Faris Hamdi Rizk

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Education

Delta Higher Institute of Engineering and Technology (DHIET), Egypt **Sep. 2021 – Jul. 2026**

*Bachelor's Degree in Engineering • GPA: **3.2/4.0***

- **Major**: Electronics and Communication Engineering with a concentration in Machine Learning and Computer Vision
- **Relevant Coursework**: Python Programming, Computer Science (I, II), Statistics & Probability Theory, Linear Algebra, Calculus (I, II), Discrete Mathematics, Computer Organization and Structure, Technical Writing
- **Relevant Independent Coursework**: Computer Vision, Deep Learning, Machine Learning, Image Processing, C/C++ Programming, Data Structures & Algorithms, Data Analysis

Research Experience

Zewail City Computing Society, Zewail City of Science and Technology, Egypt **Sep. 2024 – Present**

Research Staff Member – Applied Machine Learning Lab

Delta Higher Institute of Engineering and Technology (DHIET) **Jan. 2023 – Present**

Research Assistant – Supervisor: Prof. El-Sayed M. El-Kenawy, DHIET, Mansoura, Egypt

In collaboration with: Computer Science and Intelligent Systems Research Center, Virginia, USA

In collaboration with: Dr. Nima Khodadadi, University of Miami, Florida, USA

Research Interests

- **Primary Interests**: Computer Vision, Deep Learning, Machine Learning Applications.
- **Secondary Interests**: AI in Education, AI for Social and Economic Development, and Ethical AI Practices.

Publications

- Abdelmalak M. E. S., Khodadadi N., Zaki A. M., Eid M. M., **Rizk F. H.**, et al. (2024). **Pothole Detection in Asphalt Roads: A Comprehensive Approach for Enhanced Road Maintenance and Safety with AlexNet Model**. In *Proceedings of the 2024 International Telecommunications Conference (ITC-Egypt)*, pp. 269–274. doi:10.1109/ITC-Egypt61547.2024.10620566.
- **Rizk F. H.**, Arkhstan S., Zaki A. M., Kandel M. A., & Towfek S. K. (2023). **Integrated CNN and Waterwheel Plant Algorithm for Enhanced Global Traffic Detection**. *Journal of Advanced Intelligent Systems*, **6**(2), 36–45. doi:10.54216/JAIM.060204.
- Sherif K., **Rizk F. H.**, Zaki A. M., Eid M. M., et al. (2024). **Revolutionizing Oil Spill Detection: A Machine Learning Approach for Satellite Image Classification**. In *Proceedings of the 2024 International Telecommunications Conference (ITC-Egypt)*, pp. 245–250. doi:10.1109/ITC-Egypt61547.2024.10620599.
- Kandel M. A., **Rizk F. H.**, Hongou L., Zaki A. M., Khan H., et al. (2023). **Evaluating the Efficacy of Deep Learning Architectures in Predicting Traffic Patterns for Smart City Development**. *Journal of Advanced Intelligent Systems*, **6**(2), 26–35. doi:10.54216/JAIM.060203.
- **Rizk F. H.**, Mohamed M. E., Sameh B., Zaki A. M., Eid M. M., et al. (2024). **Enhancing Student Performance Prediction with Greylag Goose Optimization Algorithm**. In *Proceedings of the 2024 International Telecommunications Conference (ITC-Egypt)*, pp. 32–37. doi:10.1109/ITC-Egypt61547.2024.10620568.
- **Rizk F. H.**, Elshabrawy M., Sameh B., Mohamed K., & Zaki A. M. (2024). **Optimizing Student Performance Prediction Using Binary Waterwheel Plant Algorithm for Feature Selection and Machine Learning**. *Journal of Advanced Intelligent Systems*, **7**(1), 19–37. doi:10.54216/JAIM.070102.

Research Projects

Detecting Potholes in Asphalt Roads in Real-Time Using RC Car – Paper Link

Supervisors: Dr. Nima Khodadadi (University of Miami, USA), Prof. El-Sayed M. El-Kenawy (DHIET, Egypt)

- Developed and trained a Convolutional Neural Network (CNN) based on the AlexNet architecture for real-time detection of potholes in asphalt roads, achieving 92.15% accuracy, 91.38% sensitivity, and an F-score of 96.52%. Optimized the model using high-performance GPUs for deployment in real-time systems.

- Preprocessed a large dataset of road images by performing image augmentation, resizing, and normalization to enhance model robustness and improve generalization across various road conditions.
- Implemented an image analysis pipeline that leverages high-resolution video feeds to detect surface anomalies in asphalt roads. Advanced techniques like edge detection were applied to fine-tune the model's performance.
- Led the integration of the CNN model with a real-time processing system that enabled continuous, real-world pothole detection from high-resolution camera feeds, ensuring low-latency response times in dynamic environments.
- Collaborated with a cross-disciplinary team to deploy the model on a remote-controlled car for automated real-world validation, focusing on the system's ability to detect and classify potholes in varied lighting and weather conditions.

Enhancing Traffic Detection Using Deep Learning and Optimization – **Paper Link**
Supervisors: Prof. El-Sayed M. El-Kenawy (DHIET, Egypt)

- Led a team in the design and implementation of a hybrid Convolutional Neural Network (CNN) and Waterwheel Plant Algorithm (WWPA) to detect and track vehicles in global traffic data, improving real-time traffic monitoring systems.
- Achieved a model accuracy of 97.28% with the WWPA-CNN, surpassing the performance of traditional CNN models such as VGG19Net, ResNet-50, and AlexNet.
- Collaborated in developing a globally diverse traffic dataset, which included multiple environmental conditions and traffic patterns across various cities, enhancing the model's generalization ability in different regions and weather scenarios.
- The fusion of CNN and WWPA established a new benchmark for object detection systems in smart cities, offering scalable solutions for urban planners aiming to optimize traffic flow and ensure road safety.

