Hackathon on Mineral Targeting using Artificial Intelligence

1. Introduction:

IndiaAI, an Independent Business Division (IBD) under the Digital India Corporation (DIC) of the Ministry of Electronics and IT (MeitY), is the implementation agency of the IndiaAI Mission, which aims to democratize AI's benefits across all strata of society, bolster India's global leadership in AI, foster technological self-reliance, and ensure ethical and responsible use of AI.

As part of this Mission, the IndiaAI Application Development Initiative (IADI) will promote the development, deployment, and adoption of AI applications in critical sectors that have the potential to catalyze large-scale socio-economic transformation.

With this mandate, IndiaAI is working in partnership with Geological Survey of India, Ministry of Mines. The Geological Survey of India (GSI) is India's premier organization for geoscientific research and mineral resource assessment under the Ministry of Mines. It plays a crucial role in geological mapping, mineral exploration, geo-hazard risk assessment, groundwater management, and studying climate change impacts. GSI also supports sustainable mining, infrastructure development, and natural resource conservation through advanced geospatial and remote sensing technologies. Over the years, it has significantly contributed to India's industrial growth by identifying key mineral deposits and providing scientific data for policymaking and economic planning.

To further these ambitions, IndiaAI in partnership with GSI is launching the **Hackathon 2025 on "Mineral Targeting using Artificial Intelligence"**. The virtual hackathon is a strategic effort to leverage advanced technologies such as Artificial Intelligence (AI) and Machine Learning (ML) for mineral prognostication using state-of-art techniques practiced globally including interpretation, modelling and integration of multi-parametric geoscience data with emerging technologies such as AI/ ML. The aim is to use geoscience data like geology, geophysics, geochemistry, remote sensing, borehole data, etc, to identify new target areas for mineral exploration, particularly concealed and deep-seated ore bodies.

2. Guide to the Hackathon Participation

I) Stage 1:

a) Participation requirement:

- Participants may take part in the Hackathon as individuals or in groups as per the eligibility criteria detailed below.
- Multiple registration by single user, through different groups is not allowed.

b) Event Process and Schedule

- All participants are required to register at https://indiaai.gov.in to access the application form.

- A team leader will have to individually register and apply for the challenge on the IndiaAI portal by clicking the submit link.

- After the initial sign-up, the Team Leader should list all the Team Members under the Management Team and complete all organization details.

- Team Leaders will also create an account on GitHub to upload Source Code. Next, the Team Lead shall paste the link for their GitHub source code in the application form.

    - Steps to grant access to your GitHub repository:

        - Go to the main page of your GitHub repository.
        - Click on the 'Settings' tab in the menu bar.
        - In the left sidebar, select 'Collaborators'.
        - Under the 'Manage Access' section, click on 'Add people'.
        - In the text field, search for **indiaaihackathon25** and add it as a collaborator.

- Participants may use any datasets to strengthen their solution.

- Additionally, the Team Leader will have to answer all additional questions, including uploading documents, and click 'Submit'.

c) Expected Deliverables from Participants

- **Model Code and Documentation**:
    - Clear and well-documented code used to build, train, and test the model.
    - Explanation of the approach used to develop the anomaly detection model.

- **Project Report (PDF):**
    - Name and details of Participant / Company etc. In case of a group, the name of the Team Leader and the members are to be mentioned.
    - Resources used (Hardware, Software, Manpower, etc.)
    - Data used in details (List of Geological, Geophysical, Geochemical, Petrological, Drill, Remote Sensing, any other datasets)
    - List of derived data layer / extracted feature, if any, from primary data
    - Description and significance of those derivative layers or extracted features vis-à-vis mineral targeting
    - Methodology in detail, elaborating on the methodology of data processing, curation and application of techniques, classical as well as emerging methodologies, transformation operations, statistical analysis, flow chart of steps, etc.
    - Supportive documents and information related to the degree of confidence, relative contribution of input layers in the final output, etc.
    - Conceptual genetic model of the targeted mineral systems and the targeting criteria used.

- **Outcome / Result as Predictive Maps, 3D models:**
    - Predictive maps providing areas for mineral targeting as obtained through analysis of multi-theme data
    - 3D models / depth models of target mineralized body.

- **Virtual Presentation:**
    - A summary of the approach, the methodology behind the anomaly detection process, findings, and recommendations.
    - Visual aids (graphs, charts, 2D maps, 3D models) to support the presentation.

3. Problem Statement :

1. Identification of new potential areas for exploration of critical minerals like REE, Ni-PGE, and copper, as well as other commodities like diamond, iron, manganese, and gold within a pre-defined 39,000 sq. km area in the states of Karnataka and Andhra Pradesh, India.

2. Emphasis on locating concealed & deep-seated mineralised bodies with depth modelling.

3. Developing AI/ ML algorithms for data cleaning, integration, modeling, and validation.

4. Generation of mineral predictive maps showing exploration targets visualised through maps, sections, etc.

4. Evaluation Criteria and process:

There will be two stage evaluation process with pre-defined set of qualification criteria as described below:

Stage1: Screening of applications: There will be a preliminary screening of the submitted applications. Screening criteria will include novelty of the proposed solution, handling of complex datasets, clarity and details in the report, and potentiality and practicability of taking up future work based on the proposed solution. Teams for the hackathon will be shortlisted after this preliminary screening, and the list will be notified.

