Talha Ahmed

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Education

Lahore University of Management and Sciences Sep. 2020 – Present
BS. Mathematics - Economics (Joint Major) + Minor in Computer Science *CGPA/Minor GPA: 3.83/3.87*

The Lahore Alma Aug. 2018 – May 2020
A Level, Cambridge International Examinations *Grades: 4 A*s*

Research Experience

Research Assistant Jan. 2023 – May. 2022
Networks Systems Group @ LUMS *Lahore, Pakistan*

- As a directed research project, developed an app for measuring 'Digital Literacy' under supervision of Dr. Ihsan Ayub Qazi - ***Linkedin***.
- App can be found here: (**Github Link**)

Research Assistant Summer. 2023 – May. 2024
Dr.Muhammad Tahir - ***Linkedin*** *Lahore, Pakistan*

- Worked on **"Model Based Deep Learning"** as a Senior Project. (**Report + Presentation**)

Research Assistant Sept. 2023 – Dec 2023
Dr.Hassan Mohy-ud-Din - ***Website*** *Lahore, Pakistan*

- Worked on a brief term project on compiling detailed, concise notes on prominent mathematical inequalities and their applications to fields of data science, information theory etc. Compiled work can be found here: **Dropbox**

Research Projects

Digital Literacy App Development Jan. 2023 – May 2023
Networks Systems Group @ LUMS

- The digital literacy app posed as a sequel to the paper (**link**)
- Self-taught the inner workings of *shiny* framework in **R**
- Explored model deployment techniques within shiny and deployed a *Random Forest* machine learning algorithm
- The app evaluates a person's digital literacy score (between 0 and 1) given a set of answers to a questionnaire

Unrolled Optimization & Matrix Completion Summer. 2023 – May. 2024
Dr.Muhammad Tahir

- Implemented some popular Deep Learning Algorithms (**Github Link**)
- Self-taught preliminaries like *Duality Theory* and optimization techniques like *Augmented Lagrange Multiplier - ALM* etc to understand the problem formulation and solve Matrix Completion (MC).
- Replicated results of following papers **Paper 1**, **Paper 2** and prominent MC algorithms - (**Github Link**)
- Completed and refined a proposed *unfolded* ALM algorithm *ConvMC-Net* for standard matrix completion problem. (**Github Link**)
- Proposed *unfolded M-estimation* (**Paper 3**) based algorithm *ConvHuberMC-Net* for robust matrix completion in the event of impulsive Gaussian noise. (**Github Link**)

Mathematical Inequalities with Applications to Data Science Sept. 2023 – Dec. 2024
Dr.Hassan Mohy-ud-Din

- Did readings on various prominent mathematical inequalities to field of data science and information theory
- Compiled reading materials from YouTube videos, journals, conference papers etc
- Each inequality is accompanied by essential background information, a proof, some intriguing considerations, practical applications, and a demonstration in Python/MATLAB.
- Example: **Jensen's Inequality**

Academics Related

- Ranked in the **top 10%** of LUMS SBASSE Batch of 2024
- Placed on **Dean's Honor List** for **2020-2021, 2021-2022, 2022-2023**
- Projected to Graduate with **Dean's Honour List** and **High Distinction**

Relevant Coursework

- **MATH 439 (Applied Probability):** A-
- **CS 432 (Introduction to Data Mining):** A+
- **CS 535 (Machine Learning):** A+
- **MATH 325 (Convex Optimization):** A
- **CS 437 (Deep Learning):** A
- **CS 6314 (Dynamic Programming and Reinforcement Learning):** A
- **ECON 438 (Econometrics II):** A
- **CS 5302 (Generative AI for Natural Language and Speech Processing):** A
- **MATH 344 (Numerical Analysis):** A-
- **MATH 3010 (Advanced Calculus):** A-

Teaching + Work Experience

STATA Workshop Professor Usman Elahi

Teaching Assistant

- Assitant for Professor Usman Elahi (usman.elahi@lums.edu.pk) for 'Capacity Building and Training on Data Management & Analysis Using STATA' organized in collaboration with Bureau of Statistcs, Government of Punjab for Statistical Officers.

