COLLEGE OF ENGINEERING AND COMPUTER SCIENCE
FLORIDA ATLANTIC UNIVERSITY

Announces the Ph.D. Dissertation Defense of

Munid Alanazi

for the degree of Doctor of Philosophy (Ph.D.)

"HUMAN ACTIVITY RECOGNITION: INTEGRATING SENSOR FUSION AND ARTIFICIAL INTELLIGENCE"

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ABSTRACT OF DISSERTATION

HUMAN ACTIVITY RECOGNITION: INTEGRATING SENSOR FUSION AND ARTIFICIAL INTELLIGENCE

Human Activity Recognition (HAR) plays a crucial role in various applications, including healthcare, fitness tracking, security, and smart environments, by enabling the automatic classification of human actions based on sensor and visual data. This dissertation presents a comprehensive exploration of HAR utilizing machine learning, sensor-based data, and Fusion approaches. HAR involves classifying human activities over time by analyzing data from sensors such as accelerometers and gyroscopes. Recent advancements in computational technology and sensor availability have driven significant progress in this field, enabling the integration of these sensors into smartphones and other devices. The first study outlines the foundational aspects of HAR and reviews existing literature, highlighting the importance of machine learning applications in healthcare, athletics, and personal use. In the second study, the focus shifts to addressing challenges in handling large-scale, variable, and noisy sensor data for HAR systems. The research applies machine learning algorithms to the KU-HAR dataset, revealing that the LightGBM classifier outperforms others in key performance metrics such as accuracy, precision, recall, and F1 score. This study underscores the continued relevance of optimizing machine learning techniques for improved HAR systems. The study highlights the potential for future research to explore more advanced fusion techniques to fully leverage different data modalities for HAR. The third study focuses on overcoming common challenges in HAR research, such as varying smartphone models and sensor configurations, by employing data fusion techniques. Experiments were conducted on the KU-HAR and UCI HAR datasets using popular machine learning classifiers, including Decision Trees, Random Forest, Gradient Boosting, and XGBoost. XGBoost achieved the highest accuracy of 96.83\%, demonstrating its effectiveness in classifying fundamental human activities, with decision-level fusion methods further improving results. The fourth study delves into the implementation of multimodal fusion techniques for HAR by combining wearable sensor data with visual data. The research investigates the performance of the late fusion method in integrating sensor and visual modalities.

BIOGRAPHICAL SKETCH
Born in Riyadh, Saudi Arabia
B.S., King Saud bin Abdulaziz University for Health Sciences (KSAU-HS), Riyadh, Saudi Arabia, 2016

M.S., Nova Southeastern University, Fort Lauderdale, Florida, 2020
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CONCERNING PERIOD OF PREPARATION
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Time in Preparation: Year – 2020-2024

Qualifying Examination Passed: Fall 2020

Published Papers:

Alanazi, M., Aldahr, R. S., & Ilyas, M. (2022, July). Effectiveness of Machine Learning on Human Activity Recognition Using Accelerometer and Gyroscope Sensors: A Survey. In *Proceedings of the 26th World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI 2022), Online* (pp. 12-15).

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Altaher, A., Mezaal, M. K., Jan, M. T., Alanazi, M., Alsaidi, M., Salekshahrezaee, Z., & Zhuang, H. (2023, December). Finger Knuckle Print Classification Using Pretrained Vision Models. In *2023 IEEE 20th International Conference on Smart Communities: Improving Quality of Life using AI, Robotics and IoT (HONET)* (pp. 62-67).

Alanazi, M., Alsharif, B., Altaher, A. S., Altaher, A., & Ilyas, M. (2023, December). Multi-Dataset Human Activity Recognition: Leveraging Fusion for Enhanced Performance. In 2023 IEEE 20th International Conference on Smart Communities: Improving Quality of Life using AI, Robotics and IoT (HONET) (pp. 1-6).

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Alsharif, B., Alanazi, M., Altaher, A. S., Altaher, A., & Ilyas, M. (2023, December). Deep Learning Technology to Recognize American Sign Language Alphabet Using Muli-Focus Image Fusion Technique. In *2023 IEEE 20th International Conference on Smart Communities: Improving Quality of Life using AI, Robotics and IoT (HONET)* (pp. 1-6).

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Deep Learning for Multimodal Fusion in Human Activity Recognition Using Wearable Sensors and Visual Data, (Submitted to Franklin Open Journal)