AAKASH RAJESH KAKU

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EDUCATION

- **New York University - Center for Data Science (Courant) (NYU CDS)** — New York City, USA
  Ph.D. in Data Science; **CGPA**: 4/4 — Sept 2019 - Present
  - Advisors: *Prof. Carlos Fernandez-Granda and Prof. Narges Razavian*
  - Key Courses: *Communication in the Mathematical Sciences, Independent studies, Research rotation*
- **New York University - Center for Data Science (Courant) (NYU CDS)** — New York City, USA
  Master of Science in Data Science; **CGPA**: 3.95/4 — Sept 2017 – May 2019
  - Key Courses: *Mathematics of Deep Learning, Inference and Representation Learning, Deep Learning for Medicine, Natural Language Processing and Representation Learning, Machine Learning, Mathematical tools for Data Science, Deep Learning (Yann LeCun), Probability and Statistics, Python Programming for Data Science, Big Data*
- **Indian Institute of Management, Bangalore (IIMB)** — Bangalore, India
  Post Grad. Diploma in Mgmt. (equivalent to MBA); **CGPA**: 3.55/4 (Rank: 16/410) — Jun 2014 – Mar 2016
  - Major: **Business Analytics**; Minor: **Finance**
  - Key Courses: *Biz. Analytics and Intelligence, Applied Multivariate Data Analysis, Quant. Methods - 1 & 2*
- **Institute of Chemical Technology (ICT)** — Mumbai, India
  Bachelor of Chemical Engineering; **CGPA**: 8.93/10.00 (Top 10% of the Class) — 2010 – 2014

PUBLICATIONS AND PRE-PRINTS

* *equal contribution*

1. "StrokeRehab: A Benchmark Dataset for Sub-second Action Identification"
   Authors: ***Aakash Kaku****, Kangning Liu*, Avinash Parnandi*, Haresh Rengaraj Rajamohan, Kannan Venkataramanan, Anita Venkatesan, Audre Wirtanen, Natasha Pandit, Heidi Schambra, Carlos Fernandez-Granda*
   Proc. of the 36th Conference on Neural Information Processing Systems (**NeurIPS Dataset and Benchmark Track**), 2022

2. "Sequence-to-Sequence Modeling for Action Identification at High Temporal Resolution" [ArXiv]
   Authors: ***Aakash Kaku****, Kangning Liu*, Avinash Parnandi*, Haresh Rengaraj Rajamohan, Kannan Venkataramanan, Anita Venkatesan, Audre Wirtanen, Natasha Pandit, Heidi Schambra, Carlos Fernandez-Granda*
   Pre-print

3. "Deep Probability Estimation" [ArXiv]
   Authors: Sheng Liu, **Aakash Kaku***, Weicheng Zhu*, Matan Leibovich*, Sreyas Mohan*, Boyang Yu, Laure Zanna, Narges Razavian, Carlos Fernandez-Granda*
   Spotlight presentation at Proc. of the 39th International Conference on Machine Learning (**ICML**), 2022

4. "PrimSeq: a deep learning-based pipeline to quantitate rehabilitation training" [ArXiv]
   Authors: Avinash Parnandi, ***Aakash Kaku****, Anita Venkatesan, Audre Wirtanen, Natasha Pandit, Haresh Rengaraj Rajamohan, Kannan Venkataramanan, Dawn Nilsen, Carlos Fernandez-Granda, Heidi Schambra*
   Accepted at **PLOS Digital Health**, 2022

5. "Intermediate layers matter in momentum contrastive self supervised learning" [ArXiv]
   Authors: ***Aakash Kaku****, Sahana Upadhya, Narges Razavian*
   Proc. of the 35th Conference on Neural Information Processing Systems (**NeurIPS**), 2021

6. "An artificial intelligence system for predicting the deterioration of COVID-19 patients in the emergency department" [ArXiv]
   Authors: Farah E. Shamout, Yiqiu Shen*, Nan Wu*, **Aakash Kaku***, Jungkyu Park*, Taro Makino*, Stanisaw Jastrzbski, Duo Wang, Ben Zhang, Siddhant Dogra, Meng Cao, Narges Razavian, David Kudlowitz, Lea Azour, William Moore, Yvonne W. Lui, Yindalon Aphinyanaphongs, Carlos Fernandez-Granda, Krzysztof J. Geras*
   Nature npj Digital Medicine (2021)

7. "Towards data-driven stroke rehabilitation via wearable sensors and deep learning" [ArXiv]
   Authors: ***Aakash Kaku****, Avinash Parnandi*, Anita Venkatesan, Natasha Pandit, Heidi Schambra, Carlos Fernandez-Granda*
   Proceedings of Machine Learning Research (**MLHC**)), 2020

