Ameya Prabhu

http://drimpossible.github.io

Find Me

Research Interests

- Continual Learning
- Model Compression
- Bayesian Deep Learning
- Active Learning
- PAC Learning
- Graph Neural Networks

Past Interests

- Machine Learning Theory
- Submodular Optimization
- Language Modelling
- Analysis of Codemixed Data
- Knowledge Graphs in NLP
- Efficient Multimodal Representation Learning

Selected Courses

- Project: Graph Algorithms for Neural Networks
- Machine Learning
- Artificial Intelligence
- Computer Vision
- Advances in Natural Language Processing
- Digital Image Processing
- Distributed Systems
- Advanced Cryptography
- Programming Languages
- Data Structures
- Algorithms
- Project: Privacy in ML

Education

D. Phil. in Engineering Science October 2019 - Present
Advisors: Philip Torr and Varun Kanade, University of Oxford *CGPA: -*

B. Tech. (Honors) and MS by Research in Computer Science August 2014 - August-2019
Center for Visual Information Technology (CVIT), IIIT-H, India. *CGPA: 8.94/10 (Top 10%)*

Master's Thesis: Compressing Neural Networks Advisor: Dr. Anoop Namboodiri

The aim of my thesis is to understand various ways of compressing networks using methods ranging from pruning to quantization and knowledge distillation. The aim is to further develop these methods, evaluating the using CNNs across different tasks and architectures.

Publications

Ameya Prabhu*, Charles Dognin and Maneesh Singh. Sampling Bias in Deep Active Classification: An Empirical Study. EMNLP 2019.*

We show that uncertainty sampling with deep models exhibits negligible class, feature bias and is robust to critical algorithmic factors in contrast to previous literature. Also, samples actively collected show a surprisingly large overlap with supports of a SVM. These samples can be effectively generate compact surrogate datasets (5x-40x compression).

Ameya Prabhu*, Girish Varma* and Anoop Namboodiri. Deep Expander Networks: Efficient Deep Networks from Graph Theory. ECCV 2018 (Oral).*

We utilize Expander Graphs, that have excellent connectivity properties, to develop a sparse network architecture by making efficient connection patterns between layers in CNNs. Additionally, we develop highly efficient training and inference algorithms for such networks.

***Ameya Prabhu**, Vishal Batchu, Rohit Gajawada, Aurobindo Munagala and Anoop Namboodiri. Hybrid Binary Networks: Optimizing for Accuracy, Efficiency and Memory. WACV 2018 (Oral).*

We investigate the question of *where* to binarize inputs and show that binarizing the right areas in the network could contribute significantly to speed-ups, without damaging the overall accuracy as compared to end-to-end binarized networks.

***Ameya Prabhu**, Vishal Batchu, Aurobindo Munagala, Rohit Gajawada and Anoop Namboodiri. Distribution-Aware Binarization of Neural Networks for Sketch Recognition. WACV 2018 (Oral).*

We provide theoretical evidence that binary networks are potentially as accurate as infinite-precision networks and present a distribution-aware approach to binarizing deep networks that allows us to achieve the full capacity of a binarized network.

Ameya Prabhu*, Harish Krishna*, Soham Saha. Adversary is the Best Teacher: Towards Extremely Compact Neural Networks. AAAI 2018 (Student Abstracts)*

We propose a technique to train student-teacher networks with weak supervision. In addition, we propose a method to learn how to learn from the teacher by a unique strategy-having the student compete with a discriminator.

Ameya Prabhu*, Aditya Joshi*, Manish Shrivastava, Vasudeva Varma. Towards Sub-Word Level Compositions for Sentiment Analysis of Hindi-English Code Mixed Data. COLING 2016.*

We introduced Subword-LSTMs to incorporate linguistic priors in neural network architectures and show that it learns information about sentiment value of important morphemes. We present the important subwords learnt by our model in morpheme-level feature maps.