Stage 2: Final evaluation and ranking: Shortlisted participants will be given slots to present their solutions to the Jury Board in virtual mode. Based on the submitted solution and presentation, final result / rank list will be prepared.

Scoring Methodology:

The following scoring criteria will be used during the Final evaluation process:

I. Understanding of scope, Data cleaning, Feature extraction and Documentation (30 marks)

- Clarity of thought and innovation in analysis

- Cleaning and preparation of data, Use of statistical tools, Extraction of relevant features to create input data layers significant for exploration targeting from geological, geochemical, geophysical, borehole, multi-spectral datasets.
- Extraction of different features related to geophysical data sets for depth modelling
- Quality and justification/ significance of extracted features.

II. Data analysis and integration methodology, interpretation and Documentation (30 marks)

- Innovative approach applied in Geophysical data processing using developed /relevant codes &/or other available software
- Data integration process and its justification.
- Creation of codes and models for specific commodities
- Final outputs and Documentation of (30 marks)
- The degree of identification of prospective areas not included in the training dataset
- Number of new prospective zones delineated in areas hitherto unexplored/reported and their justification.
- Number of constraint depth models created across newly delineated zones as well as previously reported ones, using ground and aero-geophysical, geological and alteration, borehole data.
- Process, clarity and justification in the report for deriving the final output.
- Report on error factor and degree of influence of input factors in delineating the prospective areas.

III. Presentation and demonstration (10 marks)

Decision Making

- Prizes would be awarded to the top three teams whose models meet the jury's satisfaction regarding usability as viable solutions. A special prize would be awarded to women only teams, if any.
- If no solution meets the required standards, consolation prizes would be awarded based on the jury's discretion.
- The jury's decision would be final and binding.

4. **Awards/Outcomes:**

- **Opportunity to Build for the Nation**: Contribute to developing innovative solutions that address critical challenges faced by the country, making a direct impact on society.

- **National Recognition**: Gain visibility and recognition from government officials, industry leaders, and peers for your contributions and innovative ideas.

- **Exposure to Real-world Challenges**: Work on pressing issues faced by the nation, providing practical experience and a deep understanding of real-world problems.

- **Support for Implementation**: Wining solution may get potential support in scaling and implementing the solution for GSI.

- **Prizes and Incentives:**

  - **First Prize**: INR 10 Lakhs

  - **Second Prize**: INR 7 lakhs

  - **Third Prize**: INR 5 lakhs

  - **Special Prize** of INR 5 lakhs for All-Women Teams (if no women team in top 3)

5. **Eligibility:**

- **Company:** The team may be from any registered company.
- **Start-up:** Alternatively, the team can qualify as a start-up company.
- **Academic/R&D Organizations**: Any.
- **Autonomous Bodies:** Autonomous bodies, including public sector organizations, are eligible to participate.
- **Others**: Students or researchers associated with educational institutions, or working professionals can participate in their individual capacity or as teams.

6. **Timeline:**

S.No.	Activity	Timeline
1	Launch Date	T= 13.03.2025
2	Last Date for submission of Form	T+60
3	Evaluation of the solutions by the Jury Board	To be announced

4	Declaration of Result	To be announced

7. **Intellectual Property Rights:**

The models submitted or awarded will become the property of IndiaAI and GSI, including all intellectual property rights to their underlying methodologies and innovations, and the participants shall be deemed to have given their no objection/consent for the same and shall also remain bound by the terms of a Non-Disclosure Agreement (NDA) with respect to such work. The participants agree to provide a No Objection Certificate as an author in favour of IndiaAI and GSI for the purposes of IPR registration and ownership rights, as and when required by IndiaAI and GSI**.**

8. **General Terms:**

1. All participants have to be eligible (See Eligibility Criteria) to participate.
2. If individual innovators are associated with any institution, they must provide a No Objection Certificate (NOC) from their employer, stating that the company will have no rights to the prize money and intellectual property rights (IPR). Additionally, individuals must inform their employer of their participation in the Hackathon.
3. Any edits to the source code post the last date of submission will lead to immediate disqualification.
4. The participants will ensure code is free from viruses, malware.
5. The participants will not use this contest to do anything unlawful, misleading, malicious, or discriminatory.
6. The solution must not violate/breach/copy any copyrighted or patented, concepts in the AI market.
7. The solutions must not violate any data protection and governance regulations and policies.
8. The solution must be in adherence with related cybersecurity standards and guidelines of the Government of India.
9. The developed solution/product will be deployed in the chosen Cloud Environment and used for government entities.
10. Solutions must adhere to ethical principles and guidelines for the development, deployment and use of AI technologies, including fairness, transparency, accountability, and non-discrimination.

9. **Plagiarism and Ethics**

1. Participants are expected to uphold the highest standards of ethics and integrity throughout the Hackathon.
2. All work submitted must be original and developed by the participant or their team.
3. Plagiarism, or the use of someone else's work without proper attribution, is strictly prohibited and would result in immediate disqualification.
4. Participants must ensure that their solutions are created from scratch and not copied from existing projects or code repositories.
5. Moreover, the use of any external resources or pre-trained models should be clearly cited, and proper permissions should be obtained where necessary. Adherence to these ethical guidelines ensures a fair and competitive environment for all participants.
6. By registering for this Hackathon, participants are giving an undertaking to adhere to all plagiarism and ethical guidelines set forth by the IndiaAI.