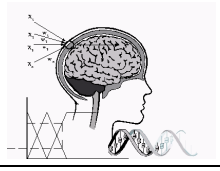
International

Innovation in Knowledge Based and Intelligent Engineering Systems



INVITED SESSION SUMMARY

Title of Session:

SOAP4EARTH: Smart Observation And Preservation for Earth

Name, Title and Affiliation of Chair:

- Stefano Marrone, Department of Mathematics and Physics, Università degli Studi della Campania “Luigi Vanvitelli”, Caserta, Italy
- Maria Stella De Biase, Department of Mathematics and Physics, Università degli Studi della Campania “Luigi Vanvitelli”, Caserta, Italy
- Gaetano Settembre, Department of Mathematics, Università degli Studi di Bari “Aldo Moro”, Bari, Italy

Details of Session (including aim and scope):

The rapid advancements in Artificial Intelligence (AI) and remote sensing technologies have profoundly revolutionized how we observe and preserve our planet. Earth Observation (EO) instruments - including multi-(hyper)spectral optical satellites, radar systems, LiDAR sensors, as well as ground-based and in situ monitoring devices such as meteorological stations, seismic sensors, and IoT-enabled environmental monitoring systems - are generating vast and continuously expanding volumes of data.

Recent machine learning workflows and deep learning models, provide researchers the capacity to process, monitor, and analyse Earth's dynamic phenomena. These innovative techniques support the extraction of meaningful insights from these high-dimensional and heterogeneous datasets with exceptional precision and granularity. A valuable advancement in EO data analysis is evident in its enhanced capability to identify complex spatio-temporal patterns, detect subtle anomalies, and recognize emerging trends with greater accuracy than conventional analytical methods.

This powerful synergy of AI and remote sensing plays a pivotal role in addressing some of the most crucial global challenges. In the context of climate change, AI-driven analysis of EO data enables the early detection of environmental anomalies, thereby supporting proactive strategies for climate mitigation and adaptation. Similarly, real-time and near-real-time monitoring capabilities are proving instrumental in the rapid identification and management of natural disasters—such as floods, wildfires, and earthquakes—ultimately contributing to risk reduction, disaster resilience, and community protection. Furthermore, the continuous observation of critical infrastructure through AI-enhanced remote sensing techniques is essential for predictive maintenance, early fault detection, and ensuring the resilience of vital systems.

Several emerging methodologies are gaining traction in this domain, including deep learning-based feature extraction, domain adaptation, semi-supervised learning, time series analysis, active learning, explainable AI, uncertainty quantification, and interactive model development and visualization. Despite the increasing adoption of AI techniques and the development of domain-specific algorithms, a significant gap remains in fostering interdisciplinary collaboration between domain experts and AI researchers. Addressing this challenge is crucial to enhancing the interpretability, robustness, and real-world applicability of AI-driven EO systems.

This invited session aims to bring together researchers, practitioners, and industry experts to discuss cutting-edge methodologies for environmental monitoring through AI-driven approaches. We welcome contributions addressing challenges and innovations in EO, particularly those leveraging satellite imagery, weather data collection from space and ground, and computational techniques for sustainability.

We invite original research and case studies related (but not limited) to the following topics:

- **Satellite Image Analysis for Environmental Monitoring and Disaster Management.**
- **Modelling and Simulation of Natural Phenomena.**
- **Geospatial Data Fusion, Analytics, and Knowledge Discovery in Earth Observation.**
- **Explainable and Trustworthy AI in Climate and Earth Sciences.**
- **Cyber-Physical Systems and IoT for Real-Time Earth Observation.**
- **Edge and On-Board Computing for Scalable Earth Observation.**
- **Digital Traceability and Transparent Environmental Governance.**
- **AI-Driven Solutions for Sustainable Development Goals.**

The article must be submitted by April 30th, 2025.

Main Contributing Researchers / Research Centres (tentative, if known at this stage):

- Università della Campania “Luigi Vanvitelli”
- Università di Bari “Aldo Moro”

Techncial Program Committee (tentative):

Antonello Aiello, Planetek Italia S.r.l. (IT)
Giuseppina Andresini, Università di Bari “Aldo Moro” (IT)
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Alessandro Parisi, Geophysical Applications Processing S.r.l (IT)
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Laura Selicato, CNR - National Research Council (IT)
Nicolò Taggio, Planetek Italia S.r.l. (IT)

Website URL of Call for Papers (if any):

https://sites.google.com/view/soap4earth/home

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