

# EMIRATI SOCIETY OF GIS AND REMOTE SENSING NEWSLETTER

## ESGRS CHALLENGE 2024: SUSTAINABILITY EDITION

The ESGRS Challenge - Sustainability Edition, organized by the Emirati Society of GIS and Remote Sensing (ESGRS) in collaboration with the Mohammed bin Rashid Space Centre (MBRSC) with prizes up to 20,000 Dirhams, has concluded with resounding success, leaving a lasting impact on the landscape of innovation and environmental problem-solving. This groundbreaking event united passionate university students to tackle real-world challenges using GIS and Remote Sensing technologies.

The challenge highlighted the creativity and technical expertise of participants, who developed innovative solutions in critical areas such as environmental monitoring, disaster management, climate change mitigation, and urban planning. By harnessing spatial data and advanced technology, students presented projects that could drive meaningful change for humanity and the environment.





More than just a competition, the ESGRS Challenge - Sustainability Edition served as a platform for young innovators to showcase their talents, emphasizing the vital role of collaboration and technological innovation in addressing global sustainability issues. Participants gained invaluable experience, honed their skills, and contributed to shaping a more sustainable future, cementing the event's legacy as a catalyst for impactful change.



## Main Themes

### Environmental Monitoring:

- Water Quality Monitoring Interface: A GIS-based application utilizing satellite imagery to analyze water quality and identify pollution sources.
- Precision Agriculture Interface: Tools to optimize crop planting and resource use, enhancing agricultural efficiency.
- Coastal Erosion Management: High-resolution satellite imagery applications for monitoring and managing shoreline changes.

### Disaster Management:

- Early Warning Systems: Integrating GIS and remote sensing data for natural disaster prediction and response.
- Post-Disaster Damage Assessment: Automating damage analysis using remote sensing imagery.
- Risk Assessment Models: Identifying vulnerable areas to improve disaster preparedness.



### Climate Change Mitigation and Adaptation:

- Carbon Footprint Mapping: GIS applications for visualizing and reducing emissions.
- Air Quality Monitoring: Interfaces for predicting and mitigating pollution events.
- Climate Impact Simulations: Spatial data-driven models aiding policymakers in adaptation strategies.

### Urban Planning and Smart City Solutions:

- Sustainable Urban Development: GIS models for optimizing land use and minimizing environmental impact.
- Urban Heat Island Effect Mitigation: Spatial data for implementing cooling measures.
- Smart Waste Management: Tools for efficient waste collection and recycling.

## HONORS & AWARDS



**Students:** Habibelrahman Hassan

**Project:** Smart Waste Management System  
for Optimizing Waste Collection

**American University of Sharjah**



**Students:** Siva Durga Adduri

**Project:** BREATHE Air Quality Monitoring and  
Prediction

**American University of Sharjah**



**Students:** Ahmed Wagih Mostafa

**Project:** Stormwater Management Using  
Geopolymer PCP

**United Arab Emirates University**



## DEEP LEARNING CAMP 2024: SHIP DETECTION USING SAR GEOSPATIAL DATA



The collaborative workshop between ESGRS and FARMIN was a resounding success, leaving participants inspired and equipped with cutting-edge skills in ship detection using SAR (Synthetic Aperture Radar) geospatial data. Hosted by ESGRS and led by Mr. Adel Yousefi, a developer and researcher at FARMIN with expertise in advanced technologies, AI, and software development, the event offered a rich blend of theoretical knowledge and hands-on learning.

Participants delved deep into SAR technology, learning its fundamentals and exploring advanced techniques for real-world problem-solving. Through immersive sessions, they engaged with Python libraries and tools, mastering skills such as annotating, visualizing, and training models for ship detection. The workshop also provided insights into implementing state-of-the-art deep learning models like YOLOv8, attendees gained invaluable skills under the guidance of industry experts.

## Key Event Highlights

- **Understanding SAR Technology:** Attendees delved deep into the intricacies of SAR data, learning its applications in ship detection and beyond.
- **Effective Data Annotation:** Participants gained hands-on experience with state-of-the-art tools to annotate datasets accurately, setting the foundation for successful model training.



