# Sanchayan Sarkar

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**Summary:** 5 years experienced in Machine Learning with expertise in Graph AI and multimodal deep learning in analyzing emotion and turn-taking behavior in multimodal dialogue. Passionate and adept in developing and applying statistical and ML algorithms in solving industry standard problems.

## Experience

***Data Scientist II (Machine Learning Research),* Katana Graph,** Denver, CO, USA. *Oct 2021- Present*

Building novel and scalable deep learning algorithms for graph-structured data.

- Developing novel self supervised embedding generation methods in a distributed environment.
- Designed a novel distributed Graph AI library and end-to-end AI platform in production.
- Developing distributed graph augmented MLP algorithms for large scale graphs using novel graph engine.
- **Achieved** 10x performance in both homogenous and heterogenous graphs without loss of accuracy.
- Binding native C++ implementations of state-of-the-art algorithms to generate python library on Graph AI.

***Graduate Research & Teaching Assistant*, University of Pittsburgh,** Pittsburgh, PA, USA. *May 2018-Aug 2021*

Research assistant in building multimodal machine learning models for turn-taking and emotion analysis in dyadic conversations.

***Project: Multimodal Turn Taking in Dyadic Conversations***

- Building end-to-end multimodal machine learning systems (in Python, PyTorch) for learning turn-taking strategies (end-of-turns, speaker pause) from multimodal (audio + video + text) sequences in dyadic interactions.
- **Achieved** statistically significant multimodal cues and **proposed** multimodal transformers to obtain higher performance.

***Project: Automatic Emotion Recognition in Dyadic Conversations***

- Built context aware multimodal sequential and non-sequential neural models (LSTM, Conv-LSTM, Transformers) for predicting composite emotion constructs from audio-video-text sequences in dyads (using Python, PyTorch).

***Project: Automatic Depression Detection in Mother-Child Dyads***

- Built a jointly learned Siamese CNN+LSTM model (in Python, PyTorch) to predict depression severity of mothers from mother-child face to face conversations using facial and head movement dynamics of dyads.
- **Increased** the performance of the prediction system by **3% (F1-Score)** over non-dyadic models.

Teaching Assistant.

- **Led classes**, **evaluated courses** and **prepared rubrics**: Algorithm Implementation (CS1501), Artificial Intelligence (CS 2710, CS 1571), Machine Learning (CS 1675), Human Computer Interaction (CS 1637).

***Project Researcher*, Indian Statistical Institute,** Kolkata, West Bengal, India. *Nov 2015- Dec 2016*

Research Intern working on developing mathematical and statistical models for human face recognition.

***Project: Illumination Variation Problem on Human Face Recognition***. [Paper]

- **Created a novel** local illumination-invariant descriptor (in MATLAB) for face recognition under varying lighting conditions.
- **Increased accuracy** over state-of-the-art methods by 6.7% on CMU-PIE, 5% on Yale B and 2% on AR and CUHK datasets.

***Project: Dimension Reduction and Noise Reduction for Face Recognition*** [Details]

- Applied linear regression to stabilize lower entropy space for dimension reduction in face recognition (using MATLAB).
- **Increased accuracy by 3%** on FRAV-2D, FERET datasets over state-of-the art methods and **established** proof of correctness.

## Skills

**Programming Languages:** Python, C/C++, MATLAB, Java, SQL
**Tools** **:** PyTorch, TensorFlow, Numba, scikit-learn, open CV, open MPI, git, AWS, Android SDK, Unity 3D
**Research Skills** **:** Deep Learning, Natural Language Processing, Graph Neural Networks, Computer Vision.

## Education

**Master of Science (MS), University of Pittsburgh,** PA, USA *Aug 2017- Aug 2021*

- Computer Science with 3+ years research experience in Machine Learning, Computer Vision and NLP. | *CGPA: 3.55 / 4.0*
- Arts & Science Fellowship, 2017-2018
- *Courses:* Machine Learning, Deep Learning, Natural Language Processing, Computer Vision, Artificial Intelligence.

**Master of Science, (MSc) University of Calcutta,** India *Jul 2013- Jun2015*

- Computer and Information Science. | *First Class, 75 % (in top 10)*
- *Thesis*: Image Enhancement using Cuckoo-Search Optimization.

**Bachelor of Science**, **(BSc)**, **St. Xavier's College, Kolkata**, India *Jul 2010- Jun 2013*

- Computer Science. | *First Class, 76% (in top 10)*

## Selected Projects

**Self supervised embedding learning** *Oct 2022- Present*

- Designing distributed scalable algorithms for self supervised graph embedding learning.

**Graph AI Platform** *Jun 2022 - Sep 2022*

- Leading a group to evaluate the AI platform for end-to-end training and inference tasks.
- Designing the native inference API for large scale graphs for distributed transductive inference.

**Graph AI Library** *Feb 2022 - Jun 2022*

- Designed & built the entire Graph AI functionality from scratch for large-scale graphs in a distributed setting.
- Native implementation of distributed feature generation, scaling, decompositions, label encoding functionality.
- 10-100x time improvement in feature engineering functions while maintaining mathematical correctness.

**Node Classification using Distributed Scalable Inception Neural Networks** *Nov 2021- Feb 2022*

- Designed a Distributed version of Scalable Inference Graph Neural Networks for large graphs.
- Achieved 10x performance improvement in time without any loss in accuracy on node classification tasks.

**Image Captioning Using attention-based image context (3730 Advanced NLP)** *Oct 2020- Nov 2020*

- Designed a caption generator (in PyTorch) from images using a Resnet-101 encoder with an attention-based LSTM decoder.

**Mortality Prediction Using Heterogenous Data Sources (3750 Advanced ML)** [Details] *Mar 2020- Apr 2020*

- Investigated contribution of multiple data sources (medications, vital signs) and built a Transformer architecture to predict mortality from continuous time-series data (using PyTorch).
- **Identified** Microbiology events as indicative of mortality and **achieved a 3% improvement** with Transformers over LSTM.

**Detecting Deep Fakes (11785 Deep Learning)** [Details] *Nov 2019- Dec 2019*

- Built a Siamese Statistical Recurrent Neural Network to detect deep-fake video sequence (using Python, PyTorch).
- **Achieved 10% increase** in AUC-ROC over Statistical Recurrent Networks in FaceForensics++ dataset.

**Detecting Pneumonia in Chest X-Ray Images: ML approaches (2750 ML)** [Details] *Mar 2019 – Apr 2019*

- Implemented Resnet-50, InceptionNet, CNN, Resnet-50 on Chest X-ray images (using Keras, Tensorflow).
- **Increased recall by 3%** using Resnet-50 over InceptionNet.

**Tiny Google - A Parallel Word Search Engine (2510 OS)** [Details] *Nov 2018- Dec 2018*

- Developed a distributed search engine, using multithreading, that searches and retrieves documents based on search words from multiple worker nodes (using Python and Threading).

**Direct Manipulation in Virtual Reality (2610 HCI)** [Details] *Nov 2017- Dec 2017*

- Extracted tracked movements from smartwatch to move objects in Virtual Reality (using Android SDK, Unity 3D).
- **Designed a novel user study** gauging the difficulty of moving a box to a sphere of varying length in the virtual environment.

## Publications

- *"Local Centre of Mass Face for Face Recognition under varying Illumination", 2017.* [Link]
- *"Challenges and Effects of Plastic Surgery on Face Recognition Performance: A review", 2016.* [Link]