Oil Spill Detection via Satellite Imagery – **Paper Link**
Supervisors: Dr. Nima Khodadadi (University of Miami, USA), Prof. El-Sayed M. El-Kenawy (DHIET, Egypt)

- Spearheaded the development of an oil spill detection system using Artificial Neural Networks (ANN) to classify ocean satellite images, attaining 96.88% accuracy.
- Constructed a custom dataset by processing satellite images, using image segmentation techniques to break down ocean images into smaller, more manageable patches, facilitating detailed analysis of oil spill features.
- Optimized the model's performance by addressing class imbalance issues and applying feature standardization techniques, ensuring consistent accuracy across different regions of interest in the satellite imagery.
- Enabled real-time analysis and visualization of the model's output using graphical heatmaps, enhancing the system's usability for environmental monitoring agencies and disaster response teams.

Predicting Traffic Patterns in Smart Cities Using Deep Learning – **Paper Link**
Supervisors: Prof. El-Sayed M. El-Kenawy (DHIET, Egypt)

- Applied various deep learning architectures, including AlexNet, ResNet-50, GoogLeNet, VGG16Net, and VGG19Net, to predict and analyze traffic patterns in urban environments.
- Performed a comparative analysis of model performance, with AlexNet emerging as the best-performing model with an accuracy of 93.18%, making it highly effective for real-time traffic pattern prediction.
- Utilized a comprehensive traffic dataset from major city intersections, capturing traffic flow dynamics across different times of the day, including peak and non-peak hours, to train and test the models.
- Implemented statistical methods, including ANOVA and Wilcoxon Signed Rank tests, to validate the performance of the models and ensure statistical significance, thereby enhancing the reliability of the model.

Greylag Goose Optimization for Student Performance Prediction – **Paper Link**
Supervisors: Prof. Marwa M. Eid, Prof. El-Sayed M. El-Kenawy (DHIET, Egypt)

- Led a team in implementing the Greylag Goose Optimization (GGO) algorithm to enhance the performance of a Multilayer Perceptron (MLP) Regressor for predicting student performance, achieving a significant reduction in Mean Squared Error (MSE) from 0.0103 to 0.0060. Based on a comprehensive dataset from Portuguese secondary schools.
- Utilized GGO for hyperparameter tuning, optimizing the MLP model's learning rate, regularization parameters, and network architecture, leading to more accurate predictions.
- Conducted a comparative analysis with other metaheuristic algorithms, demonstrating that GGO+MLP outperformed other configurations regarding predictive accuracy and computational efficiency.
- Explored various statistical techniques such as ANOVA and Wilcoxon Signed Rank Tests to validate the improvements in model performance post-optimization, ensuring statistical significance in the results. Helped educational institutions identify at-risk students early, allowing for more targeted interventions to improve overall academic outcomes.

Waterwheel Plant Optimization for Student Performance Prediction – **Paper Link**
Supervisors: Prof. El-Sayed M. El-Kenawy (DHIET, Egypt)

- Collaborated with a team in developing a robust student performance prediction model by integrating the Binary Waterwheel Plant Algorithm (bWWPA) for feature selection and a machine learning ensemble to refine accuracy and interpretability. The approach reduced Mean Squared Error (MSE) from 0.064 to 0.032.
- Led the feature engineering phase, transforming and selecting the most relevant variables from the "Students Performance" dataset. This improved computational efficiency and enhanced the model's ability to predict student success based on academic and socioeconomic factors.
- Conducted a comparative analysis between bWWPA and other metaheuristic algorithms like bPSO and bWAO, highlighting bWWPA's superior performance in feature selection for complex educational datasets. The algorithm's strength in handling high-dimensional data proved instrumental in model optimization.
- Utilized statistical significance tests such as ANOVA and Wilcoxon Signed Rank to validate improvements in the model after feature selection, ensuring the results were accurate and statistically sound.

Skills

Programming Languages: Python, C/C++

Frameworks & Libraries: TensorFlow, Keras, PyTorch, OpenCV, NumPy, Pandas, Matplotlib

Deep Learning & Computer Vision: CNNs, Transformers, Object Detection, Image Segmentation

Tools: Jupyter Notebooks, Google Colab, Git/GitHub, Linux/Unix, LaTeX

Mathematical Skills: Linear Algebra, Calculus, Probability & Statistics

Extracurricular Activities and Competitions

2nd Place (out of 25 teams) **Dec. 2023**
GDG DevFest Mansoura Hackathon *Mansoura University, Egypt*
- Secured 2nd Place for a web project showcasing freelance opportunities in Egypt.

Graphic Design Head **Oct. 2023 – Present**
Google Developer Student Club (GDSC) *Delta Higher Institute of Engineering and Technology*
- Lead design team for event materials, club branding, and promotional content.

Human Resources Member **Sep. 2023 – Dec. 2023**
IHOW Organization *Delta Higher Institute of Engineering and Technology*
- Managed recruitment, onboarding, and team-building; facilitated communication.

Graphic Designer **Jun. 2023 – Oct. 2023**
Google Developer Student Club (GDSC) *Delta Higher Institute of Engineering and Technology*
- Designed graphics for events; collaborated on creative solutions.

Languages

English: C1 Level (Advanced)

Arabic: Native Proficiency