2nd Workshop on Machine Learning for Remote Sensing (ML4RS)

Sensing | Learning | Understanding

Workshop Summary

Promoting diverse viewpoints and trans-disciplinary research is the basis for addressing the pressing questions of our times, such as climate change, social inequalities, biodiversity, and food security. Developing modern machine learning approaches tailored towards remote sensing data is key to investigating these problems efficiently. This second Machine Learning for Remote Sensing (ML4RS) workshop promotes this exchange by allowing researchers to present their a) research on environmentally and societally important applications and/or b) innovative methods that can have an impact in such application domains. This workshop is the continuation of the ICLR 2023 ML for Remote Sensing workshop that enabled local stakeholders, researchers, and students, for instance, from the Rwanda Space Agency and local CMU Africa, to discuss and debate the key problems to be addressed with machine learning. In this workshop in Vienna, we continue in this spirit by giving locally-based experts a voice to articulate important regional challenges in ML4RS, for instance, by inviting domain scientists from international organizations, such as the IAEA or the Red Cross (invited panelists). The keynote speakers are leading researchers in the intersection of machine learning and remote sensing. Our workshop is financially sponsored by industry and governmental organizations, such as the European Space Agency (pledged 3k EUR). With this proposal, we hope to establish a continual exchange in this environmentally and socially highly relevant research field of machine learning for remote sensing for the upcoming years.

Topics

The goal of this workshop is to solicit research papers addressing advancements in key topics in Machine Learning for Remote Sensing, such as domain adaptation, concept drift, out-of-distribution detection, evaluation using unlabeled data, model architectures for remote sensing data, semi-supervised learning, unsupervised learning, self-supervised learning, multi-fidelity data fusion, federated learning, data-centric AI, human-in-the-loop and active learning, machine learning for time series, methods for learning from limited labeled data (e.g., few-shot learning, meta-learning), new benchmark datasets involving remote sensing data, geographic equity, and fairness. We welcome applications related to sustainable development, societal needs, planetary exploration, and more, including but not limited to agriculture and food security, forestry, biodiversity and species distribution modeling, natural hazards and disasters, and other societal and environmental questions. Papers can present methodological innovations designed towards a particular problem or can also apply existing methods when they highlight new perspectives or limitations on existing methods or the broader environmental and societal applicability through a particular dataset or impact area.

What this workshop contributes to ICLR

We see a realization gap between methodological research on idealized benchmarks and their utility for real-world problems. We need an active exchange and discussion between method-oriented and application-focused researchers to close this gap and develop modern

approaches with actual real-world impact. We also recognize that remote sensing is a new modality for ML that requires novel ML algorithms designed for the specific nature of remote sensing data to fully unlock its capabilities and promise. The remote sensing data modality is rapidly gaining interest and attention in ML, in part due to its immense potential for impactful real-world applications.