8. "Be Like Water: Robustness to Extraneous Variables Via Adaptive Feature Normalization" [ArXiv]
   Authors: ***Aakash Kaku****, Sreyas Mohan*, Avinash Parnandi, Heidi Schambra, Carlos Fernandez-Granda*
   Pre-print

9. "Automatic Knee Segmentation using Diffusion Weighted MRI"
   Authors: A. Duarte, C. Hegde*,* ***A. Kaku****,S. Mohan*, J G. Raya*
   Accepted at Medical Imaging Meets NeurIPS, **NeurIPS**, Vancouver (Canada) 2019

10. "Scheduling loss functions for optimal training of segmentation models" [Extended Abstract]
Authors: ***Aakash Kaku****, *Chaitra Hegde**, *Sohae Chung, Xiuyuan Wang, Yvonne Lui, Narges Razavian*
Accepted at **ISMRM** ML Workshop in Sept 2018

11. "DARTS: DenseUnet-based Automatic Rapid Tool for brain Segmentation" [ArXiv]
Authors: ***Aakash Kaku****, *Chaitra Hegde**,*Jeffrey Huang, Sohae Chung, Xiuyuan Wang, Matthew Young, Alireza Radmanesh, Yvonne Lui, Narges Razavian*
Pre-print

SCHOLASTIC ACHIEVEMENTS

- Recipient of **Moore-Sloan research grant** to conduct research on human activity recognition in stroke patients using IMU sensors and deep learning; Recipient of **Travel Grant**: NeurIPS 2019; Recipient of **Scholar Award**: NeurIPS 2022
- **Dean's Merit List** Awardee for being in **top 5%** of IIMB graduating class of 2014-16; **Institute Rank 2** and **Section Topper** for term III (3.86/4)
- Awarded *Sir Ratan Tata* scholarship for standing among **Top 5** ranks of the class at ICT (Under Grad.)
- Felicitated by Mumbai Municipal Corp. with a scholarship for excellent performance (Top 2%) in Class XII Exams

PROFESSIONAL EXPERIENCE

Intern – AI in Image Processing

- *Philips Research North America, Cambridge* May 2022 – Aug 2022
Advisor: Dr. Claudia Errico and Dr. Vipul Rai Paikar
  - Proposed and built a deep-learning-based weakly supervised model for detecting acoustic shadows in abdominal ultrasound videos using a student-teacher training paradigm.
  - Combined the acoustic shadow detection model with an object detection model to shortlist high-quality frames for performing 2D organ measurements and tissue characterization (liver fat quantification) from a video. This product feature helped to reduce radiologists' workload by 85%.

Research Intern

- *NYU School of Medicine, New York* Feb 2018 – May 2019
Advisor: Prof. José Maria Raya Garcia Del Olmo, Prof. Narges Razavian
  - Performed highly imbalanced multi-class knee cartilage tissue segmentation using diffusion-weighted MRIs. Developed and implemented an efficient variant of the 2d U-Net model with 40x fewer parameters and dilated convolutions. Proposed model achieved state-of-the-art results and surpassed a human radiologist level.
  - Performed perturbation analysis to understand important features of MRI for the segmentation task. Built confidence maps that showed the model's confidence for the voxel-level predictions. [github] [Project Report]
  - Designed and implemented a 102 class segmentation DenseUnet model to segment highly imbalanced brain MR dataset. Proposed a method to schedule (change) loss function while training to ensure better convergence of the model. [ArXiv] [github]

Strategy Analyst

- *Accenture Management Consulting Firm, Bangalore* May 2016 – Aug 2017
  - Built & implemented an NLP model to categorize the process activities as automated, semi- automated or manual; Automatic categorization helped in process optimization; Resulted in savings of $3 Mn for the client.
  - Assisted two largest chemical companies in the world to undergo a successful merger by doing a thorough process due diligence; Received a letter of appreciation from the client (a Fortune 100 company) for excellent execution of the project.

RESEARCH EXPERIENCE

Human activity recognition in stroke patients using IMU sensor data [ArXiv]

- *NYU Center for Data Science and NYU School of Medicine, New York* May 2018 – Present
Prof. Carlos Fernandez Granda,Prof. Heidi Schambra
  - The proposed ResNet-like model with adaptive normalization and feature embedding achieved 10% increase in performance as compared to the traditional CNN model
  - Adaptive normalization and feature embedding component ensured the model generated features that were patient agnostic but at the same time relevant for predicting the action. This enhanced the generalizability of model.

