Archiki Prasad

Curriculum Vitae

A 504, Wallace Apartments, Grant Road
Mumbai, Maharashtra, India 400007
+91 8169992627
archikiprasad@gmail.com
archiki@iitb.ac.in
Personal Homepage

Research Interests

- Machine Learning
- Speech Processing and Recognition
- Natural Language Processing
- Interpretability and Explainability

Education

August, 2021 (Expected) **Dual Degree (B.Tech + M.Tech), Electrical Engineering** *GPA: **9.59/10***
Indian Institute of Technology Bombay, Maharashtra, India
Minor in *Computer Science and Engineering*
Currently ranked 3rd in my batch

Publications

- *A. Prasad* and P. Jyothi, "**How Accents Confound: Probing for Accent Information in End-to-End Speech Recognition Systems**," *Association of Computational Linguistics (ACL) 2020 (Long Paper)* [*paper*]
- A. Chauhan, *A. Prasad*, P. Gupta, A. P. Reddy and S. K. Saini, "**Time Series Forecasting for Cold-Start Items by Learning from Related Items using Memory Networks**," *The Web Conference (WWW) 2020 (Poster)* [*paper*]
- *A. Prasad*, V. Jain and S. Moharir, "**Decentralized Age-of-Information Bandits**," *under review, IEEE Wireless Communications and Networking Conference (WCNC) 2021* [*paper*]

Patents

- S. K. Saini, A. Chauhan, A. Prasad, P. Gupta and A. P. Reddy, "**Key-Value Memory Networks for Predicting Time Series Metrics of Target Entities**," *US Patent Application US16/868,942* | *Adobe Inc.*

Research Experience

Fall 2019 **Probing End-to-End ASR for Accent Information** [*paper*] [*code*] *RnD Project*
Prof. Preethi Jyothi IIT Bombay

- Analyzing representations of an end-to-end ASR model to explain the confounding effect of accents
- Designed a **gradient attribution** metric at the input speech frames and calculated its distance from a reference attribution; proposed a gradient **contribution** metric for intermediate level representations
- Conducted an **information-theoretic** analysis of the information encoded in the hidden representations
- Used **auxiliary classifiers** to show different levels phonetic information encoded in the representation of different accents and identified parts of the network that exhibited maximum **accent-differentiation**

Summer 2019 **Time Series Forecasting of Cold-Start Entities** [*paper*] *Research Internship*
Dr. Shiv Kumar Saini Adobe Research, India

- Worked on SKU-level sales and page views forecasting for items with little or no prior data
- Conceptualized a framework utilising web-scraped **meta-information** and extracted feature vectors from written product descriptions through topic-modelling techniques such as LDA and TF-IDF
- Proposed a novel architecture based on **Memory Augmented** Neural Networks exploiting the similarity across products and time, achieving up to **50% improvement** in mean MAPE over an LSTM baseline
- Analyzed attention heads to **explain predictions** and find similar products as per the model

Fall 2020 **Joint Noise and Accent Robustness of End-to-End ASR** *Dual-Degree Thesis*
Prof. Preethi Jyothi & Rajbabu Velmurugan IIT Bombay

- Exploring the combined effect of noise and accents on end-to-end ASR models and making it robust
- Developing noise-robust models through front-end **Speech Enhancement**, Data Augmentation, **Multi-Task Learning** and **Adversarial Training**, and conducting a comparative analysis across all techniques
- Devising metrics and techniques to measure the effect of accents and train the **accent-agnostic** models

Spring 2020 **Decentralized Scheduling via Age-of-Information (AoI) Bandits** [*paper*] *RnD Project*
Prof. Sharayu Moharir IIT Bombay

- Developed **multi-armed bandits** based policies to schedule decentralized users on various channels to **minimize total time elapsed** since the destination received most recent update from each user (AoI)
- Proposed novel **Thompson Sampling** based and hybrid policies and their **metric-aware** extensions
- Proved regret **upper bound** for an existing **UCB**-based policy and compared all policies via simulations

Summer 2018 **Evolutionary Trees Model Selection** [*slides*] *Research Internship*
Prof. Arndt Von Haesler Center for Integrative Bioinformatics Vienna

- Contributed to developing a novel technique of selecting evolutionary models for **genomic sequential** data using machine learning; One of the **first applications** of AI in computational phylogenetics
- Proposed a **frequency count** based summarizing technique reducing the input data size by over **10x**
- Designed an **LSTM**-based architecture that achieved **94.37% accuracy** on-par with statistical methods such as Bayesian and Akaike Information Criteria but with significantly **reduced inference time**

Scholastic Achievements

2020 Awarded **Institute Academic Prize** for outstanding performance in the academic year 2019-20

Summer 2020 Among the 50 students selected nation-wide to attend the **Natural Language Understanding** track of the Google AI summer school conducted by **Google Research India**