*Koustav Ghosal, **Ameya Prabhu**, Riddhiman Dasgupta and Anoop Namboodiri. Learning Clustered Subspaces for Sketch Based Image Retrieval. ACPR 2015 (Oral).*

We conjectured that sketches and images belong to different subspaces and obtain a cross-modal correspondence between the two. We use Cluster-CCA to project them onto a correlated lower dimensional subspace, for performing semantic-multimodal retrieval.

*Vinayak Athavale, Shreenivas Bharadwaj, Monik Pamecha, **Ameya Prabhu**, Manish Shrivastava, Deep Learning in Hindi NER: Tackling labelled data sparsity. ICON 2016 (Oral)*

I worked as a mentor, guiding a group of undergraduate students in performing NER on low resource languages like Hindi, showing that we can leverage unsupervised corpora to significantly improve the NER systems.

ML Frameworks

- Deep Learning: PyTorch, Keras & Tensorflow
- Parallel Computing: MPI, OpenMP & CUDA (Basic)
- Small Experiments: OpenCV, SciPy, & Scikit-Learn
- Languages: Python, C++ Java (Basic), Bash & Lua

Research Activities

Peer Reviewing Activities
AAAI 2020
ICCV 2019
CVPR 2019 (Outstanding Reviewer)

Grants & Scholarships
Google India Travel Grant
CVIT Student Travel Grant (2018-Present)

IIIT-H Activities

Overall Coordinator
The Economics Club
IIIT-H

Member
Constitution Drafting Committee
IIIT-H

Organizer
Kings of Machine Learning
Felicity '17

Writer
Eye to the Future
Tech & Society Column, Ping!
Newsletter , IIIT-H

Work Experience

Machine Learning Intern, Verisk Analytics, Aug '18 - Oct '19
Working on Uncertainty Estimation for Bayesian Deep Networks, Calibration of Neural Networks and Active Learning. Published in EMNLP '19 on the same.

Machine Learning Intern, IBM-Research, India, May '18 - Aug '18
Worked on performing trainless neural architecture search efficiently with limited computational resources, learning unsupervised representations for neural networks for IBM Watson. Submitted a paper (Under review) as a result of the internship. Awarded best intern poster for outstanding research done in the internship.

Undergraduate Research Assistant - CVIT, IIIT-H, From Jan '16 - Aug '18
Worked on developing compressed representations for limited resourced systems, starting off with neural network compression for CNNs in the domain of Computer Vision. Published two oral papers in WACV 2018 on Binary Networks as a part of the assistantship.

Undergraduate Research Assistant - LTRC, IIIT-H, Jan '15 - Jan '16
Worked on developing resources for enabling systems to work on low-resource Hindi-English Code-mixed data, along with contributing machine learning algorithms for the same. Published a full paper in COLING on Sub-word LSTMs as a part of the assistantship.

Machine Learning Intern - WizCal Inc., Monsoon '16

Analyzed the corporate data, developed their feature processing pipeline and designed time-series processing based algorithms to build intelligent meeting-scheduling systems.

Teaching Assistantships, 2015-2018

I contributed by teaching in tutorial sessions, setting and grading assignments, supervising course projects in the following courses:

- **Computer Vision** *(Spring '18)*: The graduate-level introductory machine learning course (Instructor: Prof. Anoop Namboodiri, CVIT)
- **Foundations of AI and ML** *(Sping '18)*: Introduction to machine learning in an educational initiative by IIIT-H for professionals. (Instructor: Prof. C.V. Jawahar, CVIT)
- **Statistical Methods in AI** *(Monsoon '17)*: The graduate-level introductory machine learning course (Instructor: Prof. Vineet Gandhi, CVIT)
- **Digital Signal Analysis and App.** *(Spring '17)*: The introductory undergraduate signal processing course (Instructor: Prof. Vineet Gandhi, CVIT)
- **Computer Programming** *(Monsoon '16)*: The introductory undergraduate programming course (Instructor: Prof. Anoop Namboodiri, CVIT)
- **Electronics Workshop-1** *(Spring '16)*: The undergraduate freshman year course primarily designing analog circuits with a hands-on component involving handling lab equipment. (Instructor: Prof. Madhava Krishna, RRC)
- **Digital Logic and Processor Design** *(Monsoon '15)*: The undergraduate digital processor design course consisting of boolean logic to sequential logic, ALU designs, and programming basic 8085-like processor (Instructor: Prof. Vijay Prakash, RRC)

