Chaitanya Kapoor

chaitanya.7.kapoor@gmail.com github.com/ckapoor7

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 **Nov. 2020 – Present**
B.E. (Hons.) in Electrical and Electronics engineering *Pilani, India*

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

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

Publications

Dense Residual Networks for Gaze Mapping on Indian Roads
C. Kapoor, *K. Kumar, S. Vishnoi, S. Ramanathan*
arXiv Preprint

Multiplexed Expansion Revealing (multi-ExR) for high-dimensional mapping of protein nanoarchitecture in healthy and diseased brains
J. Kang, M. Schroeder, Y. Lee, ***C. Kapoor****, K. Titterton, M. Zeng, D. Wei, L. H. Tsai, G. Feng, E. S. Boyden*
Nature Methods (under submission)

RnR-ExM: Robust Non-Rigid Registration Challenge for Expansion Microscopy Volumes
E. Besier, R. Zhang, Y. Bando, Y. Quéméner, ***C. Kapoor****, M. Alawi, M. Hoffman, A. Dalca, A. Casamitjana, I. Arganda-Carreras, E. S. Boyden, H. Pfister, D. Wei*
IEEE ISBI

Research Experience

Camera Culture Group **August 2022 – Present**
Guide: Dr. Ramesh Raskar *Massachusetts Institute of Technology, Boston*

- We propose **Neural Shadow Fields** that are capable of learning object structures from binary shadow masks. To enable this, we create a graphics-inspired differentiable forward model that can render shadows using volumetric rendering. We make use of shadow and RGB cues to enable smoother rendering of meshes.

Department of Brain and Cognitive Sciences **Feb. 2022 – Present**
Guide: Dr. Donglai Wei *Massachusetts Institute of Technology, Boston*

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

Multimodal Cognition Research Group **Jan. 2022 – Present**
Guide: Dr. Pratik Narang *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 – Present**
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*

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

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