Multi-Label Classification & Unsupervised Localization of Thoracic Diseases

- *NYU Center for Data Science, New York* Dec 2017 – Jan 2018
Independent Research
  - Built custom-made ResNet CNN to perform multi-label classification and unsupervised localization of common thoracic diseases using 1024×1024 Chest X-rays. Achieved modest AUCs of ≈ 0.7
  - Used Class Activation Maps (CAMs) & Saliency maps to perform unsupervised localization of diseases

RELEVANT DATA SCIENCE PROJECTS

Neural Machine Translation [github]

- NYU Center for Data Science, New York — Sept 2018 - Present
  - Built a neural machine translation model using an encoder-decoder architecture with word and character level encoding to translate Vietnamese to English and Chinese to English.
  - Compared and analyzed performance of different encoder and decoder architectures like bi-GRU with and without attention, self-attention based encoders, CNN-based encoders, and fully self-attention based encoder and decoder model (like Transformer model).

Yelp Recommendation Engine [github] [Project Report]

- NYU Center for Data Science, New York — Sept - Dec 2017
  - Built a recommendation engine for recommending restaurants to Yelp users with a sparse rating matrix (99.4% sparse) and traditional models like the Cosine similarity-based model, SVD, and Alternating Least Square model
  - Developed advanced models like SGD - based Matrix factorization model, Neural Network based model, Random Forest Regressor based model, and an ensemble model to achieve 20% higher performance on the sparse rating matrix completion task

Prediction of Domestic Violence in India

- Indian Institute of Management, Bangalore — Sept - Dec 2015
  - Predicted probability of domestic violence in an household in India using Indian Human Development Survey data and logistic regression based model, applied to top k PCs after reducing dimensionality using PCA
  - Suggested ways to improve situation in the domestic violence-prone regions based on the model's feature weights

Bank Marketing Campaign Analysis [github] [Project Report]

- NYU Center for Data Science, New York — Sept - Dec 2017
  - Analyzed the prior marketing campaigns of a Portuguese Bank using various ML techniques like Random Forests, Decision Trees, Grad. Boosting and AdaBoost and predicted if the user will buy the fixed income product or not
  - Recommended ways to better target customers using feature importance maps and business intuition

Dataset Search Engine for NYC Open Data portal [github] [Project Report]

- NYU Center for Data Science, New York — Feb - May 2018
  - Built a sophisticated search engine for datasets in NYC Open Data portal containing $\approx$ 1500 datasets (650 GB)
  - Developed 11 advanced search functionalities, currently not supported by NYC Open Data website, to help the user find relevant datasets; Created data summaries and used PySpark to parallelize and speed up the search process

TEACHING AND GRADING EXPERIENCE

Teaching Assistant

- *Mathematical Tools for Data Science* Spring 2021 for *Prof. Carlos Fernandez Granda* at NYU
- *Deep Learning for Medicine* Spring 2019 for *Prof. Narges Razavian and Prof. Cem Deniz* at NYU
- *Quantitative Methods 2* (Sept - Oct 2015) for *Prof. Rajlaxmi Murthy* at IIM Bangalore

Grader

- *Mathematical Tools for Data Science* Spring 2021 for *Prof. Carlos Fernandez Granda* at NYU
- *Predictive Modeling with Sports Data* Spring 2021 for *Prof. Brett Bernstein and Prof. David F L* at NYU
- *Probability and Statistics for Data Science* Fall 2020 for *Prof. Carlos Fernandez Granda* at NYU
- *Machine Learning* Spring 2019 for *Prof. David Rosenberg and Prof. Julia Kempe* at NYU

TECHNICAL SKILLS

- **Programming Languages:** Python, Excel VBA, Matlab, C++, R, SQL
- **Tools & Libraries:** pytorch, keras, pandas, nltk, ccikit-Learn, tensorFlow, openCV, matplotlib, pyspark

SERVICE

- Reviewer of NeurIPS 2019, 2021, 2022; NeurIPS - Dataset Track 2022; ICLR 2022, 2023; ICML 2022; American Journal of Neuroradiology and multiple workshops like NeurIPS Machine Learning for Health 2020, 2021.
- Mentored talented high schools girls for NYU GSTEM summer research program that promotes STEM education for the underrepresented communities - especially girls and other minorities

CO CURRICULAR ACTIVITIES

- **Sports (Cricket)**: Member of College cricket team; Gold/Silver medalist in intercollegiate competitions held in 2014/2015
- **Arts and Drama**: Directed & performed street plays for audiences of 400+ at various events, IIMB, 2015 and 2016