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Project Acronym

MultiMiner

Project Title

Multi-Source and Multi-Scale Earth Observation and Novel Machine Learning for Mineral Exploration and Mine Site Monitoring

Grant Agreement No: 101091374

Project Start Date: 1st January 2023

Project Duration: 42 Months

Deliverable No 1.2

Ethics requirements (as required by the EC)

This project has received funding from the European Union's HORIZON EUROPE research and innovation actions programme under Grant Agreement No. 101091374

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V0.2	27.02.2023	Juha Kaija	2nd draft sent to PM and MC for review
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List of Acronyms

Abbreviation	Meaning
CA	Consortium Agreement
CRM	Critical Raw Materials
EC	European Commission
ECCRI	European Code of Conduct for Research Integrity
EO	Earth observation
GA	Grant Agreement
GDPR	General Data Protection Regulation
ML	Machine learning
TSF	tailings storage facility
WP	Work package

The MultiMiner Project

The Multi-source and Multi-scale Earth observation and Novel Machine Learning Methods for Mineral Exploration and Mine Site Monitoring (MultiMiner) project develops novel data processing algorithms for cost-effective utilization of Earth Observation (EO) technologies for mineral exploration and mine site monitoring. MultiMiner unlocks the potential of EO data, including Copernicus, commercial satellites, upcoming missions, airborne and low altitude as well as in situ data, to support the entire mining life cycle including mineral exploration, operational, closure and post-closure stages. This is achieved by creating generic but highly innovative machine learning solutions which do not require any or only little ground truth data. The project focuses on new EO based exploration technologies for critical raw materials (CRM) to increase the probability of finding new sources within EU thereby strengthening the EU autonomy in the area of raw materials. MultiMiner EO based exploration solutions have extremely low environmental impact, and are thus socially acceptable, economically efficient and improve safety. The project's solutions for mine site monitoring increase the transparency of mining operations as environmental impacts can be detected as early as possible and digital information of the currently unexploitable raw materials can be stored for future generations. The applicability of the developed algorithms is demonstrated in 4 European test sites. MultiMiner is a pan-European consortium consisting of 12 partners and 1 associated partner from research institutes, academia, consulting businesses and mining industry with interdisciplinary backgrounds in geology, remote sensing and machine learning. The members come from six EU member states which represent mining regions across Europe with diverse geology with evident potential for various types of CRM resources and thousands of operational and closed mines.

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Project Consortium

Name	Short name	Country
GEOLOGIAN TUTKIMUSKESKUS	GTK	Finland
TEKNOLOGIAN TUTKIMUSKESKUS VTT OY	VTT	Finland
YARA SUOMI OY	YARA	Finland
ELLINIKI ARCHI GEOLOGIKON KAI METALLEFTIKON EREVNON	HSGME	Greece
FONDATION EUROPEENNE DE LA SCIENCE	ESF	France
CESKA GEOLOGICKA SLUZBA	CGS	Czechia
MONTANUNIVERSITAET LEOBEN	MUL	Austria
BUNDESANSTALT FUER GEOWISSENSCHAFTEN UND ROHSTOFFE	BGR	Germany
GEOSPHERE AUSTRIA	GeoSphere Austria	Austria
HELLAS GOLD S.A	HG	Greece
EFTAS FERNERKUNDUNG TECHNOLOGIETRANSFER GMBH	EFTAS	Germany
VEITSCH-RADEX GMBH & CO OG	RHI	Austria
TECHNISCHE UNIVERSITAET MUENCHEN	TUM	Germany

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Document Summary

Ethical management is an integral part of the MultiMiner project from the beginning and in fact there is a dedicated task in WP1 for the Ethics (Task 1.5 Ethics Management). This task is led by GTK and it guarantees that the results of the project have been produced using the highest ethical standards.

The main tasks of the ethics management are:

1. to ensure that the ethical standards, directives and guidelines of European Union, and fundamental principle of research integrity as set out, in the European Code of Conduct for Research Integrity (ECCRI), and international and national laws will be applied and maintained across the work packages,
2. to give advice to the partners in ethical issues,
3. to implement periodic ethics checks and to monitor possible changes in the legislation and EU guidelines.

1 Introduction

Ethics Summary Report stated that the MultiMiner proposal is ethics ready and there were no further requirements, i.e. the ethics clearance was given). However, it is necessary to present the MultiMiner ethical frame and the main guidelines for the ethics management in this deliverable. This deliverable is part of the WP1 its Task 1.5 Ethics Management, which will guarantee that the results of the project have been produced using the highest ethical standards.

2 MultiMiner ethical frame

The most important articles from the MultiMiner Grant Agreement and the Consortium Agreement are listed below. Relevant EU directives and regulations are also listed.

- Grant Agreement (GA), page 31: ARTICLE 14 — ETHICS AND VALUES
- GA, page 32: ARTICLE 15 — DATA PROTECTION
- GA, page 77: Task 1.5 Ethics Management
- GA, page 134: Ethics self-assessment
- Consortium Agreement (CA), page 4: Responsibilities of Parties
- CA, page 19: Results
- CA, page 25: Non-disclosure of information
- Directive 95/46/EC, Protection of personal data
- General Data Protection Regulation 2016/67 (of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (‘GDPR’) (OJ L 119, 4.5.2016, p. 1)

The MultiMiner project partners are to comply with the ethical principles, including the highest standards of research integrity, as set out in the Grant Agreement (Article 14), which states that all activities must be carried out in line with the highest ethical standards and the applicable EU, international and national law on ethical principles.

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Furthermore, MultiMiner will commit to and respect the basic EU values, such as respect for human dignity, freedom, democracy, equality, the rule of law and human rights, including the rights of minorities. MultiMiner will follow and respect the fundamental principles of research integrity as set out in the *ECCRI*[1].

