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| Mubashir Iqbal |  | Pakistan |
| MS Computer Science |  | Ph.D Candidate in AI or Software Engineering |

# My academic and social experiences relating to the field I want to take an education, my reasons for choosing Romania for study, and the importance of my future plans for my education and scholarship in Romania.

My story began with a spark – a fascination for electronics that ignited during high school. A 3-year training program ignited a new passion: understanding how computers weave their magic, transforming complex industrial tasks into seamless solutions. I mastered electronics at my job because I posted in the R&I department, and after the job, I pursued a Higher Secondary School education in computer science. Armed with a Bachelor's degree in 2020, I explored freelancing, honing my skills in the real world.

In 2022, my Master's journey at COMSATS University Islamabad unveiled the captivating world of AI. From the Secrets of Machine Learning algorithms for crafting intricate multilayer perception models, I was hooked. But something felt incomplete. I yearned to understand the "why" behind the "how", the whispers that guided AI predictions. This led me to interpretable AI – a field where models shed their black box and reveal their thinking. Exploring the SHAP library, I peered inside an MLP, deciphering the ranking of features that shaped its decisions. This was just the beginning.

Today, I'm driven by an insatiable curiosity to explore, experiment, and push the boundaries of AI. With a diverse skill set and a dedication to understanding the "why", I'm eager to collaborate and unlock the true potential of AI. Let's embark on this journey together, one interpretable step at a time!

Stepping into a new chapter after 14 years of unwavering dedication, I, at 33, am poised to unleash my energy on the frontier of innovation. My passion lies in revolutionizing industries through low-cost, high-impact technologies powered by Artificial Intelligence. With a burning desire to pursue a Ph.D. and delve deeper into AI, I aspire to secure a scholarship from the Romanian government to fuel my journey of learning and development. This opportunity isn't just about academic pursuit; it's about realizing dreams, pushing boundaries, and crafting solutions that shape the future. Join me as I embark on this transformative adventure, driven by a fervent commitment to innovation and a vision of a world transformed by AI.

# Case study to express my experience in MS Computer Science

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## Subject of study

Artificial Intelligence, Interpretable AI, Explainable AI, Deep Learning Neural Network, Software Engineering, Computer Science

## Research Question

1. Prediction of heart disease from NHANES dataset.
2. Explore Deep learning techniques.
3. Understanding AI through interpretable and explainable algorithms

## Analysis of the Problem to be used in the study

Coronary heart disease, a global threat claiming a third of lives, results from blood-pumping challenges like arterial sclerosis. Early detection and intervention improve survival rates, motivating researchers to develop predictive models for identifying high-risk individuals, and facilitating proactive heart disease prevention.

In Pakistan, cardiovascular disease (CVD) is the leading cause of death, constituting nearly 30% of annual fatalities. A 2022 study highlighted a 17.0% prevalence of Ischaemic Heart Disease (IHD) and high rates of risk factors like Hypertension (40.1%), Diabetes (15.8%), Overweight/Obesity (68.8%), and Tobacco use (13.6%). Healthcare practitioners employ diverse diagnostic methods, including Electrocardiogram (ECG), Holter monitoring, Echocardiogram, Exercise tests, Cardiac catheterization, Heart CT scan, and MRI, to detect heart issues. Despite governmental initiatives, further research and efforts are crucial to alleviate the substantial CVD burden.

Explainable Artificial Intelligence (XAI) is essential in AI development, ensuring transparency and trust in decision-making processes. XAI gives users insights into AI models, fostering trust, accountability, and mitigating biases. Visual elements like charts and graphs enhance XAI communication, offering intuitive representations of complex relationships in AI models. Visual explanations aid in understanding both specific predictions and overall model behavior, contributing to transparent and accountable AI systems.

I opted for the NHANES dataset and subjected it to preprocessing procedures. This entailed removing null values, eliminating duplicates, standardization, and assessment for class imbalance. To rectify any imbalance, I implemented data augmentation techniques such as SMOTE and ADAYSN to generate synthetic samples for the minority class, thereby achieving a balanced dataset. Subsequently, I developed a multilayer perceptron neural network model and conducted training using the preprocessed and balanced dataset. Finally, I assessed the performance of the model through evaluation procedures.

## Research Method for this study

I devised a multilayer perceptron neural network model and subsequently conducted training on an imbalanced dataset. The outcomes revealed a notable accuracy yet showcased suboptimal recall, sensitivity, Area Under the Curve (AUC), and F1 score. Upon recognizing these deficiencies, I undertook an investigative process, seeking insights from various sources including literature, consultations with professors, and collaboration with colleagues. It became apparent that the model's performance shortcomings were attributable to the dataset's imbalance.

To address this issue, I delved into methodologies for generating synthetic samples of the minority class. Upon achieving dataset balance, notable improvements were observed in the model's evaluation metrics. The dataset under consideration comprises 40 features, motivating exploration of the interpretable AI algorithm known as SHAP (SHapley Additive exPlanations). Leveraging this algorithm facilitated an in-depth examination of feature ranking and the involvement of feature values in predicting the target class.

## Preliminary Answer to the Research Question

I dive into the NHANES dataset to understand preprocessing methods and techniques. I delve into data visualization and explore various data augmentation approaches. Developing a Multilayer Perceptron (MLP) model, I train it over multiple epochs, observing how the training accuracy evolves. I learn to assess the model's performance on a testing data subset, examining the confusion matrix. Additionally, I explore the interpretable AI technique known as "SHAP" and visualize the Beeswarm plot to understand the top 20 feature values.

## How this study will contribute to my academic field

This study taught me how to do research, choose the right data, build deep learning models, and check how well they work. I liked writing about what I learned in my journal and watching how much I improved over time. I put all of this into my Master's thesis. I also enjoyed making a 10-minute presentation about my research and giving it during my final defense.

## Literature Review (The main academic sources)

I love reading research papers to learn new things and understand different ways to solve problems. It's exciting to explore ideas from different sources like IEEE, ScienceDirect, arXiv, Springer, and other websites. I download papers from these sites to keep up with the latest discoveries and stay informed about what other researchers are working on.

## Attention of the evaluation committee

I'm eager to explore the Romania community. I'm determined to begin a new start in Romania. Thank you for this opportunity, which has renewed my hope for discovering new knowledge and embracing new experiences in the world.