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Nilesh Kulkarni

Curriculum Vitae

Research Interests

Machine Learning, Artificial Intelligence, Natural Language Understanding, Computer Vision, Robotics.

Education

2011–2015 **Bachelors of Technology with Honors in Computer Science & Engineering and Minors in Electrical Engineering**,
Indian Institute of Technology (IIT), Bombay, CPI: **8.77/10**.

Publications

2016 **Robust Kernel Principal Nested Spheres**.
Suyash P. Awate*, Manik Dhar*, **Nilesh Kulkarni***
International Conference on Pattern Recognition (ICPR), Cancun, 2016

Industry Experience - Software R&D, Samsung Electronics, S. Korea

Mar 2016 - ongoing **Natural Language Modelling, Smart Input Panel**,
Research Associate @ Artificial Intelligence Lab.
I work on creating language models for English and Korean language using deep learning technologies majorly **recurrent neural nets(RNNs)**. I studied and applied dark knowledge and **transfer learning** to improve word perplexity. Then researched on applying model compression techniques such as **low-rank matrix factorization** and **node weight pruning** to create efficient models. The models are deployed on **mobile devices** which have memory limitations and inference time constraints. This improved on-device **keyboard predictions** and is currently bench-marked to be better than other solutions. The models were trained using **TensorFlow**.

Sept 2015 - Feb 2016 **Music Recommendation System, MILK Music**,
Research Associate @ Artificial Intelligence Lab.
I worked on developing a music-genre prediction engine for music tracks. The **genre prediction engine complements collaborative filtering** to serve music recommendations. Extracted useful data from multiple non-standard music meta-data sources. Derived relationships and dependencies between the various music genres. Visualized structure of music genres and designined algorithms for **genre similarity and user customization & de-customization**.

May 2014 - June 2014 **Machine Learning on Big Data**,
Intern @ Big Data Solutions Lab.
I worked on exploring the possibilities for distributed learning with decision trees and random forests. We successfully designed and implemented this algorithm on a Hadoop cluster.

Research Experience

July 2014 - May 2015 **Distributed Linear Programming Boost (LPBoost)**,
Undergraduate Dissertation, IIT Bombay.
Mentor: *Prof. Ganesh Ramakrishnan*

My thesis involved developing a **parallel** version for the **LPBoost** algorithm. The method involves two independent paradigms, **data parallelization** and **hypothesis space parallelization**. The formulation for the distributed Master problem was done using **Alternating Direction Method of Multipliers (ADMM)**. This allowed us to dis-entangle various variables in the joint optimization problem. The solution has a single master - multiple slave architecture. The slaves are required to solve the local optimization on the hypothesis/data space independently. Achieved consensus at the master propagating necessary penalties to the slaves. It is implemented in Akka. Report | Code

July 2014 - May 2015 **Kernel Principal Nested Sphere (KPNS)** ,
Undergraduate Research Project, IIT Bombay.
Mentor: *Prof. Suyash Awate*

Developed **KPNS** which is a kernel space statistical procedure. It is used to transform set of observations to independent un-correlated spaces called **Principal Spheres**. We achieve better performance on **Model compactness**, **Dimensionality reduction** , **Data Classification** [v.s standard methods]. The method derives its benefits from the unit norm kernel. The data lies on an unit hyper-sphere, implying a natural directional sense along the curved spherical surface. Paper

May 2013 - June 2013 **Approximate algorithms for exploration using a swarm of robots**,
Algorithms group, Technische Universitat, Braunschweig, Germany.
Mentor: *Prof. Sandor Fekete*

Researched on problems for unknown area exploration using a robot swarm. I worked on an Approximate algorithms and minimized overall error in navigation and localization with given minimum sensing capabilities of the robots.