Specific ethics rules are set out in the **Grant Agreement Annex 5**, where it is stated that the beneficiaries must pay particular attention to the principle of proportionality, the right to privacy, the right to the protection of personal data, the right to the physical and mental integrity of persons, the right to non-discrimination, the need to ensure protection of the environment and high levels of human health protection.

3 Research integrity

In addition, according to the Grant Agreement Annex 5, the beneficiaries must respect the fundamental principle of research integrity which implies compliance with the following principles:

1. reliability in ensuring the quality of research reflected in the design, the methodology, the analysis and the use of resources
2. honesty in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair and unbiased way
3. respect for colleagues, research participants, society, ecosystems, cultural heritage and the environment
4. accountability for the research from idea to publication, for its management and organization, for training, supervision and mentoring, and for its wider impacts
5. beneficiaries must ensure that persons carrying out research tasks follow the good research practices including ensuring, where possible, openness, reproducibility and traceability and refrain from the research integrity violations described in the ECCRI.

4 MultiMiner ethics self-assessment

This project involves no ethical issues as such as this project does not include research involving humans, animals, or the environment, nor does it include handling of personal data. The use of artificial intelligence is restricted to machine learning aided technologies to process remote sensing data.

Any collection of personal data (e.g. registration to public events) will follow GDPR policy. The beneficiaries will ensure that all ethics issues related to activities in the grant are addressed in compliance with ethical principles, the applicable international and national law, and the provisions set out in the Grant Agreement. This includes the ethics issues identified in this report and any additional ethics issues that may emerge in the course of the grant. In case any substantial new ethics issues arise, beneficiaries should inform the granting authority.

5 Types of data/research outputs

MultiMiner generates and collects a range of data types, most of which are instrument data. Examples of such data include, but are not limited to, point spectral data, radar satellite data and laboratory-collected

[1] https://www.allea.org/wp-content/uploads/2017/05/ALLEA-European-Code-of-Conduct-for-Research-Integrity-2017.pdf

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hyperspectral image data. These data are stored in internationally accepted file formats for their effective sharing, re-use, and preservation. The total estimated size of the data is in the order of terabytes. MultiMiner is reusing some publicly available satellite data (Sentinel, EnMAP).

The activities of the MultiMiner project where ethics requirements and particularly the data protection must be taken fully into account include the collection of data from the project partners and the stakeholders. The data is collected via range of activities, including e.g. the following:

- MultiMiner consortium contact list
- MultiMiner scientific advisory board contact list
- Progress meeting & Final conference participant list
- Stakeholders' analysis to maximize the reach and impact of the dissemination and exploitation activities:
    - Task 5.2 Stakeholders Mapping and Engagement performs an in-depth stakeholder analysis and mapping, which is used to deploy targeted dissemination, exploitation and communication activities. Key European stakeholders are identified (D5.1, M9) and efforts are made to engage with them from early on in the project. Efforts are made to integrate MultiMiner with relevant EC-roadmaps and coordinate actions with relevant EC-funded projects and organisations (e.g., EIT RawMaterials
- Training webinars (2-3)
- Three local exhibitions & test site workshops one at each mining test site locations (Siilinjärvi in Finland, Hochfilzen in Austria and Chalkidiki in Greece):
    - Local stakeholders from mining industry, governmental organizations and the wider public are invited to participate in these local exhibitions to learn about the project, its results and observe their specific implementation at the local mining test site. The aim is to raise awareness about the project and engage local stakeholders about other potential local applications of the project outputs.
- Clustering workshops
- Promotion of MultiMiner in local scientific events, schools and universities by all partners.
- Media mailing list
- Newsletter list
- MultiMiner project also communicates directly with its stakeholders through frequently issued newsletters

6 Data protection

Grant Agreement *Article 15.2 Data processing by the beneficiaries*, states as follows: “The beneficiaries must process personal data under the Agreement in compliance with the applicable EU, international

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and national law on data protection (in particular, Regulation 2016/679[2]). They must ensure that personal data is:

- processed lawfully, fairly and in a transparent manner in relation to the data subjects
- collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes
- adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed - accurate and, where necessary, kept up to date
- kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the data is processed and
- processed in a manner that ensures appropriate security of the data.

The beneficiaries may grant their personnel access to personal data only if it is strictly necessary for implementing, managing and monitoring the Agreement. The beneficiaries must ensure that the personnel is under a confidentiality obligation. The beneficiaries must inform the persons whose data are transferred to the granting authority and provide them with the Portal Privacy Statement."

7 Compliance with the Do no significant harm principle

MultiMiner is committed to respect the 'Do No Significant Harm' principle (DNSH). As the project focuses on maximizing the use of digital data and especially remotely sensed data, we see that the activities do not cause any significant harm to any of the six environmental objectives.

MultiMiner can be seen as a forerunner of responsible mineral exploration with Machine Learning (ML) based data analysis methods reducing, but not totally excluding, the need for new data acquisition with heavy machinery. Because of the strong link between Remote Sensing (RS) and ground observations, a high level of accuracy of the obtained interpretations can be ensured. In terms of exploration, RS guides field-based examinations into the most prospective areas which is important in sensitive and hazardous environments such as the high alpine Hochfilzen region. As such, the project has a positive effect both on occupational safety and environmental protection. The solutions created by MultiMiner for mine site monitoring enhances the transparency of mining throughout the entire life cycle of a mine, enabling environmental protection and tracing of contaminants and their early detection. Further, the project supports the realization of circular economy by the development of a visual 3D model / Digital Twin of the composition and volume of the TSF.

[2] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC ('GDPR') (OJ L 119, 4.5.2016, p. 1)

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