Divyam Goel

Deep Learning Researcher
Rephrase.ai
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Education

Indian Institute of Technology Roorkee — *Roorkee, India*
B.Tech in Electronics and Communications Engineering — *2018 - 2022*
- CGPA: **9.04/10**
- Thesis: Multimodal Deep Representation Learning and its Applications in Image Generation and Embodied AI

Delhi Public School Gurgaon — *Gurgaon, India*
High School — *2014 - 2017*
- All India Senior School Certificate Examination - **93.75%**
- All India Secondary School Examination - **9.8/10.0**

Awards and 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 at DPS Gurgaon for continued academic excellence through middle and high school.

Experience

Simon Fraser University — *Burnaby, Canada*
Research Assitant | Prof. Angel Xuan Chang — *July 2023 - Present*
- Working on the research and development of generative models for the task of 3D scene generation.
- Improving the understanding of inter-object spatial relationships for structured generation in autoregressive models.

Rephrase.ai — *Bangalore, India*
Deep Learning Researcher — *June 2022 - Present*
- Working on (tractable) generative models for speech AI and computer vision.
- Enriched Rephrase.ai's proprietary video generation pipeline using self-supervised multi-modal transformers, expanding its global outreach by enhancing avatar capabilities for multilingual applications.
- Collaborated closely with DevOps engineers to efficiently deploy models on AWS, optimizing the generation pipeline to enable the creation of over 100,000 personalized videos daily.
- Spearheaded a Text-to-Speech initiative, developing a voice cloning system from limited speech data. Also devised a speech restoration pipeline to extract clean speech audios of the source speaker from extremely low-quality / noisy inputs.

GIST Vision Lab — *Gwangju, South Korea*
Research Assistant | Prof. Jonghyun Choi — *July 2021 - Dec. 2022*
- Published 1 research paper in EmbodiedAI at **CVPR 2022** and submitted 1 paper at a top tier conference.
- Released a work proposing a language-guided meta-controller to learn robust task-agnostic representations, and an auxiliary reasoning loss to improve the overall cross-modal grounding capabilities of an embodied agent tasked to solve complex tasks in the real world from human dialogue.
- Submitted a work proposing a story-visualization framework (SMART) using a multi-stage multi-modal transformer with in-memory spatio-temporal context, and a discretized variational autoencoder.

The University of British Columbia — *Kelowna, Canada*
Mitacs Globalink Research Intern | Prof. Fatemeh H. Fard — *June 2021 - Sept. 2021*
- Published and presented a research paper at **ICPC 2022**.
- Built the Super Code Clone Detection-88 (SCD-88) dataset for evaluation on python-specific code clone detection.
- Achieved 140× better parameter budget and ∼95% efficient storage in adapting foundational LLMs to source code.

Pando Labs - PandoCorp PLC

Chennai, India

Research and Development Intern *Aug 2020 - Nov 2020*

- Devised 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.

Publications

Language Guided Meta-Control for Embodied Instruction Following

EAI @ CVPR 2022

Divyam Goel | Kunal Pratap Singh | Jonghyun Choi *Paper Link*

- Goel, D., Singh, K. P., & Choi, J. Language Guided Meta-Control for Embodied Instruction Following.

Leveraging Dependency Grammar for Fine-Grained Offensive Language Detection using Graph Convolutional Networks

SocialNLP @ NAACL 2022

Divyam Goel | Raksha Sharma *Paper Link*

- Goel, D., & Sharma, R. (2022). Leveraging dependency grammar for fine-grained offensive language detection using graph convolutional networks. arXiv preprint arXiv:2205.13164.

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

ICPC 2022

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

- Goel, D., Grover, R., & Fard, F. H. (2022, May). On the cross-modal transfer from natural language to code through adapter modules. In Proceedings of the 30th IEEE/ACM International Conference on Program Comprehension (pp. 71-81).

Projects

Semi-NMF Regularized Autoencoders for Hyperspectral Unmixing

IIT Roorkee

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

- Devised a new regularization scheme for autoencoders based on the inherent Semi-NMF optimization constraints of the Hyperspectral Unmixing problem.
- 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*

- Developed a library for various HMM models using PyTorch.
- 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.

Leveraging Dependency Grammar for Offensive Language Detection

IIT Roorkee

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

- Published a research paper in SocialNLP at **NAACL 2022**.
- Developed a hate-speech detection framework with Graph Convolutional Networks to use contextual information from dependency parse trees and overcome biases introduced by pejorative word senses.
- Achieved SOTA performance across several datasets with 10x fewer number of parameters than previous models.

Medical Image Segmentation and Classification Problems

IIT Roorkee

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

- Designed an active contour loss for segmentation of skin lesions.
- Developed a conditional-GAN for data augmentation 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*

- Presented the project 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

- **NeRF**: A simple 2D toy example to play around with NeRFs, implemented in pytorch-lightning. Repository can be used as a template to speed up further research on nerfs. **[Github Link]**
- **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]**

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.

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
MOOCs	Deep Learning Specialization (DeepLearning.AI), Convex Optimization (Stephen Boyd)

Programming Skills

Languages	Python, C++, Java, Matlab
Tools and Libraries	PyTorch, Lightning, Tensorflow, Flask, Streamlit, Unity 3D, AI2THOR, Blender
Others	Git, Vim, LaTex, Bash, HTML/CSS, Docker

Extracurricular Activities

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

- Organised several work-shops, paper reading sessions, and tutorials for undergrads at IIT Roorkee on self-supervised learning, autoregressive transformers and VQ-VAEs.
- Mentored 12 freshmen through their first project in Computer Vision – Semantic Segmentation of Human Faces.

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*

- Led a team of over 75 editors, designers and web-developers at the official student media body of IIT Roorkee.
- Authored critical articles on recent developments within the campus community, contributing to informed discourse and campus awareness. Also wrote abstract articles, engaging readers with diverse topics and perspectives.
- Conducted interviews with esteemed guest lecturers, enhancing the media body's reputation for insightful content.

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*

- Contributed articles and creative pieces to the semesterly magazine, and performed spoken word poetry at the Annual Slam Poetry Festival – Eunoia 2019.
- Designed and organized workshops on Slam Poetry to promote awareness and educate students about this cultural art form at IIT Roorkee.

Team Shiksha Kendra | Volunteer *June 2014 - May 2017*

- Taught science and history to a batch of 60 underprivileged middle school students, utilizing interactive teaching methods to enhance student comprehension and retention.
- Significantly contributed to an increase in average classroom attendance from 65% to approximately 80% .

Red Shift - The Physics Club | Founding Member *June 2014 - May 2017*

- Organized and played a key role in the flagship event "Capax Infinitum," an annual physics-themed event that encouraged scientific curiosity and collaboration among students.
- Participated in inter-school competitions involving quizzing, real-life experimentation, and ideation to promote the development of innovative solutions for real-world challenges.
- Mentored middle school students to prepare them both for inter-school olympiads, and intra-school science fairs.

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)
- **Harsh Agarwal**, Senior Research Engineer, Rephrase AI (harsh.agarwal@rephrase.ai)