Rakesh Dey

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Research Interest

I am passionate about comprehending the theoretical aspects of **Generative Modeling**, with a specific focus on exploring generation under multi-modal conditions. My research is mainly focused on unraveling the potential of the **latent structure** of **GAN**s & **Diffusion Model**s. In addition to this, I am also interested in exploring the **adversarial attack** in **self-supervised contrastive learning** paradigm directing model robustness. Recently I have been enjoying the exciting world of generation in **3D** and a little bit of spatial reasoning with the help of **LLM**s.

Education

Maulana Abul Kalam Azad University of Technology (WBUT): RCCIIT Kolkata, India

B.Tech. in Computer Science and Engineering; ***GPA: 8.77/10*** *August 2017 – July 2021*

Project: *Hand written digits classification using Convolutional Neural Network*

- **Relevant courses:** Artificial Intelligence (Introduction to Image Processing, Computer Vision), Mathematics I, II (Linear Algebra, Calculus, ODE, Probability, Statistics), Numerical Methods, Design & Analysis of Algorithm, Introductory Computer Graphics.

Skills

Programming Languages: Python, C/C++

Libraries: Pytorch, OpenCV, Scikit-Learn, Keras, TensorFlow, NumPy, Pandas, Matplotlib, dlib

Documentation & Typesetting: LaTeX, MS Office

Technologies: Git, Linux

Languages: English (Professional Proficiency), Bengali (Native), Hindi

Experience

CVPR Unit, Indian Statistical Institute Kolkata, India

Project Linked Person *Oct 2022 – Present, Full-time*

- Worked on the advancement of self-supervised contrastive learning by dynamically varying temperature.
  Project: Dynamic temperature scaling for self-supervised contrastive learning
  Collaborator & supervisor: Siladittya Manna, Indian Statistical Institute, Kolkata; Prof. Saumik Bhattacharya, Indian Institute of Technology, Kharagpur; Prof. Umapada Pal, Indian Statistical Institute, Kolkata
- Developed a novel method for estimating heart rate from facial video data.
  Project: Heart rate estimation from video
  Supervisor: Prof. Umapada Pal, CVPR Unit, Indian Statistical Institute, Kolkata; Prof. Palaiahnakote Shivakumara, University of Malaya, Kuala Lumpur, Malaysia
- Created and implemented a system that utilizes facial video input to accurately predict real-time heart rates.
  Project: Heart rate estimation from video
  Supervisor: Prof. Umapada Pal, CVPR Unit, Indian Statistical Institute, Kolkata; Prof. Palaiahnakote Shivakumara, University of Malaya, Kuala Lumpur, Malaysia

CVPR Unit, Indian Statistical Institute Kolkata, India

Research Internship *Apr 2022 – Oct 2022*

- Conducted a comprehensive survey on contemporary techniques for measuring blood oxygen saturation.
  Supervisor: Prof. Umapada Pal, CVPR Unit, Indian Statistical Institute, Kolkata
- Created a dataset specifically designed for the estimation of heart rate from facial video data.
  Supervisor: Prof. Umapada Pal, CVPR Unit, Indian Statistical Institute, Kolkata

Tata Consultancy Service Kolkata, India

Associate System Engineer Trainee *Sept 2021 – Apr 2022*

Research Projects

Sketch-guided Identity Preserved Caricature Generation Guildford, England
Collaborators: Dr. Ayan K. Bhunia, SketchX, CVSSP, University of Surrey *Jun 2023 – Nov 2023*
Unleashed the power of sketch for exaggerating the shape of caricature while preserving the subject's identity.

Dynamic Temperature Scaling in Self-supervised Contrastive Learning Kolkata, India
Collaborators: Siladittya Manna, Prof. Saumik Bhattacharya, Prof. Umapada Pal *Mar 2023 – Nov 2023*
Studied the impact of feature cosine similarity on temperature hyperparameter to enhance uniformity and alignment for better feature distribution in embedding space in self-supervised contrastive learning.