- **Implementing Deep Learning Models:** Leveraging YOLOv8, the camp explored advanced object detection techniques, empowering attendees to implement and adapt these models.
- **Leveraging Supervision for Visualization:** The workshop emphasized powerful visualization strategies to enhance the understanding and analysis of SAR data.
- **Hands-on Coding and Model Adaptation:** The event featured interactive sessions that blended theory with practical coding exercises, ensuring participants could immediately apply their learning.

# 3RD ANNUAL: DIGITAL TRANSFORMATION HACKATHON BY ZAYED UNIVERSITY



The 3rd Annual Digital Transformation Hackathon, hosted by Zayed University CTI NextGen Center (Dubai Campus), occurred on the 21st and 22nd of February 2024 at the CTI NextGen Center, Zayed University in Dubai. This eagerly anticipated event saw more than 50 students from different universities across the UAE come together to tackle various challenges proposed by Zayed University and the main hackathon technical partners.



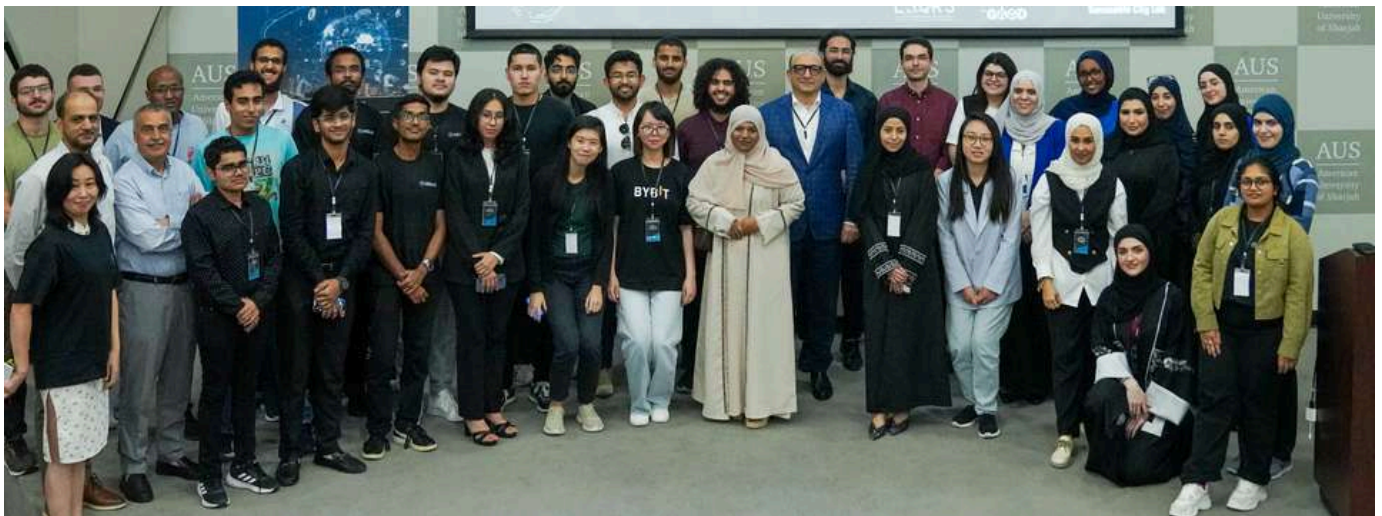


Collaborating with esteemed partners such as Dubai Chamber, Mohammed Bin Rashid Space Centre, Dubai Electricity and Water Authority, First Abu Dhabi Bank Research and Innovation Center, and Huawei. The hackathon provided a platform for innovation and collaboration. Each team, comprised of 2-4 individuals, underwent rigorous training in preparation for the competition, aiming to present their groundbreaking solutions to the panel of judges.

