Digbalay Bose

4th Year PhD student
Department of Electrical and Computer Engineering
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Research Interests

Multimodal Machine Learning, Computer Vision, Affective computing, Machine learning for Healthcare

Education

2018–Present **University of Southern California**.
- Ph.D in Electrical and Computer Engineering **GPA: 3.84/4.00**
- **Advisor:** Prof. Shrikanth Narayanan

2014–2016 **Indian Institute of Technology Bombay**.
- M.Tech in Control and Computing **CPI: 9.51/10**
- **Specialization rank**: $2/16$
- **Advisor:** Prof. Subhasis Chaudhuri

2010-2014 **Jadavpur University**.
- B.E. in Electronics and Telecommunication Engineering **CPI: 9.34/10**
- **Specialization rank**: $2/46$

Selected Publications

Submitted

Facial Plastic Surgery and Aesthetic Medicine **Automated analysis of asymmetry in facial paralysis patients using landmark-based measures**. **Digbalay Bose**, Krishna Somandepalli, Tymon Tai, Courtney Voelker, Shrikanth Narayanan, Amit Kochhar

ICASSP 2022 **Cross Domain Emotion Recognition using few shot knowledge transfer Link**.
Justin Olah, Sabyasachee Baruah, **Digbalay Bose**, Shrikanth Narayanan

Published

ICCV CLVL 2021 **Understanding of Emotion Perception from Art Link**.
Digbalay Bose, Krishna Somandepalli, Souvik Kundu, Rimita Lahiri, Jonathan Gratch, Shrikanth Narayanan

CODS-COMAD 2021 **Robust resource demand estimation using hierarchical Bayesian model in a distributed service system Link**.
Sumanta Mukherjee, Krishnasuri Narayanam, Nupur Aggarwal, **Digbalay Bose** and Amith Singhee

ICVGIP 2016 **Hierarchical Spectral Clustering based Large Margin Classification of Visually Correlated Categories. Link**.
Digbalay Bose, Subhasis Chaudhuri, Indian Conference on Vision, Graphics and Image Processing, Article:48, pp 1-8, 2016

Information Sciences **Optimal filter design using an improved artificial bee colony algorithm Link**.
Digbalay Bose, Subhodip Biswas, Athanasios V. Vasilakos, Sougata Laha, Information Sciences, vol 281, pp 443-461, 2014

Patents

US Patent 2020 **Visually Guided Query Processing Link**.
Ashok Pon Kumar Sree Prakash, Ayushi Dalmia, Amith Singhee, **Digbalay Bose**, Sumanta Mukherjee, Raghavendra Singh, Vikas C. Raykar, **US20200311480A1**, Published: 2020-10-01

Professional Experience

July 2016-June 2018 **Research Software Engineer, IBM Research Lab, India**.

- Developed an end-to-end soil moisture extraction system from satellite images by incorporating image interpolation techniques. Further web based visualizations were developed for geo-spatial analysis of the same. Integrated as a part of IBM PAIRS Geoscope. Link
- As a part of retail and operations effort, developed explainable deep learning models in the domains of image classification and visual search. Link
- Worked on analyzing human face shapes by integrating deep neural net(facenet) based feature extraction schemes with ensemble learning techniques.

Internship/Experience

July 2020 - August 2020 **Oxford Machine Learning Summer School**.

- Explored areas of Bayesian Deep Learning, Representation Learning and Machine Learning for Healthcare through seminars/lectures.
- Acceptance rate: 15%

May 2013 - July 2013 **Indian Statistical Institute, Kolkata**.

Advisor: Prof. Subhamoy Maitra, Applied Statistics Unit

- **Topic:** Cryptanalysis of stream cipher Salsa20
- Worked on the cryptanalysis of stream cipher Salsa20 and investigated a key recovery scheme based on the properties of Slid Pairs.

Research Experience

PhD research work **Content analysis of advertisement videos**.

Advisor: Prof. Shrikanth Narayanan, Signal Analysis and Interpetation Laboratory(SAIL), University of Southern California

- Compiled a dataset of 8809 videos from web sources(ads of the world.com and JWT ads sources) with metadata information regarding tags, advertising agency, producers etc.
- Developed baseline neural network architectures(recurrent, attention ad clustering based) for classifying topics from ad videos in a multimodal framework.
- Developed taxonomies for understanding impact of advertisements on viewers and content along the dimensions of social impact, violence and tone transition.

PhD research work **Visual ambience understanding**.

Advisor: Prof. Shrikanth Narayanan, SAIL, University of Southern California

- Developed multi-label scene classification models from short video clips.
- Developed methods to analyze scenes from image and video datasets by focusing on impact of person coverage on scene classes.
- Curated a generic taxonomy of movie scenes based on existing data sources followed by dataset compilation.
- Work done in collaboration with Google, USA

PhD research work **Analysis of facial paralysis patients**.

Advisor: Prof. Shrikanth Narayanan, SAIL, University of Southern California

- Developed a dynamic task based analysis system for patients vs controls using optical flow measures.
- Created a configurable web battery for automating the question template asked by doctor in clinical settings and recording timing instants for patient tasks like smiling, raising eyebrows etc. Application hosted at Face Paralysis Battery
- Created a video pipeline that involves analysis of the patient videos using facial landmarks and extracting dynamic facial measures for monitoring before and after surgery.
- Work done in collaboration with Dr. Amit Kochhar, Pacific Neuroscience Institute and Dr. Courtney Voelker, Department of Clinical Otolaryngology, Head and Neck Surgery, Keck School of Medicine.

