Rishubh Singh

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Education

Indian Institute of Technology, Delhi **July 2014 – May 2019**
Bachelor of Technology in Computer Science *GPA 8.95/10*
Master of Technology in Computer Science *GPA 8.23/10*

Publications

FLOAT: Factorized Learning of Object Attributes for Improved Multi-object Multi-part Scene Parsing
***Rishubh Singh**, Pranav Gupta, Pradeep Shenoy, Ravi Kiran Sarvadevabhatla*
Accepted at CVPR 2022.

Robustifying Deep Vision Models Through Shape Sensitization
*Aditay Tripathi, **Rishubh Singh**, Anirban Chakraborty, Pradeep Shenoy*
Under review.

How much complexity does an RNN architecture need to learn syntax-sensitive dependencies?
***Rishubh Singh**, Gantavya Bhatt, Hritik Bansal, Sumeet Agarwal*
Accepted for poster presentation at the ACL Student Workshop 2020.

Research Experience

Pre-Doctoral Researcher **September 2020 – Present**
Google Research India : Cognitive Modeling and Machine Learning Group

Human inspired deep learning models for computer vision

Multi-object multi-part scene segmentation *Published at CVPR 2022*

- Designed a scalable modeling framework based on label-space factorisation.
- Designed an inference-time zoom refinement technique that improves segmentation performance on small objects/parts.
- Propose the most comprehensive and challenging version of the Pascal-Part segmentation dataset : Pascal-Part-201.
- Achieve SoTA on all Pascal-Part versions (by complexity) beating the previous SoTA by over 8% mIOU for Part-201.
- Show larger improvements on pqIOU, a fairer version on mean IOU that weighs object/parts of all size equally.
- Working on object shape and orientation aware multi-object multi-part segmentation network.

Robust deep vision models through through shape sensitization *Under Review*

- Propose a simple, lightweight adversarial augmentation technique that explicitly incentivizes shape learning in a classification setting. Augmeted images supplement clean data during training.
- The augmentations superpose edgemaps from one image onto another image with shuffled patches, using a randomly determined mixing proportion, with the image label of the edgemap image.
- Obtain ImageNet classification accuracy gains of upto 6% over vanilla ViTs.
- Obtain large gains of 28% (Acc@1) on ImageNet-A and 16% (mCE) on ImageNet-C for ViT-B. Other ResNet and ViT models show similar gains on out-of-distribution datasets.

Interpretable and robust image classification *In Progress*

- Propose a segmentation bottleneck to localise object pixels and latent representation.
- Train the bottleneck through distant supervised classification on ImageNet-1K.
- Obtain upto 3% improvements on ImageNet-C for convolutional networks.

Improving deep learning models for production deployment

- Improved the performance of a number of views prediction model by 1-5% through multiple feature additions.
- Designed and led experiments for modeling changes - from recurrent nets to transformers.

Master's Thesis **July 2018 – April 2019**
Indian Institute of Technology Delhi *Published at ACL Student Workshop 2020*

- Analyzed neural nets that are structurally and biologically more plausible and replicate human behaviour.
- Compared various recurrent models like EIRNNs, LSTMs, RNNs against human performance to better understand cognition on high level tasks like learning subject-verb agreement.
- Showed that vanilla RNNs are significantly inferior to LSTMs on tasks like learning grammaticality.
- Showed that no one recurrent architecture performs best at all/most types of sentences.

- Proposed a new model : Decay RNN which is biologically more plausible while performing almost at par with LSTMs.
- Paper accepted at the ACL Student Workshop 2020.

Summer Undergraduate Research Award **May 2016 – February 2017**

Indian Institute of Technology Delhi

- Parallelized a Dynamic Verification Engine (INSPECT) that verifies parallel programs for correctness.
- Parallelized the dynamic partial order reduction algorithm using parallel depth first search algorithm.
- Used MPI and workload sharing to achieve an efficient optimisation reducing runtime by upto 5 times.

Teaching Experience

PreDoc Researcher **September 2020 – Present**

Google Research India

- Advising two students from IIIT Hyderabad on the project : object shape and orientation aware segmentation models.

Teaching Assistant **Fall 2017 – Spring 2019**

Indian Institute of Technology Delhi

- TA'd 4 courses in the last 2 years of my dual degree. These included courses on Artificial Intelligence, Quantum Computing, Parallel Computing and Computer Architecture.
- Responsibilities ranged from holding doubt solving sessions, assignment creation and grading, paper grading and ad-hoc QA over Moodle.

Engineering Experience

Software Engineer **July 2019 – August 2020**

Graviton Research Capital LLP *Gurgaon, India*

- Focused on code optimisation at the compiler, OS and hardware levels to ensure the fastest processing of market events.
- Responsible for writing and maintaining the backend of four markets traded by the company.
- Experienced in navigating complexities and setting up the backend for new markets.

Software Engineering Intern **May 2018 – August 2018**

Google *Mountain View, USA*

- Designed and created an API to generate customizable images/videos given camera specifications and orientation from Street View data.
- Parallelized the internals of data generation of the API using Flume obtaining a 10x increase in efficiency.
- Synthesized videos (over 100GBs) are supplementing existing collected data and are being used to train and test internal algorithms and ML models at scale.

Software Engineering Intern **May 2017 – July 2017**

Google *Mountain View, USA*

- Built a system to filter false on-call escalations and remove noise from the feedback and monitoring system.
- Improved the ad serving system to reduce the loss of ad impressions, having direct revenue impact.
- Worked with external (to Google Fiber) API's, DFP (Ad server), Spanner(large scale database) and a pipeline based task processing system.

Selected Achievements

Competitive Coding

- Qualified for ACM-ICPC Amritapuri Regional 2015 and secured 71st rank in India.
- National Top 25 in Indian National Olympiad in Informatics(INOI), selected and participated in International Olympiad in Informatics(IOI) Training Camp 2013 and 2014.

Scholastic Achievements

- National Top 40 in Indian National Astronomy Olympiad(INAO) and attended the Astronomy Orientation Camp in 2014. Top 300 in 2010 and 2011 in the same.
- Scholarship under National Talent Search Examination(NTSE) - 2010 by Govt. of India.
- National Rank 36 and fellowship under Kishore Vaigyanik Protsahan Yojana(KVPY)(Young Scientist Program) - 2013 conducted by IISc Bangalore and Govt. of India.

Extra Curricular

- Attended a semester (5th) exchange to the prestigious KTH Royal Institute of Technology, Stockholm, Sweden.
- Selected for the JENESYS program among Top 10 students from CISCE schools. A 10 day cultural exchange initiative between the Ministries of Foreign Affairs' of India and Japan.