Divyam Goel

Deep Learning Junior Researcher
Rephrase.ai
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Education

Indian Institute of Technology Roorkee
Roorkee, India

B.Tech. in Electronics and Communications Engineering
2018 - 2022

- Cumulative Grade Point Average - **9.04/10.0**

Delhi Public School Gurgaon
Gurgaon, India

Senior Secondary Education
2014 - 2017

- All India Senior School Certificate Examination - **93.75%**
- All India Secondary School Examination - **9.8/10.0**

Publications

Language Guided Meta-Control for Embodied Instruction Following
EAI @ CVPR 2022

Divyam Goel | Kunal Pratap Singh | Jonghyun Choi
Paper Link

- Proposed a language-guided meta-controller that learns more robust task-agnostic representations, with stronger associations between language instructions and the underlying actions taken by the agent.
- Proposed an auxiliary reasoning loss to improve the overall cross-modal grounding capabilities in the agent's action space.
- Showcased a ∼200% relative improvement in generalization to unseen environments for the task of embodied instruction following over the SOTA Episodic Transformer model.

Leveraging Dependency Grammar for Fine-Grained Offensive Language Detection using Graph Convolutional Networks
SocialNLP @ NAACL 2022

Divyam Goel | Raksha Sharma
Paper Link

- Proposed an intuitive and effective hate-speech detection framework (SyLSTM) based on GCNs which utilizes non-euclidean dependency structures to overcome biases introduced by pejorative word senses.
- Achieved SOTA performance across several datasets with 10x fewer number of parameters than previous models.

On the Cross-Modal Transfer from Natural Language to Code Through Adapter Modules
ICPC 2022

Divyam Goel | Ramansh Grover | Fatemeh H. Fard
Paper Link

- First work which leverages the cross-modal transfer capabilities of adapter modules in the context of programming languages based on the Naturalness Hypothesis.
- Proposed a framework to test the quality and impact of features learned by each layer of the transformer model in the context of program comprehension.

Work Experience

Rephrase.ai
Bangalore, India

Deep Learning Junior Researcher
June 2022 - Present

- Maintaining the video generation pipeline of the Rephrase AI product: generate personalized human avatars from audio.
- Developed a new training paradigm to improve the overall performance, stability, training and data efficiencies while training universal vocoders using GAN based networks. The new training paradigm has led to a mass improvement in performance in all audio related projects within the company.
- Integrated a self-supervised neural network module similar to the hubert transformer to improve the lip-synchronization of the generated avatars. This is now the primary video generation pipeline of the product.
- Developed a systematic fine-tuning strategy to improve robustness to multiple camera views.
- Experimented with text conditioned many-to-one voice cloning to combat prosody mismatch during audio personalization.

GIST Vision Lab
Gwangju, South Korea

Research Assistant | Prof. Jonghyun Choi
July 2021 - Dec. 2022

- Published a work proposing a framework of auxiliary tasks (LMC) which enables embodied agents to learn robust task-agnostic representations with stronger cross-modal grounding for the task of embodied instruction following.
- Worked on multimodal transformers, imitation learning, object detection frameworks and self-supervised learning methods for robust visual representations with environmental augmentation strategies to address limited annotated data.
- Worked on guided diffusion models, multimodal content encoders and multimodal autoregressive transformers for the task of story visualization. Developed the first zero-shot framework for the same task. Submitted as a short paper at ACL '22.

The University of British Columbia

Kelowna, Canada

Mitacs Globalink Research Intern | Prof. Fatemeh H. Fard — *June 2021 - Sept. 2021*

- Published a work detailing an empirical study on the cross-modal capabilities of adapter modules in the development of efficient but accurate language models for software engineering tasks.
- Exploited cross-modal transfer of adapters to achieve 140×better parameter budget and ∼95% efficient storage over SOTA.
- Built the Super Code Clone Detection - 88 (SCD-88) dataset for evaluation on python-specific code clone detection.
- **[Github Link] [Data]**

Pando Labs - PandoCorp PLC

Chennai, India

Research and Development Intern — *Aug 2020 - Nov 2020*

- Worked on developing novel deep reinforcement learning solutions to optimize shipping costs in the freight industry.
- Achieved $\sim 85\%$ packing efficiency in 3D bin packing and $\sim 50\%$ cost efficiency in capacitative vehicle routing over existing solutions using off-policy agents in simulated environments.
- Re-architected a heuristic algorithm to improve efficiency and allow parallelised operations on GPUs.

Selected Projects

Semi-NMF Regularized Autoencoders for Hyperspectral Unmixing

IIT Roorkee

Prof. Saurabh Khanna | Indian Institute of Technology Roorkee — *Feb. 2021 - July 2021*

- Derived a new regularization scheme for autoencoders based on Semi-NMF optimization constraints.
- Applied to hyperspectral unmixing, showing improvements in performance over synthetic and real world datasets.
- Submitted to 2022 IEEE International Conference on Signal Processing and Communications (SPCOM)

A Multi-Task Approach for the POS Tagging of Code-Mixed Social Media Data

IIT Roorkee

Prof. Raksha Sharma | Indian Institute of Technology Roorkee — *Sept. 2020 - Feb. 2021*

- Led a collaborative effort to develop a novel Multi-Task learning approach for code-mixed POS tagging (Hindi & English).
- Achieved a 93.8% accuracy over several code-mixed datasets which is competitive with state-of-the-art heuristic methods.
- Proposed methodology augments the capacity of word embeddings and can be extended to other low-resource domains.
- Developed a library for various HMM models using PyTorch.

