Shriram Sutty Bhoovendran

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Education

B.Tech. with Honors in Computer Science and Engineering **2015 - 2019**
Indian Institute of Technology Bombay, Mumbai, India *GPA: 9.56/10.00*

Interests

Artificial Intelligence, Systems

Research Experience

Continual Learning in Neural Networks [Report] **IIT Bombay**
Bachelor's Thesis | Advisor: Prof. Sunita Sarawagi *Jul 2018 – May 2019*

- Conducted a literature survey on methods to overcome catastrophic forgetting and on class-incremental learning
- Showed inability of methods such as Elastic Weight Consolidation to extend to class incremental setting
- Proposed and compared methods such as selective sampling, triplet loss, cosine similarity, distillation for class-incremental learning

Dynamic Memory Management for Training Neural Networks [Initial Report] **IIT Bombay**
Research Project | Advisor: Prof. Purushottam Kulkarni *Jan 2018 – July 2018*

- Worked on a memory manager for training Neural Networks on GPU which dynamically transfers data between CPU and GPU memory to overcome GPU memory bottleneck. Implemented vDNN - a previous work - using CUDA
- Improved training time of vDNN by removing synchronization of computation and transfer of data
- Reduced the memory consumption on CPU-side by compressing data using CPU cores
- Identified the problem of memory fragmentation in vDNN and experimented with different heuristics to reduce it

Local Max-Cut in Smoothed Polynomial Time [Report] **EPFL, Switzerland**
Research Internship | Advisor: Prof. Ola Svensson *May 2017 – Jul 2017*

- Worked on showing that the FLIP algorithm – a local search algorithm for finding local max-cut in a graph – has smoothed polynomial time complexity for general graphs
- Studied previous work showing polynomial complexity for complete graphs and bounded degree graphs
- Showed limitations of extending similar ideas to prove polynomial complexity for arbitrary graphs
- Proved smoothed polynomial time for some special class of graphs which generalize a combination of complete and bounded degree graphs

Publications

- **Dynamic Memory Management for GPU-based training of Deep Neural Networks** [Paper]
  Shriram S B, Anshuj Garg, Purushottam Kulkarni
  Accepted at 33rd International Parallel and Distributed Processing Symposium (IPDPS), 2019

Key Projects

Overcoming Forgetting in Batch-RL | Reinforcement Learning [Report] **Autumn 2018**

- Retained experience learnt from previous batches using Synaptic Intelligence – an idea to avoid catastrophic forgetting
- Learnt Q-values with neural network using batch-RL and experience replay, regularized with Synaptic Intelligence
- Reduced the amount of experience per batch required and improved the rate of convergence during training

Flow-Based Image Abstraction | Digital Image Processing **Autumn 2018**

- Used line drawing, region smoothing and quantization to convert natural image to cartoon-like images
- Used Edge Tangent Flow (ETF) to steer Difference of Gaussian (DoG) filter and 1-Dimensional bilateral filter which helps preserve feature directionality and get coherent lines compared to using isotropic spatial kernel

Rationalizing Neural Predictions | Machine Learning **Spring 2018**

- Experimented with two methods which provide reasoning behind prediction of neural networks in the context of sentiment analysis using textual product review
- Implemented RNN with Soft Attention mechanism to predict ratings of the product. Used k-means clustering of attention weights to select segments in review justifying the prediction
- Implemented a paper on Encoder-Generator model, where Generator extracts rationales using seq2seq RNN model and Encoder predicts sentiments using RNN encoder model

Intelligent Pacman Agent | Artificial Intelligence [Initial Report] **Autumn 2017**

- Explored genetic algorithm for training neural network using survival of the fittest, cross breeding and mutation
- Implemented algorithms and heuristics – Expectiminimax with alpha-beta pruning, Q-learning – which improved performance and time required for training
- Performed inference using Particle Filters and Dynamic Bayesian Nets to track invisible ghosts' approximate positions

Network of ATM Controllers | Digital Logic Design **Spring 2017**

- Designed an ATM network – ATM controller front-end on FPGA and database back-end on PC, connected by USB and with Ethernet connection across FPGAs
- Designed state machine for each module of controller and USB communication and implemented them in VHDL
- Designed and implemented protocols for communication through Ethernet across FPGAs

Tennis Ball Tracker | Computer Vision **Summer 2016**

- Designed a system for automatic tracking of tennis ball similar to Hawkeye used for Tennis
- Used two cameras to determine 3D coordinates of the ball using the method of triangulation. Used OpenCV library to determine the pixel coordinates of ball in the image
- Interpolated trajectory in video frames and found the approximate point of contact from calculated trajectory

Other Projects **IIT Bombay**

– **Compiler for Subset of C:** Developed a compiler for generating MIPS code using python lex and yacc. Supports control flow statements, loops and function calls

– **LDAP Authenticated Chat App:** Built multi-client, terminal based chat application using socket programming in Python. Implemented group chats, offline messaging, local message caching, last seen and currently online

Industry Experience

CiA402 Servo Drive over EtherCAT protocol **Texas Instruments**

Software Intern *May 2018 – July 2018*

- Provided support for Motor Control over EtherCAT protocol for synchronous control of multiple servo motors
- Implemented a standard interface – CiA402 Drive Profile – on EtherCAT slave side for exchange of position/velocity of motor between EtherCAT master and slave
- Provided generic interface support for three position encoder - EnDat, Hiperface DSL, Tamagawa

Scholastic Achievements

- **Department rank 5** in a batch of 121 students, 2018
- Secured **Advanced Performer** (AP) grade for exceptional performance in the courses Linear Algebra, Digital Logic Design Lab and Automata Theory
- Awarded Gold medal for being among the **top 35** students in Indian National Physics Olympiad, 2015
- Awarded Kishore Vaigyanik Protsahan Yojana **(KVPY)** Scholarship, 2015 by Department of Science and Technology, Govt. of India
- Received a **Letter of Appreciation** from the Human Resource Development Minister of India for exceptional performance in All India Senior Secondary Examination, 2015
- Among **Top 1%** in nation in National Standard Examination In Physics (NSEP), 2014

Teaching Experience

Undergraduate Teaching Assistant

- Operating Systems and Lab — Autumn 2018
- Digital Logic Design Lab – **TA of the month award** for January and February — Spring 2018

Responsible for setting lab questions, helping students with basic concepts of the subject and lab exercises and assisting instructor in evaluating the students

Technical Skills

Programming	Fluent in C, C++, Python; Familiar with Java, Embedded C, VHDL
Libraries/Software Skills	Tensorflow, PyTorch, OpenCV, Matlab, Git, LaTeX
Web Development	HTML, CSS, Javascript, Django, PostgreSQL

Extra-curricular Activities

- Secured **1st position** in Line Follower Competition, a one week autonomous line-follower bot making event organised by Electronics Club, IIT Bombay (2016)
- Developed game of 4-color using C# in Microsoft code.fun.do – a 3-day hackathon (2016)
- **Runner-up** in Institute Tennis General Championship (2017)
- Awarded **Bronze medal** in Institute Freshmen Tennis Open (2015)

Relevant Courses Undertaken

- **Artificial Intelligence:** Machine Learning, Probabilistic Graphical Models, Intelligent and Learning Agents, Artificial Intelligence, Digital Image Processing
- **Systems:** Computer Networks, Operating Systems, Computer Architecture, Digital Logic Design
- **Others:** Automata Theory, Compilers, Network Security, Logic in Computer Science, Data Structures and Algorithms, Discrete Structures, Database Systems

References

Upto 3 available on request