PhD research work **Multi-attribute based person modeling**.

Advisor: Prof. Shrikanth Narayanan, SAIL, University of Southern California

- Developed end-to-end models for joint detection and attribute classification from images.
- Currently working towards mapping multiple attributes from images with text queries for person retrieval.
- Work done in collaboration with Dr. Mohammad Rostami, Information Sciences Institute.

Master's Thesis **Applications of sparsity and metric learning based methods in classification problems**.
Advisor: Prof. Subhasis Chaudhuri, IIT Bombay
- Analyzed sparse representation algorithms with specific emphasis on the facial recognition and crowd video classification problems (CUHK Crowd video data set and Facial databases like AR and Yale were considered).
- Proposed a novel hierarchical scheme of image classification, that involved organization of the image categories using a self tuning variant of spectral clustering followed by application of large margin nearest neighbor algorithm on a hierarchical tree structure.

Relevant Course Work

Graduate(USC) Probability for Electrical and Computer Engineers, Linear Algebra, Random Processes, Deep Learning and its applications, Deep Learning for Speech Processing, Digital Signal Processing, Machine Learning, Affective Computing

Graduate(IIT Bombay) Computer Vision, Machine Learning, High Performance Scientific Computing, Image Processing, Wavelets, Applied Linear Algebra, Matrix Computations

Undergraduate Digital Signal Processing, Digital Control Systems, Compiler Design, Operating Systems, C Language and Data Structures, Computer Networks

Online certifications Machine Learning(Coursera,Stanford University), Neural Networks and Deep Learning (Coursera, Stanford University)

Academic Projects

Spring 2021 **Art meets Affect**.
Advisor: Prof. Jonathan Gratch, University of Southern California
Course: Affective Computing, CSCI 534
- Developed text and image classification models for classifying evoked emotions in viewers from artworks.
- Developed novel cross-modal architectures to combine textual captions and image regions for emotion classification.

Spring 2020 **Future Sales Prediction**.
Advisor: Prof. Yan Liu, University of Southern California
Course: Machine Learning, CSCI 567
- Developed an ensemble of decision tree models to predict future sales of different shops and products.
- Developed a framework for tuning hyperparameters of decision tree models using random search and hyperopt.
- Obtained a world rank of 80 among 8292 teams in the Kaggle future sales competition(Link)

Spring 2019 **Visual Question Answering**.
Advisor: Prof. Joseph Lim, University of Southern California
Course: Deep Learning and its Applications, CSCI 599
- Fused question guided attention based image representations with question embeddings (via various pooling techniques) to improve upon the SOTA in VQA(Visual Question Answering)
- Was awarded the best project by the poster session sponsors, Neudesic.

Fall 2019 **Multimodal Emotion Recognition**.
Advisor: Prof. Panayiotis Georgiou, University of Southern California
Course: Deep Learning in Speech Processing, EE 599
- Developed a CNN(VGG-VOX) based architecture for analyzing speech utterances followed by fusion using text representations for utterance level emotion label.
- Obtained competitive results on MELD and CMU-MOSEI datasets.

Spring 2016 **Parallel graph algorithms** .
Advisor: Prof. Shivasubramaniam Gopalakrishnan, IIT Bombay
Course: High Performance Scientific Computing, ME 766
- Implemented standard graph algorithms like Breadth first search, Dijkstra shortest path algorithm, Floyd Warshall's algorithm in a parallelized fashion using NVIDIA Geforce GTX Titan GPU
- Compared the results with the standard serial (CPU) implementation on the DIMACS benchmark suites.

Teaching Experience

Fall 2020 Teaching Assistant, **EE 599: Deep Learning Systems**

Skills

Languages C, C++, Python, R, Javascript, HTML, MATLAB, VHDL

Machine learning tools	Tensorflow, Keras, Pytorch, Caffe, scikit-learn
Tools	OpenCV, LaTeX, OpenSmile, Bash
Hardware	Arduino, Raspberry Pi

Reviewer

Conferences: ICME 2021, ICASSP 2020, ICME 2020, HiPC 2017

Achievements

- Awarded **Annenberg Fellowship, 2018** by University of Southern California
- Received certificate of appreciation from **IBM Research India** for contributions in data driven soil moisture modelling
- Received a certificate of academic excellence from the **Department of Electrical Engineering, IIT Bombay**, 2016
- All India Rank **251**(out of 216367 candidates) in GATE-2014, Electronics & Communication
- **32nd** rank out of 1,08,961 students in Engineering in West Bengal JEE 2010
- Secured an **All India Rank of 3128** and **state rank of 53** in AIEEE, 2010 out of 10 lakh examinees
- Secured an **All India Rank of 7241** in IIT JEE 2010 out of 5 lakh examinees
- Awarded the **Kishore Vaigyanik Protsahan Yojana scholarship** 2009 by the Department of Science and Technology, Government of India.

References

- Available on request