Understanding Information Content in Synthetic Data (from SOTA GANs) Kolkata, India
Collaborators: Subhajit Maity, University of Central Florida, USA *Sept 2023 – Present*
Explored the domain gap between synthetic and real data to understand the low information content in high-fidelity generated images and examined the potential and future applications of synthetic data in vision tasks.

Sketch-guided Generation using StyleGAN Kolkata, India
Collaborators: Subhajit Maity, University of Central Florida, USA *Aug 2023 – Nov 2023*
Investigated the influence of sparse line drawings, sketches and edge maps for image manipulation with StyleGAN.

Exploring StyleGAN Latent Space for Image Editing Task Kolkata, India
Collaborators: Prof. S. Palaiahnakote, Prof. S. Bhattacharya, Prof. S. Chanda, Prof. U. Pal *Apr 2023 – Aug 2023*
Explored optimization-based inversion techniques on latent space of StyleGAN for performing image editing tasks.

Heart Rate Estimation from Facial Video Kolkata, India
Collaborators: Prof. Palaiahnakote Shivakumara, Prof. Umapada Pal *Dec 2022 – Oct 2023*
Examined the impact of spatial and frequency domain information on heart rate estimation.

Survey on Blood Oxygen Saturation Measurement Kolkata, India
Collaborators: Prof. Palaiahnakote Shivakumara, Prof. Umapada Pal *Jan 2022 – Jun 2022*
Conducted a comprehensive study on blood oxygen saturation measurement methods and explored the potential of computer vision techniques for the same.

Papers

- **Rakesh Dey**, Palaiahnakote Shivakumara, Saumik Bhattacharya, Umapada Pal, Sukalpa Chanda, "A New StyleGAN Latent Space Based Model for Image Style Transfer" (*Accepted in* ***ICPR - 2024***)
- **Rakesh Dey**, "Can Entropy Regularization Prevent Dimension Collapse in Spectral Contrastive Learning?" (*Submitted*)
- **Rakesh Dey**, "CariSketcher: How to Generate Identity Preserved Caricature Guided by Sketch" (*submitted*)
- Siladittya Manna, Soumitri Chottopadhay, **Rakesh Dey**, Saumik Bhattacharya, Umapada Pal, "DySTreSS: Dynamically Scaled Temperature in Self-Supervised Contrastive Learning" (*Accepted in* ***IEEE Transactions on Artificial Intelligence***, arxiv)
- **Rakesh Dey**, Subhajit Maity, "Doodle the Rest: A Sketch Guided Approach towards Image Completion with StyleGAN" (*submitted*)
- **Rakesh Dey**, Subhait Maity, "Does Fidelity Aid Information?" (*submitted*)
- **Rakesh Dey**, Palaiahnakote Shivakumara, Saumik Bhattacharya, Umapada Pal, Sukalpa Chanda, "MSMDT: Mutual-Sharing-Multiple Domain based Transformer for Heart Rate Estimation Under Arbitrary Situations using Facial Videos" (*submitted*)
- **Rakesh Dey**, Palaiahnakote Shivakumara, Umapada Pal, Sukalpa Chanda, and Yue Lu, "Blood Oxygen Saturation Measurement: A Survey" (*submitted*)

Awards, Achievements & Certificates

Scholarship: Received "Half Fee Scholarship for Excellent Academic Records" for four consecutive years (2017 - 2021).
Achievements: Secured 2^{nd} & 1^{st} position in college & school art competitions respectively; elected as the president of Ramakrishna Mission Rahara school mathematics club.
Certificates: Received certificate of excellence for an outstanding summer project from GLOBSYN BUSINESS SCHOOL (2018).

Volunteer Services

- Peer reviewer: **Springer Nature Computer Science**, **ICASSP 2025**
- Volunteering experience: International Conference on Pattern Recognition **(ICPR)** 2024
- Invited talk/demo presentation: **Deep Learning for Physiological Measurements**
  Gave a small talk on Deep Learning techniques for estimating physiological parameters and presented a demo for estimating heart rate from facial video.