Akkapaka Saikiran

CSE Undergraduate, IIT Bombay

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Education

Indian Institute of Technology Bombay *2018–2022*
B.Tech. with *Honours* in Computer Science and Engineering *CPI: 9.19 / 10.00*

Research Interests

Machine Learning, Computer Vision, Fairness and Interpretability, Natural Language Processing

Internships and Research Experience

Self-supervised Learning of Multimodal Representations *Ongoing*
Prof. Preethi Jyothi and Prof. Ganesh Ramakrishnan *Bachelor's Thesis*

- Exploring self-supervised intermediate pre-training strategies to discover joint **audio-video-text representations** by learning to project individual modalities into a shared embedding space
- Experimenting with **contrastive** losses and extending them to three modalities using mixup
- Performing controlled studies on a tri-modal **synthetic dataset** to compare various techniques
- Evaluating the effectiveness of the learned representations on **cross-modal retrieval** tasks

Bing Ads Classification using Multimodal Learning | [Presentation] *Summer 2021*
Microsoft India R&D *Data Science Internship*

- Worked on improving Microsoft's Bing Ads classification module using **vision-language** models
- Studied and experimented with recent multimodal models (Oscar and VinVL) which combine word embeddings and object detection features from images and feed them to a transformer
- Designed & finetuned a multimodal pipeline, compared with baselines, and got preliminary results

Sketch-based Modeling | [Report] *Spring 2021*
Prof. Parag Chaudhuri *Research Project*

- Surveyed various approaches of generating **3D models** from user-drawn 2D or 3D sketches
- Worked on devising a novel system to generate smoothly-connected **Bézier patches** to fit sketches
- Created a dataset of **parametric surfaces** to facilitate learning of patch-stroke associations

Analysis of Vector Addition Systems | [Report] *Summer 2020*
Prof. Alain Finkel, ENS Paris-Saclay *Research Internship*

- Studied Vector Addition Systems by building an understanding of **Karp-Miller Graphs**
- Read literature about the Petri Nets' **Minimal Coverability Set** problem, notably MinCov and QCover
- Worked on the non-trivial problem of devising an algorithm to construct the **semi-linear bases** for projections of reachability sets of Vector Addition Systems, rewriting definitions and **formal proofs**

Selected Academic Projects

Fooling Neural Networks | *Fairness and Explainability in ML* | [Code] *Autumn 2021*

- Implemented **adversarial attacks** on neural networks by optimizing on images to maximize the likelihood of false predictions, following Szegedy et al.'s *Intriguing properties of neural networks*
- Optimized using gradient descent instead of L-BFGS to study incremental properties of attacks
- Performed analysis on the **transferability** of these attacks and the **ease of fooling** across classes

Image Segmentation | *Medical Image Computing* | [Code] *Spring 2020*

- Segmented **medical images** (skin cancer, retinal vessels) using deep neural networks
- Built on top of the **U-Net architecture**, augmenting it with **residual connections** and recurrence
- Evaluated the model on ISIC and DRIVE datasets, achieving impressive **dice coefficient** values

FMX Modeling and Animation | *Computer Graphics* | [Code] [Movie] *Autumn 2020*

- Modeled a bike, a rider, and a track in **OpenGL** and rendered it using shading and texturing
- Animated the above scene to create a **short movie** of an FMX rider performing stunts

Hospital Management System | *Database Systems* | [Code] *Spring 2021*
- Developed a patient-centric hospital management system as a Flask **web app** which provides functionalities such as book/cancel appointments, buy medicines, pay bills, add prescription, etc.
- Added **secure access** to patients' details & history and an interface to view disease analytics

Foreshadow (L1TF) Attack | *Computer Architecture* | [Report] *Autumn 2020*
- Explored and imitated Foreshadow, a **speculative execution attack** on Intel's processors which allows attackers to steal sensitive information from personal computers or third-party clouds
- Studied earlier attacks like **Meltdown** and **Spectre** which exploit transient out-of-order execution
- Presented a proof-of-concept by simulating SGX's **abort page semantics** to showcase an attack

Bandits and MDPs | *Foundations of Intelligent and Learning Agents* | [Code, Code] *Autumn 2020*
- Compared many algorithms for sampling the arms of **multi-armed bandits**, devising a variation of **Thompson Sampling** which outperforms other methods given a permutation of the true means
- Implemented **planning algorithms** for Markov Decision Processes and used them to solve mazes

Proofreading Rewriter | *Software Systems Lab* | [Code] *Autumn 2019*
- Developed a Python-based tool which corrects spelling and grammar mistakes while also suggesting alternative words and phrases using statistics from APIs like datamuse and phrasefinder

Academic Achievements

- Secured All India Rank 304 in IIT JEE Mains 2018 *2018*
- Secured All India Rank 665 in IIT JEE Advanced 2018 *2018*
- Awarded the Kishore Vaigyanik Protsahan Yojana (KVPY) fellowship (twice) *2016 & 2017*
- Received the prestigious National Talent Search Examination (NTSE) scholarship *2016*

Selected Coursework

Machine Learning	Artificial Intelligence and Machine Learning, Medical Image Computing, Foundations of Intelligent and Learning Agents, Fairness and Explainability in ML, Advances in Intelligent and Learning Agents*
Computer Science	Operating Systems, Computer Architecture, Computer Graphics, Virtualization and Cloud Computing, Database Systems, Compilers

* to be completed by Apr 2022

Technical Skills

Programming	C/C++, Python, MATLAB, HTML/CSS, Javascript, Java
Tools & Libraries	PyTorch, TensorFlow, Keras, Git, OpenGL, PostgreSQL, Django, NodeJS

Positions of Responsibility

- **Teaching Assistant**
  - Logic for CS (CS228) | Prof. S. Krishna, Prof. Ashutosh Gupta *Jan 2022 - Apr 2022*
  - Operating Systems (CS333, CS347) | Prof. Mythili Vutukuru *Aug 2021 - Dec 2021*
  - Calculus (MA109) | Prof. Ravi Raghunathan *Nov 2020 - Jan 2020*
  - Logic for CS (CS228M) | Prof. S. Krishna *Jul 2020 - Dec 2020*
  - English Language Improvement Training (ELIT) | SMP, IITB *Summer 2019, Spring 2020*
  - Took weekly tutorial sessions, prepared questions for assignments, and graded students
- **Winter in Data Science Mentor** | *Analytics Club, IITB* *Winter 2021*
  Guiding juniors towards understanding, implementing, and documenting **neural networks visualization tools** like saliency map approaches, occlusion sensitivity maps, and **GradCAM**
- **Editorial Head** | *CSE Research Website* *July 2021 - Present*
  Co-leading a team whose goal is to create a repository of our **department's research** activities

Extra-curricular Activities

- Represented IIT Bombay at the 34th **Inter IIT Aquatics Meet**, held at IIT Guwahati *2018*
- Swam continuously for **12 hours** covering **17** kms at **Swimathon**, IITB's swim marathon *2019*
- Attended **Vijyoshi**, an annual national science camp, as a KVPY scholar *2017*
- Bagged trophies in **mridangam** competitions at many music societies in Mumbai *2016-2018*
- Represented Mumbai Region at KVS **National Swim Meets** for 3 consecutive years *2013-2015*