The hackathon not only fostered creativity and problem-solving skills but also offered an opportunity for real-world implementation. The winning team, selected by the panel of judges, was awarded and gained the invaluable chance to implement their ideas in collaboration with the partners. It is worth mentioning that the 1st place winners chose MBRSC Challenge to work on (Developing a remote sensing-based solution to monitor water quality in a region or water body), Overall, the event served as a testament to the power of collaboration and innovation in addressing sustainability challenges in the UAE and beyond.

## AI-CITY QUEST HACKATHON

ESGRS embarked on an exciting innovation journey, offering a one-day Hackathon that brought together more than 12 teams of 2-3 university students. Participants dove deep into AI and Blockchain, aiming to unlock the secrets of smart city development. Armed with satellite image datasets, they crafted cutting-edge solutions to shape the future of urban living, competing for a chance to win prizes from a pool of 27,000 AED. The main challenges tackled during the event included urban planning and land use management, focusing on zoning regulations, land parcel management, and spatial analysis for optimal land use within cities. Teams examined how GIS and remote sensing technologies are utilized for disaster preparedness, response planning, and recovery efforts in urban areas under the emergency response and disaster management category. Sustainability was another key focus, with participants exploring applications of GIS and remote sensing for energy consumption analysis, renewable energy resource mapping, and development planning within cities. The event witnessed a remarkable success, which led to the Hackathon to be hosted annually with new challenges every year!



## HONORS & AWARDS



**Students:** Dara Varam and Rohan Mitra  
**American University of Sharjah**



**Students:** Joud Saleh, Meriem Aoudia and Majda Osoble  
**University of Sharjah**



**Students:** Sanober Sarfaraz Ahmed, Harsh Garg and Mohammed Haroon  
**BITS Pilani, Dubai Campus**



## INTRODUCTION TO PYTHON FOR SATELLITE IMAGERY PROCESSING WORKSHOP

The Introduction to Python for Satellite Imagery Processing Workshop concluded successfully, marking a significant milestone in fostering technical skills and innovation among participants. Hosted by ESGRS, the workshop provided attendees with a unique opportunity to delve into the basics of Python programming while exploring the fascinating world of satellite image processing.

Participants, ranging from beginners to those with basic programming knowledge, were guided through a hands-on learning journey that blended foundational Python concepts with practical applications in satellite imagery. The event's collaborative and interactive approach ensured an enriching experience for all attendees.



The workshop was led by Eng. Abdalla AlHammadi, a dedicated software engineer at the MBRSC Lab at the University of Dubai. With over two years of experience in remote sensing, Abdalla has made notable contributions to various MBRSC projects, including DMSat-1, KhalifaSat, and MBZSat. His expertise spans processing raw satellite data, conducting radiometric and geometric calibrations, automating operations, and employing AI and deep learning techniques for advanced data analysis. Currently pursuing his master's degree in electrical engineering, Abdalla's passion and expertise provided invaluable insights to the participants.



# “INTRODUCTION TO PYTHON FOR SATELLITE IMAGERY PROCESSING” WORKSHOP’S REVIEWS



**Hessa AlZaabi**  
MBRSC Lab Intern

The session was an invaluable opportunity to build a strong foundation in Python and see its practical applications in satellite imagery processing firsthand. The workshop was made even more enriching by the inspiring individuals I had the privilege to interact with: Nour Aburaed, Mina Al-saad, Basma Samour, and Reem AlAli. Their exceptional talent and kindness in teaching greatly enhanced the learning experience. With the valuable knowledge gained, covering significant portions of the image processing workflows, I am now eager to apply these skills to analyze satellite imagery. This workshop has truly equipped me with the tools to explore new horizons in satellite imagery analysis.



**Mahra AlHefeiti**  
UAU

This workshop delved deep into the fundamentals of Python programming, specifically applied to the fascinating realm of satellite data analysis. We explored how to harness this powerful technology to derive crucial insights, such as evaluating soil fertility and monitoring rainfall patterns, especially in crisis scenarios. The workshop was an eye-opener, demonstrating how satellite imagery can be a game-changer in tackling some of the world's most pressing challenges. It was a remarkable experience that not only enhanced our technical skills but also underscored the profound impact of innovative technology on global problemsolving.



