

Soumava Paul

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Education

Indian Institute of Technology Kharagpur

B.Tech (Major) in Electrical Engineering

Minor in Computer Science and Engineering

South Point High School, Kolkata

Intermediate in Science (10+2)

July 2016 - July 2020 (Expected)

GPA : 8.86/10

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2014 - 2016

Percentage : 95.4

Publications

- [1] **Addressing Target Shift in Zero-shot Learning using Grouped Adversarial Learning** (under review at **CVPR 2020**)
- [2] **Jointly Learning Convolutional Representations to Compress Radiological Images and Classify Thoracic Diseases in the Compressed Domain** by Ekagra Ranjan*, **Soumava Paul***, Siddharth Kapoor*, Apendu Kar, Ramanathan Sethuraman, Debdoot Sheet (* denotes equal contribution) | Indian Conference on Computer Vision, Graphics and Image Processing (**ICVGIP**), ACM, 2018

Internships

IBM India Research Labs

Research Intern, AI Tech Group, Bengaluru

May 03 - Aug 06, 2019

Poster | [Experience-Letter](#)

- Worked on **Target Shift Correction**, a problem relatively unexplored in the field of machine learning.
- Applied our novel method termed as **Grouped Adversarial Learning** to **Attribute** and **Zero-Shot Class Prediction** with 4 popular zero-shot learning datasets. Work currently under review at **CVPR 2020**.
- **Genre prediction** from movie-plot summaries of **CMU Movie Summary Corpus** using **InferSent** embeddings and **Bi-LSTMs**.

Projects

Surgical Video Analytics for Autonomous Robotic Surgery

Bachelor's Thesis Project

Aug '19 - Present

Adviser: [Dr. Debdoot Sheet](#), EE, IIT Kgp

- Models for frame-wise **regression** of different **kinematic variables** (eg. Cartesian positions, velocities, gripper angle etc.) that describe the motion of robotic manipulators for surgical tasks like **suturing**, **knot-tying** and **needle-passing**.

Neuro-Fuzzy Methods for Analyzing Students' Academic Performance

Soft Computing Term Project

Mar - Apr '19

Adviser: [Dr. S.K. Barai](#), Civil Engg., IIT Kgp

- An **autoencoder-based neuro-fuzzy model** to analyze effects of a student's day-to-day activities and interactions on his academic performance.
- Model performed significantly better compared to traditional machine learning techniques like Random Forest, SVM or MLP on 2 popular student performance datasets.

ArMyo : Action Recognition using EMG data

4th place, Inter-Hall Hardware Modelling 2019

Mar - Apr '19

- **Time-Series CNNs** for efficiently classifying 6 different arm movements using signals obtained from **EMG sensors** placed at 4 distinct locations in each arm.
- Resulting model was incorporated into an **Exoskeleton Arm** that could be used by paralyzed patients lacking sufficient arm strength.

Remote Keyboard Control through Gesture Recognition

Embedded Systems Capstone Project

Apr '19

Adviser : [Dr. Ashis Maity](#), EE, IIT Kgp

- **Arduino**-based hand gesture recognition method for remote control of a computer keyboard using **PySerial** and **PyAutoGUI** libraries.
- A total of **8** keyboard actions were controlled using 2 **HC04s**, some of them being switching between applications or browser-tabs, scrolling, taking screenshots etc.

Nuclear Segmentation

Dec '18 - Present

- Implemented **UNet** and **RelayNet** architectures for segmentation of nuclear and background pixels in images of the **BNS** and **TNBC** datasets. Currently developing different methods for a boost in performance compared to state-of-the-art results.

Traffic Sign Recognition System

Image Processing Term Project

Oct '18

Adviser : [Dr. Partha Pratim Das](#), CSE, IIT Kgp

- **Edge** and **contour detection** algorithms in pre-processed images for ROI extraction corresponding to traffic signs of **6** different shapes. Methods primarily based on [this paper](#).
- **Cross-correlation** algorithms for finding similarities between extracted ROIs and a database of high resolution traffic sign images grouped according to their shapes.

Detection of Ships in Satellite Imagery

Kaggle Challenge

Jul - Aug '18

Advisers : [Mr. Anirban Santara](#) & [Dr. Pabitra Mitra](#), CSE, IIT Kgp

- Implemented efficient data augmentation techniques to address the class imbalance problem in the dataset.
- Designed a CNN architecture that achieved a test classification accuracy of **99.63%**.