July 2012 - May 2015 **Matsya, Autonomous Underwater Vehicle(AUV)**,
Research & Development Project, IIT Bombay.
Mentor: *Prof. Leena Vachhani & Prof. Hemandra Arya*

Worked as part of team for design and development of an AUV. The AUV, Matsya, is capable of navigating and performing pre-defined tasks based on the feedback from sensors. Matsya competes at the world's largest Underwater Robotics Competition – Robosub. Funded by **Naval Research Board, India**

- **Team Leader 2014**: Lead a 40 member team comprising of three divisions: Electronics, Software & Mechanical. Managed operations, logistics, recruitment and knowledge transfer
- **Software Lead, 2013** Leading a sub-division of 5 members. Involved in development of full system stack to ensure **fail-proof mission execution**

Semi-Finalist at Robosub 2012, 2013 & 2014. Recipient of **Institute Technical Color** (9 of 7000), 2014 and **Institute Technical Special Mention** (15 of 7000), 2013 for exceptional technical contributions in field of Robotics. Technical Paper|Website

Academic Achievements

- Secured **All India Rank 77** in IIT-JEE 2011, among 500,000 entrants
- Stood in **Top 1%** (in 30,000 students across India), to appear for Indian National Chemistry Olympiad, 2011 and the Indian National Physics Olympiad, 2011

Academics

Advanced Courses	Linear Optimization,Computer Vision,Image Processing, Medical Image Processing, Artificial Intelligence, Topics in Machine Learning..
Programming Proficiency	C, C++, Java, Python, MATLAB, Scala, Javascript, PHP, HTML, LaTeX, Django, Bootstrap, Numpy-scipy, Hadoop, Cuda, TensorFlow, Torch, Theano.

Teaching

2014 **Teaching Assistant**, *CS 210 Logic Design*.

2013 **Teaching Assistant**, Hands-on workshop conducted by NVIDIA in association with CUDA Center of Excellence, IIT Bombay.

Mentorship & Positions of Responsibility

2014-2015 **Department Academic Mentor**, mentored 9 sophomores.

2013-2014 **Technical Mentor**, mentored 4 teams on technical projects.

2012-2013 **Electronics Club Coordinator** , club catering to hobby electronics @ IIT.

Seminars

Oct 2014 **Generalization and Stability of Learning Algorithms**.
Mentor: *Prof. Saketh Nath J* Slides
Discussed and presented the paper, **"Generalization & Stability"**, by Olivier Bousquet & Andr Elisseeff. We discussed about stability of algorithms under Statistical Inference Learning .

Mar 2014 **Applications of Kalman Filters in Robot Localization**.
Mentor: *Prof. Pushpak Bhattacharyya* Slides
Discussed **Kalman Filters** and their application in Robot Localization and Navigation

Feb 2014 **Introduction to Robot Operating System: Creating software for Robots**.

Jan 2014 **Underwater Robotics: Developing AUVs**.

Projects

Autumn 2014 **Texture Classification and Reconstruction**.
Mentor: *Prof. Suyash Awate* Report|Code
Worked on **texton dictionary** based learning approach **(The Leung-Malik (LM) Filter Bank)** to model and represent visual textures. Used similarity of texton histograms for texture classification

Spring 2014 **Virtual Memory for Experimental OS**.
Mentor: *Prof. Dhananjay M. Dhamdhere* Report|Code
Worked design and implementation for effective handling of Processes. **Memory allocation**, **Swap space management**, with **Process swap in and out** for input-output operations in a virtual OS.

Autumn 2013 **Sequence Alignment on GPU's**.
Mentor: *Prof. Bernard Menezes* Report|Code
Implemented a Sequence Alignment problem on GPU's with parallel version of Needleman-Wunsch algorithm. Investigated Parallel Prefix and Diagonal based approach to solve the problem. Achieved $O(n)$ complexity as compared to $O(n^2)$ in the Serial Version.

Autumn 2012 **N Body Simulation**.
Mentor: *Prof. Varsha Apte* Code
Designed a simulation for interaction of particles under intermolecular forces viz., gravitation, electrostatic and nuclear. We used the **Barnes-Hut** Algorithm to optimize computation.

Professional References

- Jihie Kim
  Vice President
  Artificial Intelligence Lab, Samsung Electronics, Software R&D Center, South Korea
  jihie.kim@samsung.com

- Prof. Ganesh Ramakrishnan
  Associate Professor,
  Computer Science and Engineering,
  IIT Bombay
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- Prof. Suyash Awate
  Assistant Professor,
  Computer Science and Engineering,
  IIT Bombay
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- Prof. Leena Vachhani
  Associate Professor
  , Systems and Control Engineering,
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