Relationship to prior workshops

This is the second edition of ML4RS (website link) with a new main organizer (M. Rußwurm) and some new co-organizers (R. Roscher, C. Pelletier). The first workshop in ICLR 2023 in Kigali (led by H. Kerner) successfully worked with local students, researchers, and professors at CMU Africa and the Rwanda Space Agency to discuss and emphasize locally relevant research. The invitation of speakers from the Rwanda Space Agency and other African countries (e.g., Google Accra, AIMS South Africa) connected the methodologies presented in the workshop with relevant applications needed in this local context, such as building footprint detection or crop mapping. The 2023 workshop was extremely successful: there were more than 100 attendees (more chairs had to be added to the room!), including more than 40 students from local Rwandan universities who were sponsored to attend by CMU Africa. We had 45 paper submissions and 18 accepted papers. Many attendees expressed their enthusiasm about the discussions and research presented at the workshop and their desire for the workshop to continue in future years. Regarding other related workshops, we are well-connected to the CVPR EarthVision workshop series through common organizers C. Pelletier and H. Kerner. We believe that this ML4RS workshop placed at a machine learning and representation learning venue nicely augments the EarthVision workshop for relevant environmental problems beyond vision and high-resolution imagery. For instance, we aim to include more topics naturally, such as time series to capture the dynamic nature of our planet and its shift with climate change, or to fundamentally discuss transfer learning approaches or how to mitigate domain shift on remote sensing data.
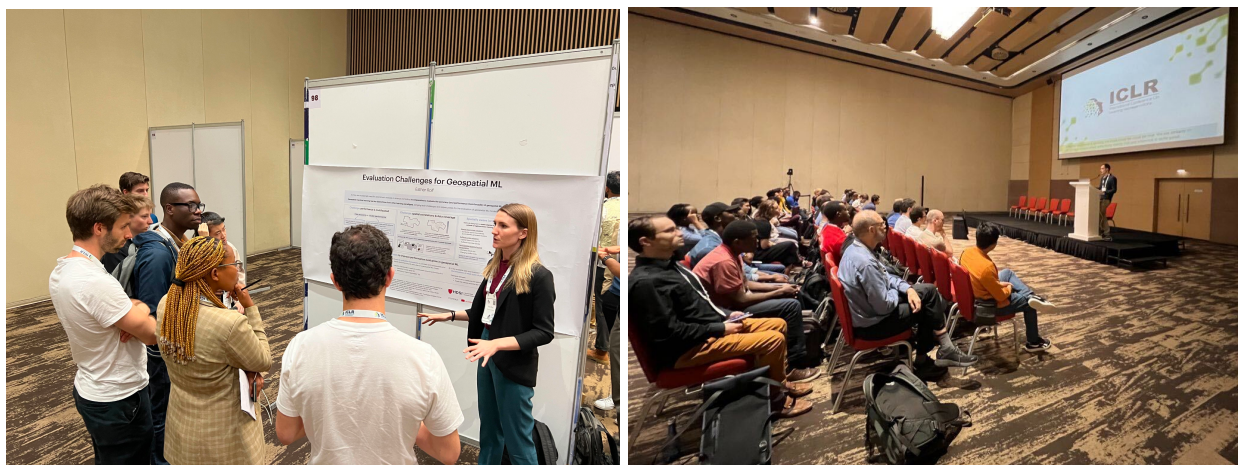
Photos from poster session and keynote presentation at ICLR 2023 Machine Learning for Remote Sensing workshop in Kigali, Rwanda.

Location-specific focus and environmental commitment
This ML4RS edition will continue this spirit of integrating local researchers and stakeholders by inviting panelists from Europe and particularly Eastern Europe. Vienna is well-known as a center for international organizations, such as the IAEA and with UN offices of UNHCR, UNIDO, and UNOSA, that, to a large degree, rely on remote sensing information to, for instance, monitor migration and refugee situations with remote sensing. The keynote speakers (one from Europe) highlight the greater applicability of remote sensing data together with the need for state-of-the-art machine learning models.

Modality and Format
We propose a hybrid workshop: We encourage all workshop contributions to be presented on-site and will stream the talks online to allow virtual participation. We will monitor questions from the stream and aim to integrate them during the sessions. The submissions in this workshop are non-archival. However, we will publish them on the website, as in last year's workshop (see links under "Accepted Papers"), and encourage authors to share accepted papers on arXiv.

Integration in Scientific Societies
This workshop is a place of exchange between the scientific ML community at ICLR and remote sensing communities. On the remote sensing side, we have representatives from all major scientific societies active in remote sensing in the organization committee:

- IEEE Geoscience and Remote Sensing Society (GRSS) through Administrative Committee Member Dr. Ronny Hänsch.
- International Society of Photogrammetry and Remote Sensing (ISPRS) through Working Group (WG) II/4 represented by Chair Prof. Ribana Roscher, and WG II/5 represented by Chair Prof. Charlotte Pelletier.
- International Association of Pattern Recognition (IAPR) through Thematic Committee 7 (TC-7) "Remote Sensing and Mapping" represented by Chair Prof. Ribana Roscher.

Financial Sponsoring
The topic of this workshop has already raised interest: the European Space Agency has pledged to support the workshop with 3000 EUR. We are in contact with Sinergise/Planet, Microsoft AI for Good, and the GRSS society, who have voiced support for funding after acceptance of the workshop. We will use the funds for invited speakers and panelists and to enable students to present their work on-site. We aim to lower the carbon footprint of this workshop by encouraging train over air transport for sponsor-funded travel.

