

# Soundarya Krishnan

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## Education

**Carnegie Mellon University (CMU)** | CGPA: 4.17/4.00

**M.S. Machine Learning**

Pittsburgh, PA | Aug 2021 – Dec 2022

Machine Learning (PhD), Probability and Mathematical Statistics, Advanced Natural Language Processing, Advanced Deep Learning, Convex Optimization, Multimodal Machine Learning, Probabilistic Graphical Models, Deep Learning Systems, Machine Learning in Practice

**BITS Pilani Goa Campus** | CGPA: 9.51/10

**B.E. Computer Science, M.Sc. Physics**

Goa, India | Aug 2016 – Jun 2021

Department Rank 1, Awarded Institute Merit Scholarship

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## Skills

C/C++, Python, Java, Javascript, MySQL, CSS, HTML5, Node.js, Hadoop, MongoDB, Apache Spark, TensorFlow, PyTorch

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## Experience

**Apple** | Natural Language Machine Learning Intern  
Seattle, WA | May 2022 – Aug 2022

Worked on Egocentric Natural Language Video Localization that can assist the elderly (and others) in remembering episodic events. Developed a zero-shot object detection and activity detection module that performs roughly equivalent to SOTA on the Ego4D dataset. Developed a multimodal transformer that addresses the task through better alignment of the video and text modalities.

**Microsoft Research** | Research Intern

Bangalore, India | Jan 2021 – Jun 2021 | Advisor: Dr. Amit Sharma

One of the primary contributors to the DiCE library [v0.5]. Implemented two model-agnostic methods to efficiently generate diverse counterfactuals in Python, wrote rigorous tests and documentation for the same. Authoring a paper on the theoretical properties satisfied by a novel feature attribution metric guided by ideas from causality.

**MIT Media Lab** | Research Affiliate (Remote)

Boston, MA | Aug 2020 – Dec 2020 | Advisor: Prof. Pattie Maes

Built CNN-LSTM models (with saliency maps) on TensorFlow for automatic sleep scoring. Accompanied model predictions with Slow waves, Spindles, K-complexes, FFT & PSD plots extracted from signal data. Integrated the pipeline on a real-time open-source web-based interface using Javascript, socket programming, Node.js, Express.ejs, D3.js, and MongoDB [Code].

**Uber** | Software Development Intern (Remote)

Bangalore, India | May 2020 – Jul 2020

Implemented Bayesian Thompson Sampling for the Multi Arm Bandit problem in Uber's AdServer team. Worked with Java, Python, Hive, Apache Spark, SQL, HDFS, Amazon AWS Lambda. Wrote comprehensive tests (90%+ coverage), and detailed documentation to assist future users. Project resulted in 5 to 10% revenue growth for Uber's advertising sector.

**Dalhousie University** | MITACS Globalink Intern

Halifax, Canada | May 2019 – Aug 2019 | Advisor: Prof. Julien Ross

Utilized linear algebra to support 'Secure, fast, and efficient optimization of quantum circuits'. Demonstrated the steps of reducing the cost of a CNOT Dihedral quantum circuit by reducing the number of T gates and replacing them with less expensive gates [Report].

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## Selected Projects

**Multimodal Multihop Retriever**

CMU | Jan 2021 – Dec 2021

Proposed the first ever multimodal and multihop retriever that performs fine grained retrieval over information sources as a method to automatically answer a given question given multiple images and text snippets as sources. Method is SOTA for retrieval on the WebQA dataset [Report].

**Learning Sparse Transformers using Kernels**

CMU | Jan 2021 – Dec 2021

The main computational bottleneck in Transformers is the quadratic complexity in the attention block. Designed a method with (theoretical) linear complexity and reduced FLOPS in the attention block by using binary Kernels to learn the attention pattern [Report].

**Survival Analysis for COVID-19 modelling**

ACMI Lab, CMU | Jun 2021 – Aug 2021 | Advisor: Prof. Zachary Lipton

Built a Cox Proportional Hazards model for survival analysis of COVID-19 patients in the Allegheny Health Network database. Performed data analysis on MySQL, obtained risk scores from the model, and calibrated the model to obtain high-accuracy estimates of hospital load at future dates. Model currently deployed at Allegheny General Hospital.

**ML for Healthcare**

TCS Research & BITS Goa | Jun 2020 – Sep 2020

Advisors: Prof. Ashwin Srinivasan & Prof. Lovekesh Vig

- Extracted domain-specific features directly from the image data using DNNs built in TensorFlow, and constructed a symbolic model for the diagnosis of COVID-19 from chest X-rays using these features. Generated visual and textual explanations, and integrated all steps in a web-based interface. [1]
- Built a Keras segmentation model to isolate the lung region from the rest of the X-ray, and built a model to detect COVID-19 from the segmented lung. Employed embeddings of disease symptoms produced by the CheXNet network and created an ensemble for classification. Prime Minister's office is interested in using this tool for mass screening in airports and railway stations. [2]
- Evaluated the efficacy of transfer of a brain-lesion model to the lung (and vice versa) by comparing against a model constructed without model-transfer and using lesion-agnostic transfer. [3]

**Social Networks-based Chatbot**

BITS Goa | Aug 2019 – Dec 2021

Built a platform agnostic Social Networks & NLP based Python chatbot that scrapes chat data, ranks expertise of users, suggests experts and timings for various topics extracted from the chat. [4]

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## Publications and Posters

[1] Constructing and Evaluating an Explainable Model for COVID-19 Diagnosis from Chest X-rays

Rishab Khincha, [Soundarya Krishnan](#), Krishnan Guru-Murthy, Tirtharaj Dash, Lovekesh Vig, Ashwin Srinivasan [Preprint]

[2] CovidDiagnosis: Deep Diagnosis of COVID-19 Patients Using Chest X-Rays

Kushagra Mahajan, Monika Sharma, Lovekesh Vig, Rishab Khincha, [Soundarya Krishnan](#), et al.

TIA, MICCAI 2020. Springer LNCS [Paper]

[3] A Case Study of Transfer of Lesion-Knowledge

[Soundarya Krishnan](#), Rishab Khincha, Lovekesh Vig, Tirtharaj Dash, Ashwin Srinivasan

MIL3D, MICCAI 2020. Springer LNCS [Paper | Talk]

[4] Network Community Analysis Based Enhancement of Online Discussion Forums

[Soundarya Krishnan](#), Rishab Khincha, Neena Goveas

- ACM-W India 2020 Poster Competition: Won 1st Place [Links]
  - YRS, CODS-COMAD 2021: Honourable Mention [Demo]
  - WiDS Cambridge 2021: Lightning Talk [Poster]
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## Achievements and Leadership

- Selected Participant, **Google Research India AI Summer School**, Aug 2020
- Recipient, **Grace Hopper Celebration India**, July 2020
- Co-founder, **BITS Goa Women in Tech**, May 2020 [Links].