Abhranil Chandra

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Education

Indian Institute of Technology, Kharagpur Kharagpur, India

Major: Mechanical Engineering *July 2019 – May 2023*

- Relevant Courses: Programming and Data Structure, Mathematics-I and II, Transform Calculus, Image Processing, Dynamics, Thermo-Fluid Science, Kinematics of Machines, Probability & Statistics, Discrete Maths, AI-Foundations and Applications

Research Interests

Probabilistic ML, Deep Learning, Reinforcement Learning, Computer Vision, Applied NLP

Publications, Pre-Prints and Conferences

Cognitive Modeling and Computational Linguistics Workshop- NAACL 2021 March 2021

Shared Task: Predicting Human Reading Behavior

- Worked with the eye-tracking data of the Zurich Cognitive Language Processing Corpus (ZuCo 1.0 and ZuCo 2.0) recorded during normal reading
- Built a linguistically motivated approach to predict 5 eye-tracking features of each word in a sentence. Experimented with several models and architectures like Bert, Roberta, Albert, Electra, DistilBert, BiLstm
- Finally developed a novel architecture consisting a Language Model (RoBERTa base with dense layers on top to learn the semantic relations) and a Feature Model (dense layers with transformers to learn from the extra features we engineered). Concatenated the outputs of the two models and passed through a softmax to give final predictions. Got a final R^2 score of 0.87
- Will attend the conference in June 2021
- The code and paper will soon be made public

Research Experience

Open Domain Question Answering May 2021–pres

Advisor: Prof.Jordan Boyd-Graber,CLIP, University of Maryland *College Park, USA*

- I will be joining the Computational Linguistics and Information Processing research group as a research assistant in June 2021.
- My primary research objectives are to create a better system for answering questions on more complicated datasets like QuizBowl and Jeopardy Questions, creating a better system for knowing when to signal to answer(particularly relevant for QA in time constrained environments like quizzing), predicting the human difficulty of a question, and converting between question formats using machine translation to improve and expand the existing datasets.

Adversarial Attack and Defenses on Sparse Data April 2021–pres

Advisor: Prof.Yi-Zhe Song, Director of SketchX Lab, University of Surrey *Surrey, UK*

- Working on novel adversarial attack and defense algorithms and modifications on existing popular attack algorithms like FSGM, DeepFool, CW attack etc. to finetune them on sparse image data like sketches and signatures.
- Currently doing extensive literature survey of adversarial attacks and defences in different fields and prototyping and fine-tuning the common algorithms a custom dataset that the Lab uses.

Yield Mapping for Various Crops May 2021–pres

Advisor: Prof.Won Suk Lee, University of Florida *Remote*

- Under the Foreign Training Program of IR Cell, IIT kgp, I got this research internship.
- In this project, a dataset of 2,000 strawberry images was collected and augmented to train multiple deep learning models for strawberry detection that would detect important parameters of the yield prediction system - mature and immature green strawberries and flowers.
- Working on building a centroid detection tracking algorithm to track and count these objects while avoiding re-counting. The deep learning models have scored over 98% accuracy in detecting mature strawberries and 90% in detecting flowers on the test dataset and will be used toward developing strawberry yield prediction models.

Segmentation of Areas from Satellite Images for Agent-Based Disease Modelling Mar 2021–pres

Advisor: Prof.Partha Pratim Chakraborty & Prof.Adway Mitra, CSE,IIT Kharagpur *Kharagpur, India*

- Creating segmentation maps to locate different regions from satellite images (eg. buildings, roads, water-bodies, recreational areas, etc.). Trained a Masked-RCNN and UNet model on the SpaceNet 6 dataset to do semantic segmentation on the satellite images and got a training accuracy of 94% and validation accuracy of 87%.
- Creating a deep learning model to give GIS output when we input labeled satellite data of any area with the segmentation of different gathering spots (eg. eateries, parks, housing areas, recreational areas, etc.) and later expand to a generalized learning model.
- Doing literature review on use of computer vision techniques to identify patterns in urban environments.
- The project is under the CoE Artificial Intelligence, IIT Kharagpur and is part of the RAKSHA scheme of Department of Science and Technology.

Heartbeat Sound Classification Jan–Apr 2021

Advisor: Prof. Abdulhamit Subasi, University of Turku, Finland *Remote*

- Working on classification of heart diseases based on stethoscope audio.
- Currently working on feature extraction methods and data exploration and visualisation. Used audio processing techniques like MFCC, DWT, WPD, TQWT, EEMD to extract features from the raw audio data of stethoscopic sound collected from hospitals using the digital stethoscope DigiScope and the iStethoscope Pro iPhone app.
- Reading papers based on deep learning models to learn from audio data.
- Trained models like 1D CNN, BiLSTM, Stacked GRU, CNN+LSTM, CNN+BiLSTM and ConvLSTM2D to classify the heart diseases from the audio features extracted by various audio processing techniques. Got a mean accuracy of 90.2% on training data and 68.7% on validation data.