**Jwahr Alnaqbi**  
Center for Space Science, NYU

I gained insights into the extensive uses of satellite imagery. Specifically, we engaged in activities focused on monitoring vegetation and water landscapes, which are essential to provide time-sensitive information on their status to relevant stakeholders. I was introduced to a rich library of unrestricted satellite images that I can use to practice image analysis. I performed image analysis using Python code and learned to generate NDWI and NDVI, with an image for Dubai as a case study. It was concise and covered the main points needed to gain landscape monitoring using satellite image skills. I appreciate the generous efforts made by MBRSC to spread knowledge on techniques and skills applied at the center.



**Anoud AlZaabi**  
SAASST

The focus of the workshop was on methodologies for visualizing and processing satellite images using Python. The session began with a brief introduction to the Python programming language and progressed to image preprocessing techniques and advanced analysis algorithms. Using data from the Sentinel-2 mission, we analysed the imagery with the normalized difference water index (NDWI) to identify flooded areas in Dubai following the intense rainfall on April 16, 2024. This hands-on analysis provided valuable insights into how Python can be utilized to extract meaningful information from satellite imagery datasets, demonstrating its practical applications in environmental monitoring and disaster management.

## ADVANCED RASTER ANALYTICS AND AI ALGORITHMS FOR GIS & REMOTE SENSING HANDS-ON WORKSHOP

The workshop organized by ESGRS, successfully provided an enriching and interactive platform for participants eager to enhance their expertise in cutting-edge Python techniques for geospatial analytics. The event focused on advanced raster data processing and AI-driven geospatial applications, equipping attendees with the skills to address complex challenges in GIS and remote sensing.

The workshop was led by Dr. Ahmad Omar Aburizaiza, Senior GIS Regional Lead & Solutions Engineer at JLL. Dr. Ahmad's extensive background includes pivotal roles in academia, government, and the private sector, with notable contributions at NASA and Mapbox.

This hands-on workshop not only delivered invaluable insights but also served as a catalyst for innovation in the geospatial domain. Participants left empowered with advanced knowledge in raster analytics and AI applications, equipped to drive transformative progress in GIS and remote sensing technologies.



