Mohammad Hussain

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Education

Bilkent University Expected June 2025
BSc, Electrical and Electronics Engineering
***Relevant Courses**: Digital Signal Processing, Digital Communications, Neural Networks, Information Theory, Microprocessors, Programming in Python, Deep Learning (Udemy), Introduction to Machine Learning (Coursera), NLP (Udemy), Introduction to Generative AI (Coursera)*
***CGPA**: 3.28/4.00 — 80% Merit Scholarship*

Experience

Nanomagnetic Instruments, Ankara June – September 2023
Trainee Engineer

- Resolved DAC power issues using soldering and troubleshooting; validated PCBs for DAC and ADC boards, and prepared bill of materials.
- Configured AK4495 DAC in PWM mode via I2C on BASYS3 and Arduino; enabled I^2S communication with Raspberry Pi Pico to generate audio waveforms.
- Improved system efficiency by designing a custom oscillator with Raspberry Pi Pico, replacing KT7050.

Modern Technology Laboratories, Jeddah August – September 2024
Intern

- Developed a crack detection system using the ESP32 microcontroller integrated with Convolutional Neural Networks (CNNs), utilizing a hybrid approach for image capture and real-time processing on an external device.
- Created and optimized a neural network model for predicting concrete compressive strength using the UCI dataset; established baseline performance with Random Forest and Gradient Boosting models, achieving 95% accuracy with the final PyTorch model.

Selected Projects

Final Year Project: Video Analytics and Sensor Integration System 2024 – Present
Conducted under the supervision of Karel Electronics

- Developing a real-time monitoring system integrating video analytics with environmental sensors (temperature, humidity, air quality, etc.) for smart city and industrial applications.
- Implementing YOLO, OpenCV, and anomaly detection algorithms for edge-based video analytics on Raspberry Pi to reduce latency and bandwidth usage; optimizing for 5G communication.
- Anomalies are detected and flagged by the edge devices and further validated by a central management system for more accurate decision-making and action triggering.
- Utilizing Quectel 5G EVB Kit for testing and optimizing 5G communication infrastructure for seamless integration with edge devices.
- Integrating environmental sensors for comprehensive monitoring and developing 5G network gateways for reliable and low-latency communication.

Individual Research Project: Training Neural Networks for Legged Locomotion 2024 – Present
Supervised by Prof. Omer Morgül

- Enhanced data representation by analyzing variable relationships without regression or learning methods, utilizing MATLAB's `hist3` function and "Tiled Histogram View" to visualize interactions between variables, such as the inverse relationship between touchdown angle and final vertical position.
- Focused data analysis on key datasets (SLIP, SLIPD, TDSLIP) to illustrate model behavior variations across different inputs and conditions.
- Expanded learning methods comparison by using all nonzero initial apex variables and control inputs to predict the final apex, testing models including Support Vector Machine (SVM), Gaussian Process Regression (GPR), and Neural Networks.

Optical Character Recognition (OCR) System Development 2024

- Developed an OCR system using Python and OpenCV to extract text from images.
- Implemented Tesseract OCR engine for text recognition and preprocessing techniques for image enhancement.
- Achieved high accuracy in extracting text from various image formats, including scanned documents and photographs.

Image Classification using Convolutional Neural Networks 2024

- Developed an image classification model using CNNs to categorize images from the CIFAR-10 dataset.
- Implemented the model in PyTorch, achieving an accuracy of 85%.
- Optimized the model using data augmentation, dropout, and batch normalization techniques.

Sentiment Analysis of Movie Reviews using NLP 2024

- Built an NLP model to perform sentiment analysis on movie reviews from the IMDB dataset.
- Utilized tokenization, word embeddings, and LSTM networks in TensorFlow.
- Achieved 90% accuracy in predicting positive and negative sentiments.

Customer Segmentation using K-Means Clustering 2024

- Applied unsupervised learning with K-Means clustering to segment customers based on purchasing behavior.
- Analyzed customer groups to provide insights for targeted marketing strategies.
- Employed Python libraries such as Pandas, NumPy, and Matplotlib for data processing and visualization.

Movie Recommendation System using PyTorch 2024

- Implemented a stacked autoencoder (SAE) for collaborative filtering in a movie recommendation system; trained SAE with mean squared error loss to predict missing ratings.

Uniform and Non-Uniform Scalar Quantization of Gray-Scale Images 2024

- Implemented scalar quantization techniques on gray-scale images; developed a compander for non-uniform quantization using the Lloyd-Max algorithm.
- Enhanced image compression efficiency through MATLAB simulations.

Size Reduction and Generation in Digital Images 2024

- Conducted digital image processing for size reduction using anti-aliasing filters and approximation techniques in MATLAB.
- Improved image resolution and processing speed with algorithmic optimizations.

Signal Generator 2023

- Created a signal generator for precise signal manipulation using the FRDM-KL25Z board, DAC, and ADC components.
- Applied DSP techniques to ensure signal accuracy and stability in testing environments.

Plant Water Moisture Controller 2023

- Developed an automated system for monitoring plant moisture using BASYS 3 and Arduino, optimizing water usage with adaptive control algorithms.

Automated Trash Bin 2023

- Designed an automated trash bin with ultrasonic sensors for touchless lid operation, using BASYS 3 and VHDL for control integration.

Discrete Operational Amplifier for Audio Applications 2023

- Designed a high-performance operational amplifier for audio applications using BJT transistors, ensuring low-noise operation.

Skills

Programming: Python, C, C++, MATLAB, VHDL, Linux
Machine Learning: PyTorch, TensorFlow, TensorFlow Lite
Tools: Jupyter, SciPy, NumPy, Pandas, OpenCV, YOLO, Tesseract OCR
Languages: English (fluent), Urdu (fluent), Arabic (intermediate), Turkish (intermediate)