

UN Open GIS: Geo-AI Working Group First Consultation Call Report



UN Open GIS
INITIATIVE

Geo-AI WG Co-Chair
Tomaz Logar,
United Nations Global Pulse

Friday, 11 September 2020

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What Is Geo-AI WG

The UN Open GIS Initiative, established in March 2016, is an ongoing Partnership Initiative for Technology in Peacekeeping of the United Nations Department of Operational Support (DOS). In 2020 the UN Open GIS Initiative actively addressed the increased need for applying Artificial Intelligence (AI) in geospatial work by establishing a fifth working group - the Geo-AI Working Group. The Group's objective is to experiment with and integrate AI technology into the wider UN Open GIS Initiative's workflow, and research, development and implementation of Artificial Intelligence technologies for the United Nations operations. Currently, the Geo-AI working group is co-chaired by the Food and Agriculture Organization of the UN (FAO) and UN Global Pulse, the UN Secretary-General's initiative on big data and AI for development, humanitarian action, and peace.

The consultation call on Friday, September 11th 2020, was one of the first activities of the Geo-AI working group. The event connected United Nations colleagues with wider geospatial actors from academia and industry to gauge where our collaborative efforts should be focused to provide the most benefit.

Consultation Call Objectives

With that in mind, the objectives of the call were to:

- Share current **UN activities and aspirations** in the field of Geo-AI;
- Share **non-UN research and operations** in the use of Geo-AI;
- **Gather feedback** from the various stakeholders present on priorities, partnerships and collaborations in the Geo-AI space;
- **Determine potential collaborations** between communities of practice to promote and further support UN-system operational response.

Build-up

In the build-up to the event, we invited current members of the UN Open GIS Initiative to present their projects, the opportunities and challenges they are currently facing, and what they see as valuable solutions (from the geospatial AI point of view, of course). In order to get a sense of wider possibilities, we also invited representatives from the GEO community, including academics, researchers, and industry leaders. Among attendees were representatives from the

UN-GGIM Academic Network, UN-GGIM Geospatial Societies, UN-GGIM Private Sector, Radiant Earth, and OpenStreetMap Ecosystem Humanitarian Associations Open Source Geospatial Foundation (OSGeo).

Participants

The consultation call consisted of two main segments - presentations of Geo-AI stories and discussions among participants during a Geo-AI panel.

Presenters:

- Andrea Manara (International Telecommunication Union),
- Lorenzo Vita (UNODC Illicit Crop Monitoring Programme),
- Do-Hyung Kim (UNICEF),
- Saeid Pirasteh (GeoAI Smarter Map and LiDAR Lab, Southwest Jiaotong University),
- Pekka Sarkola (Gispo) and
- Zhongxin Chen (Food and Agriculture Organization)

Panel discussion:

- Opening remarks: Kyoung-Soo Eom (UN Open GIS Initiative)
- Moderator Maria Antonia Brovelli (Politecnico di Milano)
- Hamed Alemohammad (Radiant Earth),
- Yifang Ban ([UN GGIM Academic Network](#)),
- Zaffar Sadiq Mohamed-Ghouse ([UN GGIM Geospatial Societies](#)),
- Bo Percival (OSM Ecosystem Humanitarian Associations),
- Barbara Ryan ([UN GGIM Private Sector](#)), and
- Angelos Tzotsos (OSGeo)

Presentations



AI for Good Global Summit



- Leading action-oriented, global & inclusive United Nations platform on AI.
- The Summit is organized every year in Geneva by the ITU with XPRIZE Foundation in partnership with over 35 sister United Nations agencies, Switzerland and ACM.
- The goal is to identify practical applications of AI and scale those solutions for global impact.

Andrea Manara (International Telecommunication Union):

<https://ungp-pub.s3.amazonaws.com/unopengis/geo-ai/cosultation-call-1/manara-ai-geospatial-itu.pptx>



Andrea Manara presented the work of the ITU with respect to Geo-AI.