## PAPER HIGHLIGHT

# SEMANTIC SEGMENTATION OF REMOTE SENSING IMAGERY USING AN ENHANCED ENCODER-DECODER ARCHITECTURE

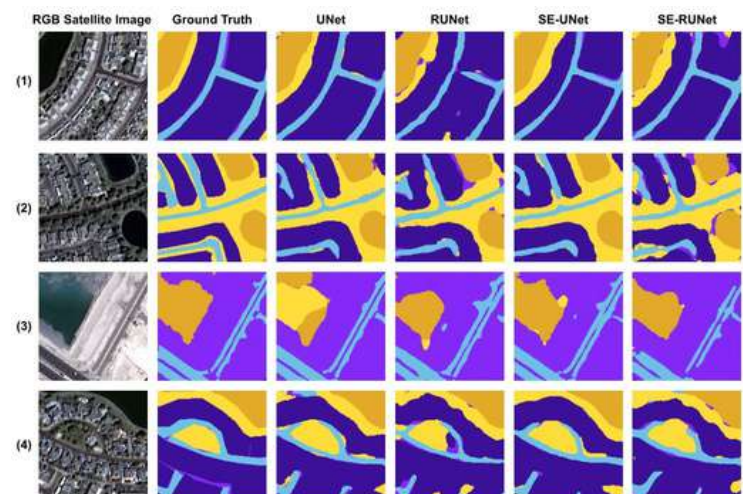
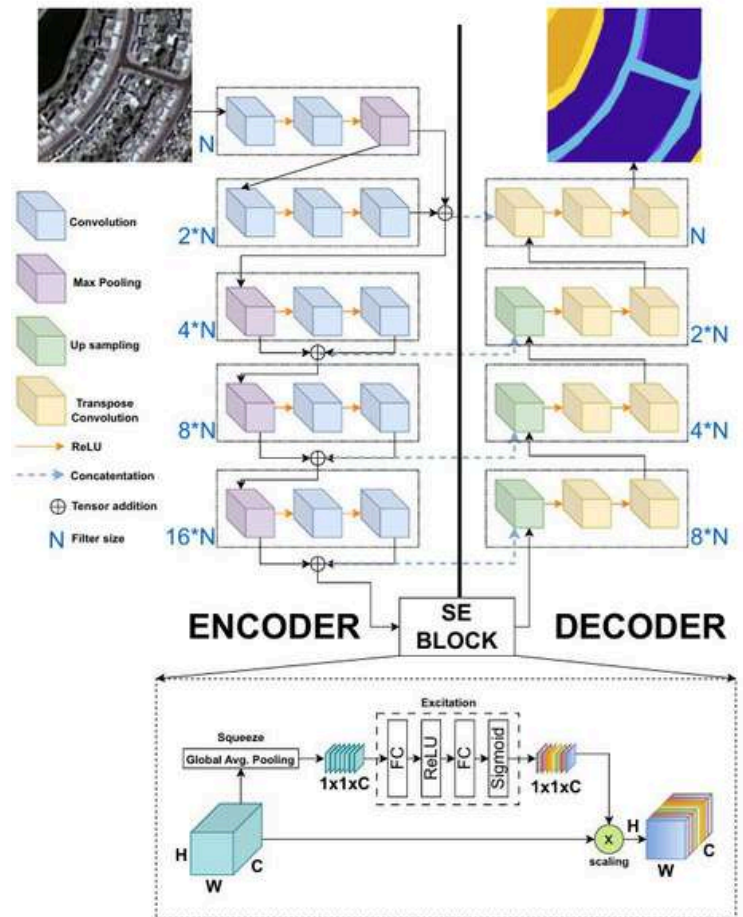
N. Aburaed <sup>1</sup>, M. Al-Saad <sup>1</sup>, M. Q. Alkhatib <sup>1</sup>, M. S. Zitouni <sup>1</sup>, S. AlMansoori <sup>2</sup>, H. Al-Ahmad <sup>1</sup>

<sup>1</sup> College of Engineering and IT, University of Dubai, Dubai, UAE.

<sup>2</sup> Mohammed Bin Rashid Space Center, Dubai, UAE.

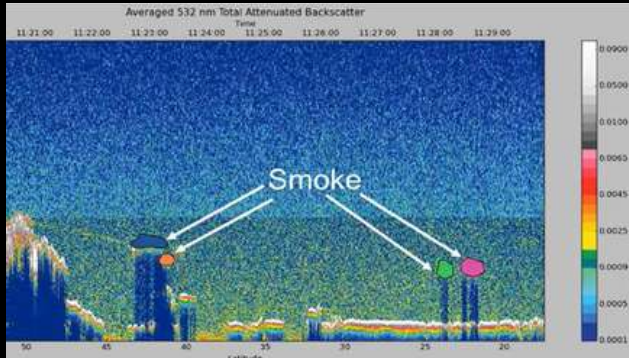
### ABSTRACT

Semantic segmentation is one of most the important computer vision tasks for the analysis of aerial imagery in many remote sensing applications, such as resource surveys, disaster detection, and urban planning. This area of research still faces unsolved challenges, especially in cluttered environments and complex sceneries. This study presents a repurposed Robust UNet (RUNet) architecture for semantic segmentation, and embeds the architecture with attention mechanism in order to enhance feature extraction and construction of segmentation maps. The attention mechanism is achieved using Squeeze-and-Excitation (SE) block. The resulting network is referred to as SE-RUNet. SE is also tested with the classical UNet, termed SE-UNet, to verify the efficiency of introducing SE. The proposed approach is trained and tested using "Semantic Segmentation of Aerial Imagery" dataset. The results are evaluated using Accuracy, Precision, Recall, F-score and mean Intersection over Union (mIoU) metrics. Comparative evaluation and experimental results show that using SE to embed attention mechanism into UNet and RUNet significantly improves the overall performance.



[CLICK HERE TO READ THE FULL PAPER](#)

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