ML Projects

Neural Algorithm for Artistic Style in Sketches, Spring'17
Implemented the style transfer paper to transfer color between two images experimenting with different loss functions for the content and style loss and extending it to color sketches, obtaining an automatic colorization method for sparse domains

Unsupervised semantic sentence retrieval for use in Chatbot Systems, Spring'16

Developed a system to semantically rank relevant domain-related sentences using KNN and Skip-thought vectors to the current sentences fine tuned on a scraped Reddit dataset and showed that it is better than using TF-IDF based inverted index.

POS Tagging using Seq-Seq LSTMs posing it as SMT task, Monsoon'16

Implemented a sequence to sequence system for POS Tagging by modeling it as a statistical machine translation task, aimed at capturing dependencies from all over the entire sentence, instead of a specific window of words. It failed to beat standard tagging methods.

Structured Tensors for Large Scale SBIR, Monsoon'15

Implemented a Sketch based Image Retrieval (SBIR) system using Structure Tensors & Sketch Tokens. This allows fast online addition of new images to the database and efficient querying them by new and old Sketches.

NLIDB System for processing Natural Language Queries, IASNLP Summer School '15

Developed a simple baseline Natural Language Interface to Database (NLIDB) system to convert a Natural Language (NL) query into a Structured Query Language (SQL) and then use the SQL query to retrieve information from databases.

Programming Projects, 2015-Present

- Implemented a distributed banking sytem, and cryptographic protocols using Diffie-Hellman Key Exchange Protocol using Java RMI.
- Implemented various parallel algorithms like sorting, computing MSTs and the games like Game of Life in MPI.
- Implemented a compiler for a subset of the C language using Flex and Bison for parsing, followed by generating ASTs and conversion to LLVM intermediate representations.
- Implemented graph and string processing algorithms along Data Structures like Seg-Trees, AVL-trees, Hash-Maps for Data Structure and Algorithms courses.
- Developed a mobile app security framework with a pipeline consisting of automatic decompilation from .apk to .java code, with static and dynamic code flow analysis along with various signature detection algorithms.
- Developed a bash shell in C++.

Past Achievements and Awards,

- Dean's Merit List holder for outstanding performance in Academics.
- Dean's Undergraduate Research Award holder for outstanding publications.
- Best intern poster awardee, IBM-Research for research performed during internship.
- Selected among the top 40 in India for International Chemistry Olympiad Training Camp (IChOTC)
- Selected in KVPY programme by Indian Institute of Sciences (IISc) in top 100 in India

Workshops, Conferences and Schools Attended, 2015-2018

- Attended NeurIPS 2018 in Montreal, Canada and CVPR 2019, Long Beach to get more exposure to current research problems.
- Presented my work on Deep Expander Networks in an oral session at ECCV 2018 in Munich,Germany
- Presented my two works on Binary Networks in oral sessions at WACV 2018 in Lake Tahoe, CA/NV, USA and in R&D Showcase, IIIT-H
- Presented my Subword-LSTM work in a poster session at COLING 2016 in Osaka, Japan and in R&D Showcase, IIIT-H
- Completed the 1-week Undergraduate Summer School on Computer Science CSA, IISc Banglore (CSAUSS 2016)
- Presented my work in a talk on *Learning Clustered subspaces for SBIR* at ACPR 2015 in Kuala Lumpur, Malaysia and at the annual R&D showcase in IIIT-H- 2015
- Completed the 2-week IIIT-H Advanced Summer School on NLP (IASNLP-2015)