During his presentation, Andrea spoke about the ITU's flagship event AI For Good Global Summit. This event has the goal to identify practical applications of AI and scale those solutions for global impact.

Notable past work was track 3 of the 2019 ITU AI For Good Global Summit titled "[Space, AI and Satellite](#)". It was about the challenges and the opportunities of satellite imagery, satellite data and its applications for agriculture, reducing poverty, deforestation and its impact on the environment and climate.

The defining feature of this year's summit will be the pursuit of impact of scale. Due to the Covid situation it will be a continuous digital event with weekly programming across multiple formats, platforms and time zones. There will be 3 Breakthrough and 4 Solutions tracks: AI for Gender Equality, AI for Food, AI for the Environment, AI for Trust Solutions, AI for the Preservation of Culture and Natural Heritage, AI for the Future of Smart Mobility and AI for Health Solutions. He has invited us to join in this year's events, especially the one on Tuesday, October the 13th: "[How can Artificial Intelligence reduce disaster risks in countries?](#)".

Participants showed interest for a possible inclusion in the 2021 AI for Social Good Global Summit of a geospatial track in the program. A.Manara agreed to relay this interest to the ITU management and will come back with proposals for the involvement of the UN Open GIS initiative.

He also let us know of ITU's Global Initiative on AI and Data Commons which is a collaborative platform to support AI based solutions for the 2030 Sustainable Development Goals. The overall goal of this initiative is to match problem owners with providers of solutions using AI and data, scale and sustain AI-based projects, make resources, datasets and know-how available and accessible, and complement the work of standard bodies by increasing their work's visibility.



Lorenzo Vita (UNODC Illicit Crop Monitoring Programme):

<https://ungp-pub.s3.amazonaws.com/unopengis/geo-ai/cosultation-call-1/vita-lorenzo-unodc-icmp-wg5ai.pptx>



Lorenzo Vita from the [United Nations Office on Drugs and Crime \(UNODC\)](#) presented the work and the challenges of the Illicit Crop Monitoring Programme (ICMP). According to a decision taken by the UN General Assembly in 1998 every UN member state will monitor the cultivation of crops for illicit purposes. UNODC provides technical assistance to member states with national monitoring systems to detect coca, opium poppy or

cannabis, and compiles data at the global level to report to member states.

One of the main challenges they've so far faced is that illicit crop detection is based on visual interpretation and manual delineation of fields - that requires human resources, which causes it to be time consuming and subjective. Other challenges include differentiation from other crops, cost and availability of high-resolution satellite images, difficult access, poor security and limited ground truth information for quality control.

Last, but not least, a challenge is that survey results are very time sensitive - making this work a fertile ground for AI applications. Due to recent positive events in the field - dramatic advancement in technology, increasing number of satellites in orbit, options to overcome cloud cover issues, broad availability of historical data and free imagery at coarser resolution - AI could assist ICMP by automated detection of areas suitable for illicit cultivation, automated detection and delineation

of illicit crops, early warning on expansion areas of illicit crops, coverage, timeliness and frequency of assessments and improving yield and production estimates.

We could see from other presentations that there is quite a bit of overlap between UNODC and other Geo-AI members' work on crop detection, most notably with GeoAI Smarter Map and LiDAR Lab and FAO.

Equal AI for Children

UN Open GIS Geo-AI consultation

Do-Hyung Kim PhD.
September, 2020

dokim@unicef.org



Do-Hyung Kim (UNICEF):

<https://ungp-pub.s3.amazonaws.com/unopengis/geo-ai/cosultation-call-1/kim-do-hyung-unicef.pdf>



Do-Hyung Kim from the [United Nations Children's Fund](#) talked about the importance of addressing biases in Artificial Intelligence. One way of doing that would be “white boxing” the models. AI models currently work in a very opaque way. Somebody feeds annotated data through a series of model’s processing layers, which get tweaked a little by every piece of information they receive. After we send enough of this training data

through, the model’s layers are changed in such a way that it is capable of inferring an annotation by itself when we feed it data without annotation information. That is how AI produces results as if it was a human being. However, it can only tell what it’s “best guess” is and not what the reasoning behind this guess is. Hence we say it’s a “black box” - we put something in the box, we get something out, but what happens inside is unknown. Not knowing that is something we want to eliminate when we need accountability in our decision processes - we want to “white box” them, make them transparent and justifiable. This presentation touched on that.

