**Parallel Sessions Details (Day 2)**

• **Date: Sunday October 20, 2024, Time: [16:30-18:00] Cairo Local Time**

• **Session: SU5**

**AI & Evolutionary Computation**

**for Engineering Applications**

• **Session Chair: Dr. Hesham El-Badawy, Dr. Walaa Hassan**

**Room: F7 Value Chain**

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| **Paper ID** | **Paper Title** |
| **57802** | Efficient Blind Detection for 5G NR Polar-Coded Physical Downlink Control Channels Using Deep Learning |
| **63683** | Enhancing Agricultural Efficiency with Blockchain-  Orchestrated Drone Swarms and Kubernetes |
| **63713** | The Effects of Diverse Brain MRI Modalities on Multiple Sclerosis Lesions Segmentation: Comprehensive Analysis |
| **63844** | YOLOv8-Based Surveillance Robot for Real-Time Threat Assessment and Mitigation |
| **66531** | Cell Throughput Prediction Using AI models:  Insights from the O-RAN Framework |
| **69052** | A Comprehensive Review of Generative AI Applications  in 6G |

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| **Paper ID** | **57802** | **Paper Title** | **Efficient Blind Detection for 5G NR Polar-Coded Physical Downlink Control Channels Using Deep Learning** |
| **Author(s)** | | * ***Mohamed Talha*** * ***Khaled M. F. Elsayed***   ***(Department of Electronics and Communications Engineering), Faculty of Engineering,***  ***Cairo University, Giza, Egypt)*** | |
| **Abstract** | | | |

In 5G LTE-NR wireless systems, polar codes serve as the channel-coding scheme for physical downlink control channels (PDCCH) due to their efficiency. However, identifying the dynamically changing transmission location of PDCCH poses complexity and latency challenges for receiver design. Recent attempts for latency improvement proposed two stage blind detection schemes with an initial PDCCH candidate selection stage followed by high-performance decoders, yet the latency of the initial decoding stage remains significant. In this paper, we propose a low-latency scheme leveraging deep neural networks in the candidate selection stage to achieve significant latency reduction. Neural networks are used to recognize the structure of polar codes to efficiently eliminate invalid candidates and apply polar decoding solely to the selected subset. Simulations are performed to demonstrate the achieved latency reduction and detection accuracy. The proposed scheme is shown to reduce the decoding latency significantly at the cost of a slight reduction in the detection accuracy.

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| **Paper ID** | **63683** | **Paper Title** | **Enhancing Agricultural Efficiency with Blockchain-**  **Orchestrated Drone Swarms and Kubernetes** |
| **Author(s)** | | * ***Shebl Soliman*** * ***Ahmed Bendary***   ***(Communications Engineering Department,***  ***Military Technical College (MTC), Cairo, Egypt);***   * ***Hisham Dahshan***   ***(Computer Science Department,***  ***Future University, Cairo, Egypt)*** | |
| **Abstract** | | | |

Integrating advanced technologies in agriculture is essential for addressing challenges related to secure, transparent, and efficient data management. Our proposal paper offers a novel technique that leverages Hyperledger Fabric, deployed on a Kubernetes cluster, to support swarm drone operations in agricultural applications. The proposed system architecture comprises a multi-organization blockchain network, where each organization operates a peer node and multiple ordered nodes. Utilizing the chain code-as-a-service model enables dynamic updates of smart contracts, ensuring adaptability and flexibility.

Robust communication between drones and the blockchain network is facilitated through APIs, enabling real-time data collection and decision-making. A custom chain code was developed to cater to agricultural needs, offering functions such as drone registration, data updates, and querying based on parameters like location and battery status. The performance of the chain code was rigorously evaluated using Hyperledger Caliper under various transaction rates, including fixed and linear scenarios. The system was also integrated with Prometheus and Grafana for real-time monitoring and visualization, ensuring high availability and operational transparency. The results demonstrate that this blockchain-based architecture significantly enhances agricultural drone applications' reliability, security, and scalability, providing a robust framework for future advancements.

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| **Paper ID** | **63713** | **Paper Title** | **The Effects of Diverse Brain MRI Modalities on Multiple Sclerosis Lesions Segmentation: Comprehensive Analysis** |
| **Author(s)** | | * ***Rezq Muhammed Thabet*** * ***Maryam Al-Berry*** * ***Dina Khattab*** * ***Howida A. Shedeed***   ***(Scientific Computing Department,***  ***Computer and Information Sciences,***  ***Ain Shams University, Cairo, Egypt)*** | |
| **Abstract** | | | |

Multiple Sclerosis (MS) is a long-term neurological condition that significantly impacts the spinal cord and brain. Diagnosis of MS is primarily conducted through various methods, with Magnetic Resonance Imaging (MRI) being a key technique. MRI modalities are reliable and precise diagnostic tools that offer clinicians detailed images, revealing vital details about the brain's structure and function. MRI images can be obtained using MRI scanners, with different settings. This yields to the generation of different types of images which are called sequences/modalities. Some of the most popular modalities are Proton Density weighted (PDw), T1-weighted (T1w), T2-weighted (T2w), and Fluid Attenuated Inversion Recovery (FLAIR). Diagnosing MS from brain MRI is crucial because it is hard and time-intensive process and is particularly susceptible to manual or human error. In this work, we conduct a comprehensive analysis of how the choice of MRI modality can significantly affect the process of MS lesion segmentation using the proposed segmentation methodology based on UNETR model. The study showed and proved that FLAIR modality shows up to be the best and the most efficient method to use where it significantly improves all evaluation metrics scores than T1w and T2w modalities. Using FLAIR sequence the model could achieve an average Dice Similarity Coefficient (DSC), sensitivity, and precision scores of 78.1%, 56.9%, and 62.1%, respectively.

