algorithms using Radon Transforms, FFTs, Super Resolution, etc.
 - Reverse engineered an Optical Mouse to be used as a Camera

AWARDS & DISTINCTIONS

- **Google Artificial Intelligence Contest** 2010, Worldwide Rank: **55**; India Rank: **1**
- **National Winner** (Awarded \$6500), Texas Instruments India Analog Design Challenge 2010, among 93 teams
- **Gold Medalist**, Indian National Physics Olympiad 2007
- All India Rank **428** (among 2,50,000) in IIT-JEE, conducted by Indian Institutes of Technology
- All India Rank **153**, State Rank **3** (among 6,35,000) in AIEEE, conducted by CBSE
- **Top 1%** (among 30,000+), Indian National Chemistry Olympiad 2007
- **Top 1%** (among 30,000+), Indian National Mathematics Olympiad 2007
- **Placed 8th** in India, CBSE Group Mathematics Olympiad 2006 [Rankings]
- **First Place**, City Inter-School Mathematics Olympiad – 'Actuaria 2006'
- All India Rank **495**, Rank in Mathematics **113**, in National Science Talent Search Examination 2005
- **National top 0.1%**, Certificate of Merit, in CBSE Class X Mathematics Examination

COMPUTER SKILLS

- Programming Languages, Packages & Tools – C, C++, Python, MATLAB, Java, Scilab, OpenCV

RELEVANT COURSEWORK

Computer Science & Engineering			Systems & Signal Processing
Machine Learning	Computer Vision	Data Structures & Algorithms	Stochastic Modeling, Queuing Theory
Pattern Recognition	Image Processing	Advanced Operations Research	Probability & Random Processes
Advanced Reinforcement Learning		Game Theory	Analog and Digital Signal Processing