Thoracic Disease Classification in Chest X-Ray Images

ICVGIP 2018

May - Jul '18

Adviser : [Dr. Debdeep Sheet](#), EE, IIT Kgp

- Explored algorithms like **Recurrent CNNs**, **Multiple Instance Learning (MIL)**, **dilated CNNs**, **Multiview Networks** and **Autoencoder-based feature learning**.
- Surpassed state-of-the-art methods by **2.5%** in the **AUROC** score. 1 research paper has been published on the same.

Grain Imaging

AI Team, AgNext Technologies Private Limited

Apr - Nov '18

Adviser : [Dr. Mrigank Sharad](#), IIT Kgp

- **AgNext** is a startup in collaboration with IIT Kharagpur which aims to develop exciting and impactful Ag-Tech solutions. During my time here, I worked on **Broken Grain Identification** and **Quality Analysis** in rice grain images.
- Developed techniques to automatically segment rice grains and determine their size statistics in a given sample.
- Built CNNs to efficiently detect the number of broken and normal grains in a sample with a prediction accuracy of around **87%**.

DigiCon - Digitization of Doctor's Handwritten Prescriptions

1st place, Inter-Hall OpenSoft 2018

Mar - Apr '18

[Github Link](#)

- A fully automated parser for digitizing doctor's handwritten prescriptions through technologies like OpenCV, OCR, NLP, Flask etc.
- Worked on **Handwritten text recognition** using the Google Cloud Vision API and image preprocessing methods to extract better results from OCR API including **deskewing** of skewed images.

Technical Skills

Programming Languages Tools & Frameworks

Python • C • MATLAB • R
PyTorch • Keras • Librosa • OpenCV • Arduino IDE • Processing • Git • Shell • MacOS
• \LaTeX

Relevant Courses

CS : Machine Learning, Image Processing, Algorithms, Computer Networks, Computer Architecture and Operating Systems, Programming and Data Structures⁺, Cognitive Information Processing

EE : Signals and Networks⁺, Embedded Systems⁺, Control Systems Engineering⁺, Digital Electronic Circuits⁺

Math & others : Probability and Stochastic Processes, Linear Algebra, Transform Calculus, Symbolic Logic, Soft Computing
(⁺ denotes practicum included)

Awards & Achievements

- Selected for **University of Alberta Research Experience (UARE) 2019** programme to conduct research in medical imaging and deep learning at the **University of Alberta**.
- Recipient of the **Jagadis Bose National Science Talent Search (JBNSTS) Scholarship** : Cleared the examination in 2016. This is a senior scholarship Program conducted by JBNSTS Kolkata since 1958.
- Secured a **Department Change** from **Biotechnology and Biochemical Engineering** to **Electrical Engineering** among top **10%** students (out of 1400) with a CGPA of **9.4/10** at the end of my 1st year.
- **KVPY 2016** : Secured an All-India Rank of **922** in one of the most prestigious examinations initiated by Department of Science and Technology, Government of India and conducted by IISc Bangalore in 2016.
- **IIT JEE Advanced 2016** : Secured an All India Rank of **5253** among **1.2 million** candidates.
- **West Bengal Higher Secondary Examination 2016** : Secured **16th** rank in the State with an aggregate score of **95.4%**.
- **West Bengal Joint Entrance Examination 2016** : Secured a state rank of **181**.

Extra-Curricular Activities

- Member of **OpenSoftware & Hardware Modelling** Teams, Lal Bahadur Shastri Hall of Residence.
- Mentor to **5** first year students of Electrical Engineering Department as a part of **Student Welfare Group (SWG)**, IIT Kharagpur.
- Member of **Technology Students' Gymkhana (TSG) Tennis Club**, affiliated to **Bengal Tennis Association**.
- Attended a week-long **Robotics Workshop**, organized by Technology Robotix Society, IIT Kgp in December 2016.
- Former member of **Kharagpur Data Analytics Group**, a students' initiative under IEEE Block, IIT Kharagpur and supervised by [Dr. Debdeep Sheet](#), IIT Kgp.
- Former News Reporter at **The Scholars' Avenue**, the independent student-run campus newspaper of IIT Kharagpur.