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| **Paper ID** | **63844** | **Paper Title** | **YOLOv8-Based Surveillance Robot for Real-Time Threat Assessment and Mitigation** |
| **Author(s)** | | * ***Yasmine Hany*** * ***Youssef Kelg*** * ***Youssef Emam*** * ***Nouran El Bendary*** * ***Youssef Abdelshafy*** * ***Gehad Alkady*** * ***Moheb Mekhail***   ***(Electrical Engineering Department,***  ***German International University (GIU), Cairo, Egypt);*** | |
| **Abstract** | | | |

This research presents the development of a sophisticated autonomous surveillance robot designed to enhance security measures. Equipped with cutting-edge sensors, advanced image processing capabilities, and autonomous navigation, the robot effectively detects and responds to threats in real time. The system utilizes the You Only Look Once (YOLO)v8 neural network for accurate threat identification, while robust hardware and software integration ensures reliable performance across diverse environments. By combining these elements, the research demonstrates the potential of spy robots in safeguarding communities and individuals from emerging security challenges. The spy robot is adept in real-time threat evaluation, and continuous monitoring with minimal human intervention.

Some properties included accurate threat detection, localization, and classification. The main threat detection module uses YOLOv8 which attains an accuracy level of 92%. The system was verified to be reliable during tests conducted. Technological advances such as these require collaboration among different disciplines.

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| **Paper ID** | **66531** | **Paper Title** | **Cell Throughput Prediction Using AI models: Insights from the O-RAN Framework** |
| **Author(s)** | | * ***Ali Waleed*** * ***Hesham Ali***   ***(Electrical Engineering Department, Arab Academy for Science and Technology (AASTMT), Smart Village Branch, Giza, Egypt);***   * ***Hesham El-Badawy***   ***Director of Central Administrative for Research and Development, Ministry of Communications and Information Technology (MCIT), Cairo Egypt*** | |
| **Abstract** | | | |

A massive number of connected devices in 5G/B5G leads to an ultra-dense network (UDN), causing several handover (HO) management issues. These issues include frequent and unnecessary handovers, radio link failures, signaling overhead. This rapid growth of mobile users creates heavy traffic loads and degrades the overall throughput of the network. User Equipment (UE) growth will cause unbalanced loads as well as traffic congestion, leading to increasing handover failures and cellular outages. We will shed light on the Open Radio Access Network (O-RAN) fundamentals and architecture. O-RAN is a new era of mobile networks that uses open, interoperable and disaggregated Radio Access Network (RAN) nodes. O-RAN has many advantages in tackling unbalanced and misallocated traffic in the system. Therefore, the main objectives of the concurrent study are to engage artificial intelligence (AI) as an innovative solution for cell throughput prediction. In other words, the paper studies the prediction of cell throughput using two AI models: i) a supervised deep learning (DL) model, which is Long Short-Term Memory (LSTM), and ii) a supervised machine learning (ML) model called XGBoost. The paper shows the difference in evaluation using Mean Squared Error (MSE) and training time by implementing state-of the-art AI models as well as comparing the training time for both AI models. The study gives the first step to enhance handover management solutions.

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| **Paper ID** | **69052** | **Paper Title** | **A Comprehensive Review of Generative AI Applications in 6G** |
| **Author(s)** | | * ***Haitham Mahmoud*** * ***De Mi***   ***(College of Computing, Birmingham City University, Birmingham, United Kingdom);***   * ***Tawfik Ismail***   ***(Department of Telecommunication Engineering,***  ***Taibah University, Madinah, 42353, Saudi Arabia);***   * ***Hesham El-Badawy***   ***Director of Central Administrative for Research and Development, Ministry of Communications and Information Technology (MCIT), Cairo Egypt*** | |
| **Abstract** | | | |

The transition to 6G networks introduces a range of challenges due to increasing complexity, data traffic growth, and the demand for personalized services. Traditional network management techniques are no longer sufficient, as 6G networks require faster speeds, lower latency, and support for advanced applications. Open Radio Access Networks (O-RAN) offer a flexible architecture to address these challenges by enabling the integration of hardware and software from different vendors. As networks evolve, AI-driven solutions are increasingly critical for maintaining smooth operations and optimizing performance. Generative AI is gaining a large attention in 6G networks to solve complex issues like resource allocation, traffic prediction, and security. Hence, this paper aims to: (a) systematically review existing studies on Generative AI, focusing on its use cases, opportunities, and challenges, and (b) thoroughly examine both current and potential applications of Generative AI, analyzing the problems they address, the proposed solutions, and identifying gaps in the existing research.