Kushagra **Pandey**

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Education

University of California, Irvine — *Irvine, California*
PhD in Computer Science | 4.0/4.0 — *Sep. 2022 - May, 2027 (Expected)*

Indian Institute of Technology (IIT), Kanpur — *Kanpur, India*
Masters in Computer Science and Engineering | 10.0 / 10.0 — *Sept. 2020 - May. 2022*

Indian Institute of Technology (IIT), Bhubaneswar — *Bhubaneswar, India*
Bachelors in Electrical Engineering | 8.87 / 10.0 — *July. 2012 - May. 2016*

Research Publications

Generative Diffusions in Augmented Spaces: A Complete Recipe
Kushagra Pandey, Stephan Mandt
Preprint,
`https://arxiv.org/abs/2303.01748`

DiffuseVAE: Efficient, Controllable and High-Fidelity Generation from Low-Dimensional Latents
Kushagra Pandey, Avideep Mukherjee, Piyush Rai, Abhishek Kumar
Transactions on Machine Learning Research,
`https://openreview.net/forum?id=ygoNPRiLxw`

Inference of cell state transitions and cell fate plasticity from single-cell with MARGARET
Kushagra Pandey, Hamim Zafar
Nucleic Acids Research (IF: 19.16)
`https://doi.org/10.1093/nar/gkac412`

VAEs meet Diffusion Models: Efficient and High-Fidelity Generation
Kushagra Pandey, Avideep Mukherjee, Piyush Rai, Abhishek Kumar
NeurIPS 2021 Workshop on Deep Generative Models and Downstream Applications
Oral Presentation (Spotlight)

Research Experience

PhD Student — *UC Irvine*
Graduate Student Researcher | Supervisor: Prof. Stephan Mandt — *Sep 2022 - Present*
- Exploring continuous score-based generative models and their applications to areas like Neural Data Compression.

Efficient, Controllable and High-Fidelity Generation from Low-Dimensional Latents — *IIT Kanpur*
Masters Thesis | Supervisor: Prof. Piyush Rai — *July 2021 - May, 2022*
- Worked on improving the sample quality of VAE's by hybrid generative modelling approaches for image synthesis.
- Worked on understanding the fundamental problems underlying the poor reconstruction quality of non-hierarchical or standard VAE's in general.

Elucidating cellular dynamics using Unsupervised Representation Learning in single-cell RNA-seq data — *IIT Kanpur*
Research Assistant | Supervisor: Prof. Hamim Zafar — *December 2020 - Present*
- Working on developing Deep Latent Variable Models for multi-omic data integration
- Developed MARGARET: a deep unsupervised metric learning-based algorithm for trajectory inference in fundamental biological processes like cell differentiation using single-cell RNA-seq data.

Visual Surveillance using Unmanned Aerial Vehicles *IIT Bhubaneswar*

Undergraduate Thesis | Supervisor: Dr. Debi Prosad Dogra *Sep 2015 - May 2016*

- Worked on real-time detection and tracking of road segments from aerial imagery captured using UAVs. See `https://github.com/kpandey008/Road-detection-and-tracking`
- Developed a sparse coding based model for detecting abnormal events in crowd-surveillance videos. See `https://github.com/kpandey008/Abnormal-Event-Detection)`

Broad Research Interests

Deep Generative Models with a current focus on Score-Based models, Unsupervised Representation Learning.

Recent Academic / Research Projects

Hindi to English Neural machine translation *Course: Statistical NLP*

Framework: PyTorch | Code: https://github.com/kpandey008/Hin2Eng-NMT

- Designed and developed an end-to-end Hindi to English Neural Machine Translation system.
  - Developed a data-preprocessing / cleaning pipeline for Hindi and English text datasets.
  - Proposed a novel dual attention mechanism in the standard transformer architecture.
  - On an in-house competition, the proposed model achieved a BLEU score of 0.1428 and was ranked 3rd out of around 100 submissions.

Advanced Emergency Braking System in CARLA *Course: Embedded and Cyber physical Systems*

Framework: PyTorch, Keras, CARLA | Code: https://github.com/kpandey008/carla-aebs

- Developed an Advanced Emergency Braking system (AEBS) in CARLA to study the impact of Out of distribution samples in a learning-enabled controller (LEC). The core contributions included:
  - Extracting data from the CARLA simulator and training a CNN for estimating distance between two cars.
  - Training an RL agent using the DDPG algorithm to estimate the appropriate braking signal given an estimated distance and car velocity.
  - Implementing a VAE-based conformal predictor for detection of out of distribution samples.

Conditional Text to Image Generation using Hierarchical VAEs *Course: Statistical NLP*

Framework: PyTorch | Code: https://github.com/kpandey008/hvae-g2v

- Performed an extensive literature survey of language grounding to vision models and implemented a text-conditional Hierarchical VQ-VAE model for image generation from text sequences on the CUB200 dataset.

Predicting Drug Resistance in Mycobacterium Tuberculosis (MTB) *Course: Computational Genomics*

Framework: PyTorch | Code: Private

- Developed a novel multi-task model to predict the resistance of Mycobacterium tuberculosis (MTB) towards several first and second line drugs commonly used for treating tuberculosis.
- The proposed model achieved the best prediction rates in 7 out of 10 drugs among all the submissions in an in-house competition.

Technical Skills

Programming Python
Frameworks PyTorch, PyTorch Lightning

Academic achievements

- HPI Fellowship Recipient
- Received the Dean's Award at UCI for excellent research potential among incoming graduate students.
- Ranked 1st in a cohort of 100 students in the CSE department at IITK. Received the Academic Excellence Award for 2020-2021 and 2021-2022 for the same (Awarded to top 10% students).