Expected attendance
Based on the first edition of our workshop, we expect an attendance of approximately 50-100 participants. This is also in line with related tutorials (e.g., Machine Learning for Remote Sensing: Agriculture and Food Security tutorial at CVPR 2022) and workshops (e.g., EarthVision workshop at CVPR 2023).

Outreach and Promotion

We can build on the promotion and outreach channels established last year and will provide a 2024 website consistent with last year's site. We have contacts with newsletters of Remote Sensing Societies, such as Geoscience and Remote Sensing eNewsletter, ISPRS e-Bulletin, and the IAPR-TC7 newsletter. We will also promote the workshop in relevant Google groups, such as the Women in Machine Learning Group, as done last year in this post. Further, most of the organizers have active Twitter/X profiles with a combined number of roughly 10k followers. We will also ask our diverse network of program committee members to promote the workshop in their networks.

Proposed Schedule

In the schedule of Table 1, we facilitate discussion at three scales:

1) two keynotes and two contributed talk sessions with audience questions,
2) one panel discussion among invited guests with audience questions,
3) one poster session for small-scale one-on-one exchange (we follow last year's feedback where two shorter poster sessions were perceived as too short. Hence, we propose a single but longer (1.5 h) poster session)

Table 1: draft agenda for Machine Learning for Remote Sensing workshop.

start-end time	topic
9:00-9:10	Introduction and opening remarks
9:10-9:40	Keynote speaker #1: Sherrie Wang (MIT)
9:40-10:00	Coffee break (possibility to set up posters with initial discussions)
10:00-10:30	Poster Spotlights (6 x 5 min each. Questions later on posters)
10:30-12:00	Poster Session
12:00-13:30	Lunch (opportunity to visit posters)
13:30-14:00	Keynote speaker #2: Damian Borth (Univ. St Gallen)
14:00-15:00	Accepted paper oral talks (2 x 20 min each with questions)
15:00-15:30	Coffee break (opportunity to visit posters)
15:30-16:30	Panel - Beyond Benchmarks: Machine Learning for the Planet ● Ramona Pelich (International Atomic Energy Agency IAEA) ● Stefan Lang (Univ. Salzburg) ● Nico Lang (Univ. Kopenhagen) ● Grega Milcinski (CTO Sinergise/Planet)
16:30-17:30	Accepted paper oral talks (4 x 10 min each with questions)
17:30-17:35	Closing remarks and adjourn

Workshop organizers

[Marc Rußwurm](#) (new organization lead 2024) is an Assistant Professor for Machine Learning and Remote Sensing at Wageningen University, Netherlands. He works with time series classification, as well as transfer learning across geographic locations through meta- and few-shot learning. Application-wise, we has published works covering crop-type mapping, deforestation, and marine debris and plastic litter detection from satellite imagery.

[Hannah Kerner](#) (organization lead 2023) is an Assistant Professor in the School of Computing and Augmented Intelligence at Arizona State University. Her research focuses on developing AI and machine learning advances needed to address the world's most pressing challenges, including food security, climate change, and space exploration. As the AI/ML Lead for the NASA Harvest program, she is deploying research methods in real operations for stakeholders in industry, government, and humanitarian organizations.

[Ribana Roscher](#) (new 2024) is a Professor of Data Science for Crop Systems at the University of Bonn, Germany. She heads the same-titled group at the Institute of Bio- and Geosciences at Research Center Jülich, Germany. She develops machine learning methods to address challenges in environmental sciences and sustainable agriculture. She specifically focuses on techniques for sophisticated feature learning, data-centric, and explainable machine learning.

[Charlotte Pelletier](#) (new 2024) is an Associate Professor in computer science at the University of South Brittany and the Obelix team at the Institute for Research in IT and Random Systems (IRISA), Vannes, France. She is the co-leader of the GeoData Science track within the Erasmus Mundus Joint Master Degree named Copernicus Master in Digital Earth. Her research focuses on machine learning, in particular time series analysis with applications in remote sensing.