Do-Hyung also presented a case of school mapping and introduced UNICEF and ITU’s joint initiative GIGA - a global initiative to connect every school to the Internet and every young person to information, opportunity and choice. He invited participants to showcase their projects in an upcoming edition of the Remote Sensing journal: https://www.mdpi.com/journal/remotesensing/special_issues/land_use_classification_GIS_remote_sensing_data_AI_technology



GeoAI, Smarter map and LiDAR Lab

Some Points of View on GeoAI Consultation Projects-UN Open GIS

Saeid Pirasteh-Southwest Jiaotong University, China

sapirasteh@swjtu.edu.cn, s2pirast@uwaterloo.ca
www.geoime.ca
<https://gsee.swjtu.edu.cn/EN/Homepage.htm>



Saeid Pirasteh (GeoAI Smarter Map and LiDAR Lab, Southwest Jiaotong University):

<https://ungp-pub.s3.amazonaws.com/unopengis/geo-ai/consultation-call-1/pirasteh-saeid-geoai+presentation-for-un-open-gis-1.pptx>



Saeid Pirasteh described his team's work at [GeoAI Smarter Map and LiDAR Lab, at Southwest Jiaotong University](#).

His team offers Geospatial Infrastructure Management Ecosystem (GeoIME) - a cloud-based web App technology that can calculate the damage index, determining the vulnerability and risk estimation of buildings and bridges for before and after an earthquake disaster, and to deliver

automated recommendation for retrofitting and reinforcement Potentially, it can be adapted and customized for other disasters like floods and landslides and another infrastructure such as roads. GeoIME is an ecosystem aiming resiliency to strengthen the infrastructure for a more reliable environment. This is the classification of its vulnerability and risk to natural disasters in times of normal operations and its state after a disaster. If used on a mobile device, GeoIME offers an Augmented Reality experience - vulnerability assessment is incorporated into recorded pictures or videos when walking or driving next to structures.

Saeid's team's second Geo-AI application touches on common points with Lorenzo Vita's work described above - Geo-AI for agriculture. This solution detects twenty five different types of crops, addressing the problem of farmers misclassifying their crops in government-mandated reports. One example of crop detection significance is in areas where water management is essential -

different kinds of crops require different amounts of irrigation and not knowing or managing requirements can lead to water shortages.

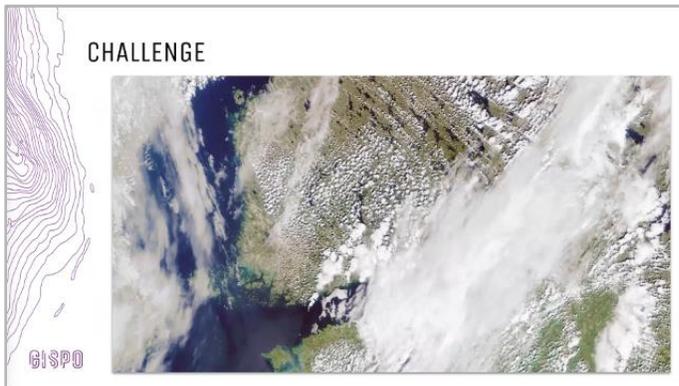
Next points Saeid made were proposing to write a book with other UN Open GIS colleagues about Geo-AI and Disasters to empower the 2030 Sustainable Development Goals, and collaborating on Sichuan Spin-Off Technologies Centre(Faculty of Geosciences and Environmental Engineering, Southwest Jiaoting University) for disaster prediction and analysis in that area.