ECON 221: Intermediate Macroeconomics (Fall 2022) Professor Usman Elahi

Teaching Assistant

- Held weekly office hours, conducted assignment tutorials, created/reviewed/invigilated/graded quizzes, created/reviewed/solved assignments, and engaged in semi-formal student counseling

EDUX 562: Data Lab (Spring 2023) Professor Ahmad Ayub

Teaching Assistant

- Held weekly office hours, invigilated STATA labs, graded assignments, and engaged in semi-formal student counseling

CS 535: Machine Learning (Spring 2024) Professor Momin Ayub Uppal

Teaching Assistant

- Held weekly office hours, invigilated quizzes and exams, graded assignments, and engaged in semi-formal student counseling

Undergraduate Research Projects/Presentations

Course Group Project on Arrhythmia Detection through ECG Fall 2020

EE 100: Engineering Laboratory

- Implemented software capable of detecting different arrhythmia types through ECG data (**Project Video**).

Course Project on ISS Tracking and Velocity Measurment Spring 2021

PHY 100: Experimental Physics Lab I

- Using real-time captured instances, and tools like Tracker and ImageJ, the velocity of ISS was predicted (**Lab Project Presentation**).

Analyzing Music Trend in the Last Century Fall 2022

CS 334: Principles and Techniques of Data Science

- Wrote a blog post on *Medium* covering Explatory Data Analysis (**EDA**), Statistical Inference and Predictive Modelling on *Spotify* dataset to answer research questions pertaining to the trend of music in the last century. (**Blog Link**)

Econometric and Regression Analysis Fall 2022

ECON 330: Econometrics I

- Carried out Econometric and Regression Analysis on a demographic dataset gathered from primary sources like survey questionnaire.

- The analysis focused on tackling the research question: "*Does Gender have an effect on Academic Performance*"
- Careful attention was paid to whether the standard *OLS* assumptions hold true for our model (**PDF link**).

Clustering, Association and Frequent Pattern Mining Spring 2023

CS 432: Introduction to Data Mining

- Wrote a detailed report on data analysis of a drugs consumption related dataset (**PDF link**).
- The report focused on the various factors affecting drug consumption in Connecticut, USA
- State of the art algorithms for clustering like **DBSCAN**, **Apriori** and **Fpgrowth** for Association and Frequent Pattern Mining were employed to make data driven-inference regarding drug consumption in Connecticut, USA

Sentiment Analysis on Audio Recordings Spring 2023

CS 535: Machine Learning

- Identification and extraction of features followed by a mathematical background of some popular machine learning methods and their performance evaluation (**PDF Link**).

Panel Data and Tobit Analysis on Health Care Dataset Fall 2023

ECON 438: Econometrics II

- Using a german healthcare dataset which is of panel data nature, we explored the research question *What are the factors that determine the number of recent doctor or hospital visits of an individual?*
- We addressed the research question using two methods: 1) Zooming in on a single cross-section and using *tobit* models, 2) Using panel data models involving *fixed, random* effects and their numerous variants
- Much attention was paid to whether key assumptions like *normality* for tobit models or presence of *serial auto-correlation* for panel data models were violated or not. (**Project Report + Source Code**).

Reinforcement Learning Algorithms on Tic-Tac-Toe Fall 2023

CS 6314: Dynamic Programming and Reinforcement Learning

- We aimed to train an agent capable of playing 1) 2D Tic-Tac-Toe (3×3), 2) 2D Tic-Tac-Toe (4×4), 3) 3D Tic-Tac-Toe ($4 \times 4 \times 4$)
- We implemented algorithms like *Value Iteration, Temporal Difference Learning, Deep Q Networks etc* to tackle problems arising from vast huge spaces and more. (**Project Report**), (**Github Source Code**)

Speech Recognition and Translation System For Medical Communication Spring 2024

CS 5302: Generative AI for Natural Language and Speech Processing

- We aimed to develop an application that can interpret, translate, and vocalize spoken language in real-time, and is specifically catered for patient-doctor conversations.
- We integrated various open source models for of Automatic Speech Recognition, Neural Machine Translation, and Text-to-Speech synthesis etc. (**Project Deliverables**), (**Github Link**)

Technical Skills

Languages: C++, Python, STATA, MATLAB, R, HTML/CSS, Tableau
Programming Frameworks: Keras, Tensorflow, PyTorch, OpenCV, Shiny, Numpy, Pandas, Matplotlib, Seaborn
Tools: Linux, Git, Dropbox, Latex, Microsoft, VS Code, Google Colab