[Hamed Alemohammad](#) is an Associate Professor in the Graduate School of Geography at Clark University and also the Director of the new Center for Geospatial Analytics. His research interest lies at the intersection of GISciences and geography to use observations and analytical methods through machine learning to better understand the changing Earth system.

[Gedeon Muhawenayo](#) is a Ph.D. student at Arizona State University focusing on Machine Learning for Remote Sensing. He is also part of the Rwanda Space Agency (RSA) Geospatial team, where he contributes to the development of machine learning systems that leverage satellite imagery for real-world applications.

[Gabriel Tseng](#) is a Ph.D. student at McGill / Mila - Quebec AI Institute and a Machine Learning Engineer at NASA Harvest. His research investigates applications of machine learning to remote sensing data, focussing on learning with few labels. His work bridges methodological advances and the deployment of machine learning models for real-world remote sensing applications.

[Ronny Hänsch](#) leads the Machine Learning Team in the Signal Processing Group of the SAR Technology Department at the Microwave and Radar Institute of the German Aerospace Center (DLR). His research interest is computer vision and machine learning with a focus on remote sensing (in particular, SAR processing and analysis). He has extensive experience in organizing remote sensing community competitions, serves as the GRSS representative within SpaceNet, and was the technical lead of the SpaceNet 8 Challenge.

Confirmed invited speakers

Damian Borth (confirmed) is the chair of Artificial Intelligence and Machine Learning at the University of St. Gallen, Switzerland, and covers the area of deep neural networks. His research focuses on representation learning through supervised and unsupervised approaches with applications to computer vision, remote sensing, text-to-speech synthesis, and financial time-series data.

Sherrie Wang (confirmed) is an Assistant Professor at MIT. She uses novel data and computational algorithms to monitor our planet and enable sustainable development. Her focus is on improving agricultural management and mitigating climate change, especially in low- or middle-income regions of the world. To this end, she frequently uses satellite imagery, crowdsourced data, LiDAR, and other spatial data. Due to the scarcity of ground truth data in these regions and the noisiness of real-world data in general, her methodological work is geared toward developing machine learning methods that work well with these constraints.

Confirmed invited panelists

Ramona Pelich (confirmed) is a remote-sensing scientist at the International Atomic Energy Agency in Vienna, which monitors nuclear facilities around the globe with remote-sensing data. She can share her experience in the potential of integrating modern machine learning methods in monitoring nuclear facilities remotely across the world.

Grega Milcinski (confirmed) is the chief technological officer at Sinergise, a large-scale remote sensing data provider recently bought by Planet Inc., which increasingly integrates state-of-the-art data analysis and machine learning models in their processing pipelines. He will share his experiences in providing information to domain scientists through global-scale data.

Nico Lang (confirmed) is a postdoctoral researcher at the Belonge Lab in the Department of Computer Science, University of Copenhagen, Denmark. He recently published a global-scale data product on tree canopy height at Nature Ecology & Evolution that uses an uncertainty quantifying neural network in combination with satellite-based LiDAR remote sensing. He will share his experiences understanding and adapting lessons learned in modern machine learning to global-scale data products that are used by ecologists on a daily basis.

Stefan Lang (confirmed) is an Associate Professor at the Department of Geoinformatics at Salzburg University. His vision is to enhance technical and organizational capacities with cutting-edge technological advancements at the interface of satellite Earth observation, geoinformatics, and machine learning. He will share his experiences in integrating modern machine learning in his work with Doctors Without Borders in developing countries.

Diversity and Inclusion

We took care to reflect different viewpoints and backgrounds throughout the organizing committee and invited speakers and panelists. The organizing committee has members born in three continents (North America, Europe, and Africa) and is roughly gender balanced. We invited representatives of governmental organizations and industry to the panel discussion. The confirmed keynote speakers are one junior (Sherry Wang; Assistant Professor) and one senior researcher (Damian Borth; Associate Professor and Chair). With this composition, we hope to reach a diverse community of global researchers interested in addressing the pressing questions of our time with ML for remote sensing research