At the end he expressed a general interest in collaborating with participants on GIS software development, training, capacity building, and further consultations.



Pekka Sarkola (Gispo):

<https://unqp-pub.s3.amazonaws.com/unopengis/geo-ai/cosultation-call-1/sarkola-gispo-un-pilot-project-cfsi-2020-09-11.pdf>



Pekka Sarkola's presentation was about [Gispo's](#) cloud-free satellite imagery project.

Cloud-free satellite imagery pilot project's aim is to address a common problem in satellite imagery processing - obstructing clouds.

Its objective is to set up a system to create cloud-free satellite-imagery for

further usage in crop identification processes. It achieves that by taking several images of the same area at different times and creating one multi-temporal image. Each pixel of the resulting image is from the latest cloud-free moment, creating an optimal mosaic of best available patches through a longer period of time.




Geospatial Artificial Intelligence at FAO

Zhongxin Chen, Karl Morteo, Douglas Muchoney



**Food and Agriculture Organization
of the United Nations**

Zhongxin Chen (Food and Agriculture Organization):

<https://ungp-pub.s3.amazonaws.com/unopengis/geo-ai/cosultation-call-1/chen-geo-ai.pptx>



Zhongxin Chen, co-chair of the Geo-AI working group presented several FAO projects.

The most recent FAO's contribution to the geospatial community was the release of the Hand-in-Hand initiative geospatial platform - a cloud-based interoperable geospatial big data platform to make data from different sources and domains work together.

When it comes to Geo-AI applications FAO has experience with land cover and crop classification using satellite imagery, phenology and ground reference data, palm tree mapping, fleet estimation, aquaculture mapping, fall armyworm / locust infestation, damage analysis, etc.

FAO Data Lab analyzes the impact of the Covid-19 pandemic on food and agriculture, value chains, food prices and food security.

Zhongxin let us know that they are looking for new or better AI solutions for quick near-real time crop mapping with Machine Learning, quantitative remote sensing for agriculture parameters, forest mapping and monitoring, fishery fleet and aquaculture monitoring, pests and disease monitoring and damage analysis (most recently for desert locust), disaster and emergency management, etc.

As a Geo-AI working group co-chair he presented our interest in technology networking in the UN system, Geo-AI community for innovation (including with non-UN organizations), Geo-AI algorithms, tools and platforms, Geo-AI ethics, sample datasets, Geo-AI boot camps or hackathons, Geo-AI best practices, standards and protocols, seminars and conferences.

He also mentioned that FAO can offer the Geo-AI working group the Hand-In-Hand geospatial platform, Geo-AI research and application cases, hosting of working group meetings, training and internships.

Panel Discussion

The panel opened with [World Geospatial Industry Council](#)'s **Barbara Ryan** and went back and forth with panelists offering their thoughts.



Barbara kicked off discussions stating that, while sensors will likely keep being siloed in the near future (e.g. one project's work will be done via a given satellite only), we can expect combining different types of sensors in the longer term. This could include using citizen science, meaning people who opt to use their mobile phones as sensors.

Barbara noted that WGIC is interested in working with the Geo-AI working group. She mentioned they did a global assessment of regulations and legislation for the protection of personal privacy in countries around the world. WGIC members are interested in protecting personal privacy and Barbara thinks that would make a good topic for a potential joint UN Open GIS - WGIC study.

She thinks it might be a good idea to do this study of ethical implications and see it from an academic perspective, a humanitarian perspective, a private sector perspective and, perhaps the most important, from perspective of governments that are partners in the UN GGIM effort.

The WGIC policy committee has undertaken another study titled "Policy Research and Geospatial Applications of AI/ML". It's going to interview around 40 WGIC members about what geospatial applications of AI they are working with right now. They could send this study once it's ready, and could also like to enter into dialogue with the UN Open GIS Geo-AI working group as well, as policy implications of this report get flushed out by Lokendra Chauhan.

