

CHAITANYA KAPOOR

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Research Interests

I am passionate about **Machine Learning** in general, and **Computer Vision** in particular. The sheer fun of grokking an amalgamation of myriad mathematical techniques in service of the discipline, and seeing them all come alive on a computer (through various tools and techniques), is a perennial source of joy and wonder to me!

Education

Birla Institute of Technology and Science (BITS), Pilani

B.E. (Hons.) in Electrical and Electronics engineering

Nov. 2020 – Present

Pilani, India

CBSE 2020 – 94.5% (honors in **Physics**)

ICSE 2018 – 94.25% (100% in **Mathematics**)

Publications

Large-Scale 3D ExM Registration: A Comparison of Methods

A. Casamitjana, G. Fleishman, E. Besier, R. Zhang, M. Alawi, C. Kapoor, H. Pfister, E. S. Boyden, D. Wei

[manuscript in preparation]

Multiplexed Expansion Revealing (multiExR) for Imaging of Many-Component Nanostructures in Healthy and Diseased Brain

J. Kang, M. Schroeder, Y. Lee, C. Kapoor, T. B. Tarr, K. Titterton, M. Zeng, E. Niederst, D. Wei, L. H. Tsai, G. Feng, E. S. Boyden

[manuscript in preparation]

RnR-ExM: Robust Non-Rigid Registration Challenge for Expansion Microscopy Volumes

E. Besier, R. Zhang, Y. Bando, Y. Quémener, C. Kapoor, M. Alawi, M. Hoffman, A. Dalca, A.

Casamitjana, I. Arganda-Carreras, E. S. Boyden, H. Pfister, D. Wei

ISBI 2023 - [website]

Fast and Lightweight UAV-based Road Image Enhancement Under Multiple Low-Visibility Conditions

C. Kapoor, A. Warriar, M. Singh, P. Narang, H. Puppala, R. Srinivas, A. P. Singh

PerCom Workshops (PerSASN 2023) - [to appear]

Dense Residual Networks for Gaze Mapping on Indian Roads

C. Kapoor, K. Kumar, S. Vishnoi, S. Ramanathan

[preprint]

Research Experience

Camera Culture Group

Guide: Dr. Ramesh Raskar

August 2022 – Present

Massachusetts Institute of Technology, Boston

- Glossy object reflections can reveal hidden information about the surrounding environment. By turning them into cameras, we can access unique views beyond a camera's field-of-view. Our method turns such objects with **unknown geometry** into radiance-field cameras to image the world from the objects' perspective, and synthesizes **novel views** which are visible only to the object.

Department of Brain and Cognitive Sciences

Guide: Dr. Donglai Wei

Feb. 2022 – Present

Massachusetts Institute of Technology, Boston

- Our group explores building computational models for brain image analysis derived from **Expansion Microscopy (ExM)** and **multiplexed Expansion Revealing (multiExR)**. As part of this, we are developing novel algorithms to perform **joint-intensity based** and **point-based** image registration.

Multimodal Cognition Research Group

Guide: Dr. Pratik Narang

Jan. 2022 – Feb. 2023

BITS Pilani, India

- Our present research focuses on unpaired image to image translation from the RGB domain to the **Hyperspectral** domain with the help of an **ACL-GAN**.
- Working on enhancing **Drone Based Surveillance in Low-Visibility Conditions**, a project funded by [ARTPARK](#), under the aegis of IISc Bengaluru. This is primarily an object detection problem, for which I am trying to bring to bear the power of **Vision Transformers** to gain more insights into it.

Computer Vision Research Society

August 2021 – August 2022

Guide: Dr. Pratik Narang

BITS Pilani, India

- At present, I am working on **self-supervised image super resolution** with a special focus towards medical imaging.
- I have also actively worked on **video super resolution** using **deformable convolutions** with a **TDAN** baseline.

Sally Robotics

August 2021 – Present

Guide: Prof. Bijay Kumar Rout

BITS Pilani, India

- As the lead of the Computer Vision subsystem, I am working on designing novel (and lightweight) algorithms for **Real-time Semantic Segmentation** which can be deployed in the context of autonomous vehicles.

Invited Talks

06/23 SIS Symposium, Harvard SEAS, *Seeing Beyond the Camera*

Projects

Irodov solutions | \LaTeX

Ongoing

- [Problems In General Physics](#) is a quintessential problem set for cementing fundamental concepts in an advanced high-school and undergraduate Physics curriculum. [This](#) is my rendition of solutions to these. It is my labor of love! My love of Mathematics & Physics and a passion for typesetting beautiful documents in \LaTeX .

Expression Recognition using Deep CNNs | *Python*

August 2021

- Facial expression recognition seeks to classify facial expressions into various categories such as **anger**, **fear**, **surprise** etc. Using the network model from [DeXpression](#), and enhancing it with **5-fold** cross validation on the canonical Extended Cohn-Kanade (CKP+48) dataset, I was able to achieve a mean training set accuracy of **99.47%** and a mean testing accuracy of **98.98%**.

Generative Adversarial Network (GAN) | *Python*

April 2021

- This introductory project uses a GAN to generate numeric digits from its corresponding Devanagari equivalent. I used **scikit-learn** to implement the digit classifier, and wrote the GAN implementation (from scratch using **numpy**!), which using output from the digit classifier, generates digits in the *MNIST* dataset.

Technical Skills

Languages: Python, C, MATLAB, Unix Shell Scripting , \LaTeX

Technologies/Frameworks: Keras, Tensorflow, Numpy, PyTorch, Git, OpenCV