Leveraging Dependency Grammar for Offensive Language Detection

IIT Roorkee

Prof. Raksha Sharma | Indian Institute of Technology Roorkee — *June 2020 - Sept. 2020*

- Published a work proposing a hate-speech detection framework which uses Graph Convolutional Network to embed fine-grained contextual information from the dependency parse tree into the feature space of the agent.
- The proposed approach utilizes inherent dependency structures to overcome biases introduced by pejorative word senses.

Medical Image Segmentation and Classification Problems

IIT Roorkee

Prof. Balasubramanian Raman | Indian Institute of Technology Roorkee — *Dec 2019 - March 2020*

- Designed an agent using dilated convolutions, trained using an active contour loss for segmentation.
- Developed a conditional-GAN for data augmentation and noise reduction specific to ultrasound images.
- Reviewed latest research in GANs, HCI and other Deep Learning techniques for improved segmentation in medical imaging.

Self Driving Car

IIT Roorkee

Team Member | Artifical Intelligence and Electronics Society — *Jan 2019 - April 2019*

- Project was presented at the annual technical exhibition - **Srishti**.
- Developed a pipeline for lane detection using a combination of heuristic and deep learning methods.
- Integrated the python codes with Raspbian modules for sensorimotor control of the RC vehicle. **[Github Link] [Demo]**

Open Source Projects

- **HyperspecAE**: Code for the experiments on the Samson Dataset as presented in the paper: Hyperspectral Unmixing Using a Neural Network Autoencoder (Palsson et al. 2018) **[Github Link]**
- **Neural Network Visualizer**: Developed a Web Application using Flask and Streamlit for improved visualization of simple FFNNs trained using the Keras Functional API **[Github Link]**
- **Snake**: First github repository (2018), console based game of snake. During my first year of undergrad studies. Just compile the code and you are ready to go! **[Github Link]**

Notable Achievements

2022 **IIT Roorkee Heritage Foundation Excellence Award for 2021**: Awarded for excellence in academia & leadership.

2021 **MITACS GRI Scholar**: Research grant awarded by the **Mitacs-SICI partnership** to top international undergraduates for a research internship under the supervision of Canadian university faculty members.

2020 **IIT Roorkee Heritage Foundation Excellence Award for 2019**: Awarded for excellence in academia & leadership.

2017 **The Special Award For Academic Excellence**: Awarded to the top 3 students of DPS Gurgaon for academic excellence.

Relevant Courses

Machine Learning	Artificial Intelligence, Deep Learning for Computer Vision, Natural Language Processing
Mathematics	Probability and Statistics, Linear Algebra, Calculus, Discrete Mathematics
Fundamentals	Data Structures, Computer Architecture, Computer Programming, Digital Logic Design
Electronics	Digital Signal Processing, Digital Image Processing, Signals and Systems, Automatic Control Systems, Communication Systems and Techniques, Digital Communication
MOOCs	Reinforcement Learning (David Silver), Deep Learning Specialization (DeepLearning.AI), Convex Optimization (Stephen Boyd)

Datasets

Super Code Clone Detection - 88 (SCD-88) *Kelowna, Canada*

Prof. Fatemeh H. Fard | The University of British Columbia *Sept. 2021*

- The dataset contains 11,400 python code examples for a retrieval based code clone detection task.
- The dataset is a python-specific subset of the cross-language code clone detection dataset scraped from AtCoder.

Programming Skills

Languages	Python, Java, C++, Matlab, Octave
Tools and Libraries	PyTorch, Keras, Tensorflow, Scikit, Jupyter, Numpy, OpenCV, Flask, Streamlit, Unity 3D, AI2THOR
Others	Git, Vim, LaTex, Bash, HTML/CSS, Docker

Extracurricular Activities

Vision and Language Group | Core Member *Dec 2020 - May 2022*

- Organised several work-shops and tutorials on self-supervised learning, autoregressive transformers and VQ-VAEs for the benefit of the student populace.
- Organised deep learning centric paper reading sessions and contributed to internal research projects.

IEEE Student Chapter | Core Member *Feb. 2020 - May 2022*

- Organised several paper reading sessions and invited talks to promote student interest in electronics and computing.

Watch Out! | Chief News Coordinator *Aug. 2018 - May 2022*

- Lead a team of over 75 editors, designers and web-developers at the official student media body of IIT Roorkee.

National Sports Organisation | Squash Team *Aug. 2018 - May 2022*

- Bronze medalist in the Institute Sports Trophy.
- Participated in both inter and intra college sporting events.

Kshitij - The Literary Magazine | Senior Coordinator *Aug. 2018 - April 2020*

- As the member of the English Editorial Cell wrote for the semesterly magazine and performed spoken word poetry at the Annual Slam Poetry Festival, Eunoia 2019

References

- **Jonghyun Choi**, Associate Professor, Yonsei University (jc@yonsei.ac.kr)
- **Fatemeh H. Fard**, Assistant Professor, The University of British Columbia (fatemeh.fard@ubc.ca)
- **Saurabh Khanna**, Assistant Professor, IIT Roorkee (sakhanna@ece.iitr.ac.in)
- **Nisheeth Lahoti**, Founder, Rephrase AI (nisheeth@rephrase.ai)