Abhranil Chandra

+91-9051723651 | abhranil.chandra@iitkgp.ac.in | linkedin.com/in/abhranil | github.com/abhra | abhra-niliitkgp.github.io

Education

Indian Institute of Technology, Kharagpur — Kharagpur, India
Major: Mechanical Engineering — *July 2019 – May 2023*

- Minor: Mathematics and Computing; Micro-Specialisation: Artificial Intelligence
- Relevant College 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, ML- Foundations and Applications*, AI for Manufacturing* (*=ongoing)

Research Interests

- Deep Learning, Reinforcement Learning & DeepRL, Bayesian and Evidential Deep Learning, Adversarial ML, Applied Computer Vision & NLP

Publications

Leveraging recent advances in Pre-Trained Language Models for Eye-Tracking Prediction
CMCL workshop at NAACL 2021

Improving Question Answering with Generation of NQ-like Questions
Submitted to MRQA workshop at EMNLP 2021

Internships & Research Experience

IIT Kharagpur, India — Aug 2021–pres
Research Assistant — *Advisor: Prof.Pabitra Mitra*

- Working on uncertainty estimation in deep learning models using Bayesian Deep Learning
- Doing extensive literature review at this moment on topics in Latent Variable Models, Expectation Maximization, and Variational Inference

University of Maryland, USA — Jun–Aug 2021
Research Assistant- CLIP Lab — *Advisor: Prof.Jordan Boyd-Graber*

- Trained retrieval QA systems like DrQA and DPR and generative QA systems like RAG and T5 on QB and NQ dataset. RAG gave best test scores- Sacreblue, Meteor and Exact Match score of 38.4, 0.36 and 0.41 respectively.
- Developed a novel heuristic algorithm using extensive Preprocessing, Coreference Resolution, Parse Tree, String replacement and Bag of Words techniques to translate QB type questions to NQ type questions with the aim to train QA system on augmented NQ dataset to improve performance.
- Also used MT systems like OpenNMT, FairSeq, BertNMT and M2M100 to automate the above process.
- Submitted our work in the MRQA workshop at EMNLP 2021 in August.
- Working to submit a full conference paper in ACL 2022 in November.

University of Surrey, UK — Apr 2021–pres
Research Assistant- SketchX Lab — *Advisor: Prof.Yi-Zhe Song*

- Doing extensive literature survey of adversarial attacks and defences in different fields and implemented the common adversarial attack methods like FGSM, DeepFool, CW etc. on a custom dataset that the Lab uses.
- Working on novel adversarial attack algorithms and modifications on existing popular attack algorithms as they fail to hack the systems for sparse image data like sketches and signature.
- Will be submitting our work in CVPR 2022.

Shared Task: Predicting Human Reading Behavior — Jan–Mar 2021
Cognitive Modeling and Computational Linguistics Workshop- NAACL 2021 — *Independent Research Work*

- 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. The code and paper will soon be made public.

University of Turku, Finland Jan–Apr 2021

Research Intern- Institute of Biomedicine *Advisor: Prof. Abdulhamit Subasi*

- Worked on classification of heart diseases based on stethoscope audio.
- Worked on feature extraction methods and data exploration and visualisation. Used audio processing techniques like MFCC, DWT, WPD 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.
- Did extendive literture survey on deep learning methods 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.

Application Projects

University of Florida May–Jun 2021

Research Project *Advisor: Prof.Won Suk Lee*

- 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 fruits, immature fruits and flowers.
- Worked 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.

CoEAI, IIT Kharagpur Mar–May 2021

CV Researcher *Advisor: Prof.Adway Mitra*

- Segmentation of Areas from Satellite Images for Agent-Based Disease Modelling
- 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 97% and validation accuracy of 84% and mean IOU scores of 0.62 on training dataset and 0.47 on the validation dataset.
- The project is under the CoE Artificial Intelligence, IIT Kharagpur and is part of the RAKSHA scheme of Department of Science and Technology, Government of India.

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

Research Project *Advisor: Prof.Pabitra Mitra*

- Weld Defect Characterization using Computer Vision for Tata Steel Ltd
- Analyzed the A, B, C Scan data, did necessary Data Preprocessing on the input data.
- 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.

Sentiment Analysis Using BERT and RoBERTa Dec 2020

Personal Project

- 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

Deep Dive into GANs Oct–Dec 2020

Personal Project

- Studied basics of GANs through the GAN Specialization on Coursera

- Read papers and implemented several GAN architectures from scratch, experimenting with different loss functions to stabilize training like- BasicGAN, DCGAN, Conditional GAN, infoGAN, AC-GAN, Amine GAN, Cycle GAN, Star GAN, SRGAN, SAGAN

RL and its applications in Atari Games Oct 2020

Personal Project

- 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 using Chest X-rays and CT Scans June 2020

Personal Project

- 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

Technical Skills

Languages: Python, C++/C, Matlab, LaTeX
Frameworks:PyTorch, TensorFlow, Keras, Scikit-learn, NLTK, Numpy
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
- Reinforcement Learning Specialization- Coursera
- Deep Reinforcement Learning- Udacity
- 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

Senior 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