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IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing
Special Issue on
“Onboard Intelligence for Earth Observation and Planetary Exploration”

The space sector is currently undergoing a technological disruption featured by onboard intelligence. By processing the information captured from the space directly onboard the spacecrafts with advanced AI techniques, onboard intelligence has the potential to realize more efficient, agile, autonomous, and reconfigurable Earth Observation (EO) and planetary exploration systems.

In EO, the end users often expect acquiring valuable insights and making optimal decisions at low latency. Accordingly, considerable research efforts have been devoted into investigating onboard intelligence for EO applications like the early detection of natural disasters, vessel incidents, and gas leaks. Onboard intelligence also allows for identifying low-quality EO data, e.g., cloud-covered satellite images and remote sensing images containing limited information of interest, and then discarding them to save the costs of downlink data transmission to the Earth. To further investigate and demonstrate the potential of in-orbit computing, two EO missions will be launched soon 1) ESA’s next-generation Φ -sat-2 satellite and 2) IMAGIN-e ISS Mounted Accessible Global Imaging Nod-e) demonstration by Microsoft and Thales Alenia Space. A so called [OrbitalAI](#) challenge is currently organized under these two missions and is opened globally. The winners will deploy their AI models directly onboard these platforms. In the near future, onboard intelligence is foreseen to play a key role in planetary exploration by allowing the spacecrafts to process vast amounts of data to gain insights and make autonomous decisions based on such insights so as to complete complex tasks. For example, it may be used to process the data collected by the rovers on the Martian surface to identify and classify geological features and leverage such features to help plan the rover's movements and operations. It may also be used for the spacecrafts flying around planetary bodies to analyze the data captured by the spacecrafts’ remote sensing payloads for the purpose of mapping the surface and studying the composition and structure of the monitored planets.

This special issue will be focused on the new and challenging mission concepts and applications in EO and planetary exploration. It will provide a forum to promote interdisciplinary research across Remote Sensing, Computer Vision, Advanced AI, Onboard Computing, and Edge Computing among others towards augmenting onboard intelligence for next-generation EO and planetary exploration. The broad topics include (but are not limited to):

- Onboard AI platforms, frameworks, and systems for supporting EO and planetary exploration missions.
- Advanced onboard AI techniques (e.g., tiny machine learning) for data processing, analysis, and interpretation
- New onboard learning paradigms in space, e.g., continual learning, distributed learning, and federated learning.
- Data-centric onboard AI.
- Onboard AI-driven decision making in space, such as Swarm intelligence for satellite constellation, onboard event detection/prediction-based decision making, and collective intelligence for mission-critical applications.
- Security, privacy, and trustworthiness of onboard AI.
- Onboard AI-based EO and planetary exploration for transportation, urban design, agriculture, energy, environment, management of resources and emergency, etc.

Schedule

01 May 2023 Submission system opening

31 Oct 2023 Submission system closing

Format

All submissions will be peer reviewed according to the IEEE Geoscience and Remote Sensing Society guidelines. Submitted articles should not have been published or be under review elsewhere. Submit your manuscript on <http://mc.manuscriptcentral.com/jstars>, using the Manuscript Central interface and select the “**Onboard Intelligence for Earth Observation and Planetary Exploration**” special issue manuscript type. Prospective authors should consult the site <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9082768> for guidelines and information on paper submission. All submissions must be formatted using the IEEE standard format (double column, single spaced). Please visit http://www.ieee.org/publications_standards/publications/authors/author_templates.html to download a template for transactions. Please note that as of Jan. 1, 2020, IEEE J-STARS has become a fully open-access journal charging a flat publication fee \$1,250 per paper.

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