Weld Defect Characterization using Computer Vision for Tata Steel Ltd Aug–Nov 2020

Advisor: Prof.Pabitra Mitra,CSE,IIT Kharagpur *Kharagpur, India*

- Analyzed the A, B, C Scan data, did necessary Data Preprocessing on the input data.
- Found image moments (especially Zernike Moments) to analyse the weld defect types.
- Applied different Machine Learning & Deep Learning techniques to predict the magnitude of the weld defects and thus guide for acceptance or rejection of that weld achieving 78% accuracy.

Application Projects

Sentiment Analysis Using BERT and RoBERTa Dec 2020

- BERT and RoBERTa is state-of-the-art natural language processing model from Google and Facebook respectively. Using their latent space, it can be re-purposed for various downline NLP tasks, such as sentiment analysis.Studied the BERT and RoBERTa paper to gain theoretical knowledge of its working
- Achieved 91% accuracy using BERT and 94% accuracy using RoBERTa in predicting positive/negative sentiments on the IMDB reviews dataset
- Used BERT and RoBERTa from the Hugging Face transformers library and Pytorch for preprocessing and finetuning the model

RL and its applications in Atari Games Oct 2020

- Studied basics of Reinforcement Learning through David Silver Lectures and few portions of Sutton and Barto's book on Reinforcement Learning
- Studied Dynamic Programming, Monte-Carlo Learning , Temporal Difference Learning , Value Function Approximation , SARSA , Q-Learning and Policy Gradient methods
- Implemented DQN and A3C reinforcement learning algorithms on Breakout and Pong Atari Games and trained the models to a descent level and then compared the results

COVID-19 Detector Flask App based on Chest X-rays and CT Scans using Computer Vision Nov 2020

- Did a lot of literature survey of the latest research papers describing methods being used to reliably use Deep Learning to predict Covid-19
- COVID-19 Detection based on Chest X-rays and CT Scans using four CNN models by Transfer learning-VGG16, ResNet50, InceptionV3, Xception. Also trained a CNN from scratch giving comparable accuracy of about 96%
- Built a simple Flask-App where the user can upload Chest X-rays or CT Scans and get the result
- Working on model interpretability by implementing Grad-CAM to visualise the class activation maps

Image Captioning Jul 2020

- Studied the research paper "Show and Tell: A Neural Image Caption Generator"
- Implemented my own version using CNN model Inception-v3 for image analysis followed by a LSTM based sentence generator
- Trying to improve the model by using Attention based methods

Technical Skills

Languages: Python, C++/C, Matlab, HTML/CSS
Frameworks:Scikit-learn, NLTK, TensorFlow, Keras, PyTorch, Flask
Developer Tools: Git, Sublime, VS Code, PyCharm
Operating System: Linux(Ubuntu), Windows

MOOCs and Online Courses

- Statistics110: Probability(HarvardX)
- CS229: Machine Learning(Stanford)
- CS230: Deep Learning (Stanford)
- CS231n: Convolutional Neural Networks for Visual Recognition (Stanford)
- CS224n: Deep Learning for NLP (Stanford)
- Reinforcement Learning (DeepMind) by Prof. David Silver
- Machine Learning(Stanford Online)- Coursera
- Mathematics for Machine Learning Specialization- Coursera
- Deep Learning Specialization(deeplearning.ai)- Coursera
- DeepLearning.AI TensorFlow Developer- Coursera
- Natural Language Processing Specialization(deeplearning.ai)- Coursera
- Advanced Machine Learning Specialization(National Research University Higher School of Economics)- Coursera
- Algorithms Specialisation(Stanford Online)- Coursera
- Generative Adversarial Network Specialization(deeplearning.ai)- Coursera

Positions of Responsibility & Volunteer Experience

Core Member, Kharagpur Data Analytics Group Oct 2020 - Present

- IIT Kharagpur's official society on Machine Learning related things
- We discuss research papers, conduct reading sessions, conduct workshops on ML related topics
- Participate in competitions and do independent research work

Sub-Head, Business Club IIT Kharagpur Aug 2019 – Mar 2020

- Teach freshmen about machine learning and deep learning
- We conduct Indian Case Challenge every year- it is India's largest case competition(3000+ student participation) with participation from international teams as well
- Conduct multiple workshops in collaboration with Intel, NOMURA, ZS Associates related to Business Strategy and Analytics

National Service Scheme(NSS) Volunteer Jul 2019 - Present

- Teach underprivileged students in nearby villages of IIT Kharagpur the basics of English, Maths and Computing