Barbara's final point was a call to UN Open GIS members to share information about WGIC with their private sector partners who might want to join the Council.

Yifang Ban of [Kunliga Tekniska Högskolan - Royal Institute of Technology](#)

spoke about the challenges of model generalization and voiced positive intentions about collaborating with the United Nations on education and curriculum development. Yifang expressed an interest in collaborating to build capacity in this field, and mentioned that efforts could be made to collect Geo-AI courses that already exist in one platform. She added that courses could be tailored to be more application-specific (e.g. for agriculture, disaster management, common Geo-AI, etc.).



Hamed Alemohammad from the [Radiant Earth Foundation](#)

started discussions by asking “How will AI become an integral part of the decision-making process?”, “How do we build trustworthy models?” and “How do we bring more transparency to decision making processes that include Artificial Intelligence?”... All these questions led to the point of importance of demystifying AI and turning models from black boxes, which they mostly are, into something that can be fully analyzed and transparent.



Radiant Earth is currently working on:

- Providing a repository for sharing Machine Learning data and tools specialized for geospatial problems, building infrastructure that enables Geo-AI;
- Developing community standards for cataloging geospatial data;
- Being a catalyst to bring developers and practitioners together;
- Minding privacy / managing classified data;
- Funding networking to advance solutions.

Zaffar Sadiq Mohamed-Ghouse

mentioned work by the [UN GGIM Geospatial Societies](#) with digital twins and a mapathon around Australian bushfires. He pointed out that AI tools should always be subject to human intervention, and abide by the principles of fairness (managing bias and data quality risks), privacy and security, transparency, and accountability. It is Zaffar's opinion that developing countries



would want to and be able to use the Geo-AI working group's body of knowledge, so we should build our network in that general direction. He also noted that Geospatial Societies would benefit from some guidelines coming from the Geo-AI working group.

He believes that Geospatial Societies could contribute a lot to the ethics component (in addition to technology) of the Geo-AI and encouraged meetings such as this consultation call to be frequent.

Ethics of AI was a strong subject during discussions. **Bo Percival** of the [Humanitarian OpenStreetMap Team](#) (HOT) argued the importance of training models that will not amplify biases and of moving the thinking behind using GIS from detecting objects to benefiting people.



He believes that AI should be complementing the work of the people contributing to OpenStreetMap or benefiting people being impacted by the OSM data.

He agreed with Maria that the Geo-AI working group presents a good opportunity for contributing HOT's work and tools to the UN to help solve common problems.

Bo also emphasized the importance of collaborating across stakeholders and groups to benefit everyone, especially the most marginalized populations.

[OSGeo](#) is managing many geospatial open source software projects - GDAL, Grass, QGIS, GeoServer, MapServer, GeoNode, GeoNetwork being just a few in their suite. OSGeo representative **Angelos Tzotsos** reaffirmed the support of OSGeo for open source.



OSGeo is very good at attracting volunteers and Angelos is sure that if they pointed out the needs of Geo-AI for good, their community would be willing to help.

While we addressed the influence of AI on open source, he noted that OSGeo is very aware that opening up source code is not enough. They are committed to also working towards open data, open standards, open education and open science in general.

Takeaway Points

The panel discussions concluded with participants each coming from their own perspective but adding to a common thought that **ethical development and use of the AI** is one of very important avenues that need to be pursued.

We agreed that introducing Artificial Intelligence presents a new challenge to the open source geospatial community. In days before AI open sourcing meant giving access to source code through a permissive license and writing documentation. With AI, though, the **open source needs to be expanded** to training data and additional guidelines to facilitate full reproducibility.