2017 Received **Advanced Performer**'s grade (about top 1% of class) in Linear Algebra and Economics

Presentations & Talks

2020 Oral presentation of a long paper on Explaining the Effect of Accents in E2E ASR at ACL 2020

2019 3 talks and a poster presentation on Cold-start Analytics to the AI Lab of Adobe Research, India

2019 Presentation on Secure Voice Communication at Texas Instruments-DSP Seminar, IIT Bombay

2018 Talk on Uses of Recurrent Neural Networks to the Center for Integrative Bioinformatics Vienna

Other Selected Projects

Spring 2020 **Small Footprint Keyword Spotting** [*report*]
Prof. Preethi Jyothi & Prof. Rajbabu Velmurgan Supervised Research Exposition
Identified key words in continuous speech through **ResNet** and **Convolutional Neural Network** based models with extensive applications in detecting wake-word(s) like 'Alexa', 'Siri' in personal assistants. Analysed **robustness** to background noise and compared performances on Google Speech Commands. **Reduced** number of **parameters** and number of **operations** of models in order to run on ARM processors.

Fall 2019 **Contextual Multi-Armed Bandits** [*report*] [*slides*]
Prof. Sharayu Moharir Advanced Concentration Inequalities
Analysed a variant of MABs with **underlying (user) context** that influences rewards and actions (on items), and evolves over time based on them; specifically dealt with **positive externality** on user arrivals. Explored existing bandit algorithms and conceptualized a **novel** Rejection Based Arm Elimination policy.

Fall 2019 **Low-Resource Dialect Adaptation of ASR** [*report*]
Prof. Preethi Jyothi Automatic Speech Recognition
Explored adaption of end-to-end ASR model: DeepSpeech2 on two **low-resource** Spanish dialects. Conducted comparative analysis of **zero-shot learning**, **transfer learning** on different parts of models and **adversarial training** techniques; demonstrating up to **40% improvement** in Word Error Rates.

Fall 2018 **Artistic Style Transfer in Images**
Prof. Ajit Rajwade — Foundations of Digital Image Processing
Designed an iterative algorithm to perform style transfer from famous paintings to real-life pictures on MATLAB and achieved results comparable to machine learning based algorithms. Performed foreground-background **segmentation** using edge detection, **patch matching** from content image to style image via nearest neighbour search and **image optimisation** using IRLS.

Fall 2018 **Audio Source Seperation** [*report*]
Prof. Sunita Sarawagi — Introduction to Machine Learning
Designed a framework that uses a deep **Convolutional Neural Network** based model for separating professionally mixed songs into constituent vocals, drums, bass and other music through STFT features.

Relevant Coursework

Electrical Engineering	Data Analysis and Interpretation, Probability and Random Processes, Advanced Concentration Inequalities, Applied Linear Algebra, Speech Processing, Information Theory and Coding, Digital Signal Processing, Communication Networks, Network Security, Microprocessors
Computer Science	Introduction to Machine Learning, Automatic Speech Recognition, Natural Language Processing with Deep Learning (online), Foundations of Digital Image Processing, Operating Systems, Data Structures and Algorithms, Computer Programming and Utilization
Mathematics	Linear Algebra, Multivariate Calculus, Complex Analysis and Differential Equations (I and II)

Teaching Experience

Spring 2018 & Spring 2020 **Teaching Assistant** *MA106: Linear Algebra*
Conducted weekly tutorial sessions for a batch of 50 freshmen. Assisted the professor in creating evaluation scheme and evaluating students' answer scripts.

Fall 2019 **Teaching Assistant** *MA205: Complex Analysis* and *MA207: Differential Equations II*
Conducted weekly tutorial sessions for a batch of 50 sophomores. Assisted the professor in preparing questions, creating evaluation scheme, evaluating answer scripts, and designing grading policy.

Fall 2020 **Teaching Assistant** *EE229: Signal Processing I*
Co-managing logistics of an online class of 80 sophomores. Assisting the professor in preparing questions, creating evaluation scheme, evaluating answer scripts, and designing grading policy.

Technical skills

Languages	C/C++, Python, R, bash, HTML
SW/ Tools	MATLAB, Scilab, Git, Docker, LaTeX, Arduino, Quartus
ML Libraries	TensorFlow, PyTorch, Keras, NumPy, OpenCV, Pandas

References

- **Prof. Preethi Jyothi**
  Assistant Professor, IIT Bombay
- **Dr. Shiv Kumar Saini**
  Sr Research Scientist II, Adobe Research
- **Prof. Sharayu Moharir**
  Assistant Professor, IIT Bombay
- **Prof. Rajbabu Velmurgan**
  Associate Professor, IIT Bombay