

# Ananda Narayan

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## EDUCATION

Year	Degree & Institution	CGPA
2016	4 <sup>th</sup> year Ph.D candidate, Computer Science & Engineering (specialized in Machine Learning applications), <b>University of Michigan</b>	<b>4.0/4</b>
2013	M.S, Computer Science & Engineering, <b>University of Michigan</b> Data Mining Certificate, Michigan Inst. of Computational Discovery & Engineering, <b>University of Michigan</b>	<b>4.0/4</b>
2012	M.Tech, Electrical Engineering, <b>Indian Institute of Technology (IIT) Madras</b> Thesis on Learning Theory applied to Bandit problems in Reinforcement Learning	<b>9.12/10</b> Rank – <b>1</b>
2011	B.Tech, Electrical Engineering, <b>Indian Institute of Technology (IIT) Madras</b> (Minor: Operations Research)	<b>9.12/10</b>

## 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 27<sup>th</sup> 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](http://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)
- Co-founder, AutoScientist.com ([ask for details on traction](#)) (Fall '15-Summer '16)
  - An intelligent automated assistant, to help data scientists in everyday workflow
  - Inspired by automaticstatistician.com; Was hard to productize custom needs of individual customers, though we were receiving more inbound RFPs than we could handle
  - ~ 2015 Q4: **Google** released Google Sheets "Explore" functionality pretty much covering our MVP features
- 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**)
  - Up to **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
  - Up to **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 up to **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 8<sup>th</sup>** 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