Kyoung-Soo Eom, chair of the UN Open GIS has concluded with words of gratitude for presenters and panelists who have conveyed interesting and useful ideas. He reiterated an overarching impetus of the UN Open GIS of **creating links between scientific communities, academia, private sector and United Nations and other international organizations** to collectively create solutions that will tackle challenges we are facing by using open source technology. We are looking forward to any advice and tips our colleagues would be willing to dispense.

Offers and Requests

The consultation call was an excellent opportunity for geospatial practitioners to gain insight into colleagues' strong points and communicate what we are looking for:

Andrea Manara (ITU)	
Offers	Requests
<ul style="list-style-type: none"> ● AI For Good Summit running in upcoming weeks ● AI For Good Summit could add geospatial track in 2021 	
Lorenzo Vita (UNODC)	
Offers	Requests
<ul style="list-style-type: none"> ● Use cases for Geo-AI 	<ul style="list-style-type: none"> ● Access to VHR satellite imagery ● Crop monitoring models ● Cost sharing
Saeid Pirasteh (GeoAI Smarter Map and LiDAR Lab)	
Offers	Requests
<ul style="list-style-type: none"> ● GeoIME pre- and post-disaster infrastructure assessment technology ● Software development ● Training ● Capacity building ● Consultations 	<ul style="list-style-type: none"> ● Imagery (cloud-free) ● Processing servers ● Contributing chapters to a book ● Guide to licensing ● Funding
Zhongxin Chen (FAO)	
Offers	Requests
<ul style="list-style-type: none"> ● Hand-In-Hand Platform ● Geo-AI research and application cases ● Hosting WG meetings ● Training ● Internships 	<ul style="list-style-type: none"> ● Tech / Geo-AI community ● Algorithms / models / tools ● Geo-AI ethics ● Datasets ● Best practices, standards
Barbara Ryan (WGIC)	
Offers	Requests
<ul style="list-style-type: none"> ● WGIC releases monthly newsletters on policy watch 	<ul style="list-style-type: none"> ● WGIC is trying to attract private sector partners, if we have any that would like to join, let them know

	<ul style="list-style-type: none"> WGIC will be looking for reviewers of their report
Yifang Ban (KTH)	
Offers	Requests
<ul style="list-style-type: none"> We could work together to develop more application-specific courses (e.g. for agriculture, disaster mgmt, basic GeoAI) for capacity building 	
Hamed Alemohammad (Radiant Earth)	
Offers	Requests
<ul style="list-style-type: none"> Radiant MLHub: a repository for sharing geospatial training data for ML applications. Designing a ML model hosting catalog Community standards for geospatial ML applications and data Being a catalyst to bring developers/practitioners together Minding privacy / managing classified data Funding networking to advance solutions 	<ul style="list-style-type: none"> Welcoming any training dataset that the community wants to share publicly Soliciting user feedback on how they want to interact a ML model catalog
Zaffar Sadiq Mohamed-Ghouse (Geospatial Societies)	
Offers	Requests
<ul style="list-style-type: none"> We could find a common problem UNGGIM could contribute to ethics in addition to tech 	<ul style="list-style-type: none"> More frequent meetings like GeoAI Consultation
Angelos Tzotsos (OSGeo)	
Offers	Requests
<ul style="list-style-type: none"> GDAL, Grass, GeoNode, GeoNetwork and other open source projects Good potential for open source contributors to Geo-AI 	

Proposed Next Steps

1. A compilation of Geo-AI activities of UN Agencies and UN Collaborators;
2. Determine Geo-AI needs in terms of software, hardware and training;
3. Develop a plan for a system for sharing data, platforms, algorithms and experiences in Geo-AI;
4. 'New' fields: citizen science / social media, simulation / prediction, geo-knowledge management / discovery, data mining, ethics, privacy, community benefits, open source licensing;
5. Roadmap of Geo-AI WG: framework, extensive collaborations, networking, publications, training, seminars / conferences, resources/projects, prioritized activities
6. Recommend a collaborative platform for 1-3 above