Sanchayan Sarkar

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Summary: 5+ years experienced in Machine Learning with expertise in distributed graph neural networks and multimodal vision and language models in analyzing emotion and turn-taking behavior in conversational dialogue. Passionate and adept in developing both ML platforms and building deep learning algorithms to provide industry standard solutions.

Experience

Data Scientist II (Machine Learning Research), Katana Graph, Denver, CO, USA.   *Oct 2021- Present*
- Developed scalable semi-supervised based pipelines for automatic graph topology learning, from raw relational data, for fraud detection and entity resolution tasks, with significant precision gain over SOTA approaches.
- Designed a novel distributed Graph AI platform (using PyTorch and MPI), for end-to-end training and inference of graph based machine learning models, with **10-100x improvement** in performance time while maintaining mathematical correctness.
- Created a distributed Scalable Inference Graph Neural Network (SIGN) for node classification tasks (using pytorch) **achieving** a **10x** improvement in performance time without the loss of accuracy.

Graduate Research & Teaching Assistant, University of Pittsburgh, Pittsburgh, PA, USA.   *May 2018-Aug 2021*
- Built a context aware end-to-end multimodal system for predicting turn-taking and emotion states (end-of-turn, affect) from audio-video dyadic conversations. **Created** a novel multimodal transformer (in pytorch) to achieve state of the art performance.
- Built a novel siamese CNN+LSTM based approach (using pytorch) to predict depression severity from mother-child dyadic conversation videos, achieving a **3% F1-Score gain** over non-dyadic models.
- **Led** classes and **evaluated** courses: 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*
- **Created a novel** local illumination-invariant descriptor (in MATLAB) for face recognition under varying lighting conditions, with a 2-5% **increase** in accuracy over state-of-the-art methods on CMU-PIE, Yale B and CUHK datasets. **[Paper]**
- **Designed** a regression model (using MATLAB) to stabilize entropy space for dimension reduction in noisy facial images with **3% accuracy gain** over state-of-the-art methods on FERET and FRAV-2D datasets. **[Details]**

Skills

Programming Languages: Python, C/C++, MATLAB, Java, cypher query.
Tools   : PyTorch, TensorFlow, Numba, scikit-learn, DGL, dask, 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.
- 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

Automatic semi-supervised graph learning from tabular data   *Oct 2022- Present*
- Created a **novel scalable** semi-supervised graph learning pipeline from raw tabular data based on GRALE + similarity graphs (using PyTorch, dask).
- Achieved **5-7% precision gain** on downstream GNN models for both fraud detection and entity resolution tasks.

Distributed Graph AI Platform   *Feb 2022 - Present*
- Built native distributed algorithms for distributed feature engineering, scaling and decompositions.
- Designed APIs for distributed preprocessing, training and inference engines for graph neural network (GNN) pipelines.
- Achieved **10-100x** time improvement in feature engineering functions (using Python, MPI, PyTorch).

Node Classification using graph augmented MLPs   *Nov 2021- Feb 2022*
- Designed a Distributed version of Scalable Inference Graph Neural Network (SIGN) for graphs of size 1 TB (using PyTorch).
- Achieved **10x** performance improvement in time without any loss in accuracy for node classification.

Multimodal Turn Taking and Emotion Recognition in Dyadic Conversations   *Aug 2019- Aug 2021*
- Developed context aware multimodal language models for learning turn-taking strategies (end-of-turns, speaker pause) in multimodal dialogue (audio + video + text). Got a **3% F1-score gain** over SOTA approaches with our novel multimodal transformer (using PyTorch, python).
- **Identified** statistically significant cues and built context aware sequential neural models (Conv-LSTMs) with them for predicting composite emotion constructs from dyadic conversation videos (using Python, PyTorch).

Automatic Depression Detection in Mother-Child Dyads   *Aug 2018- Dec 2020*
- 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.

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.

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]