TITLE PAGE

- **Problem Statement ID –** 1565
- **Problem Statement Title-** Target detection by optimizing Anomaly Detection in Hyperspectral Image Processing using AI/ML
- **Theme-** Clean and Green Technology
- **PS Category- Software/Hardware-** Hardware
- **Team ID-** 46428
- **Team Name (Registered on portal)-** 404 Found

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ANOMALY AND TARGET DETECTION IN HYPERSPECTRAL IMAGING

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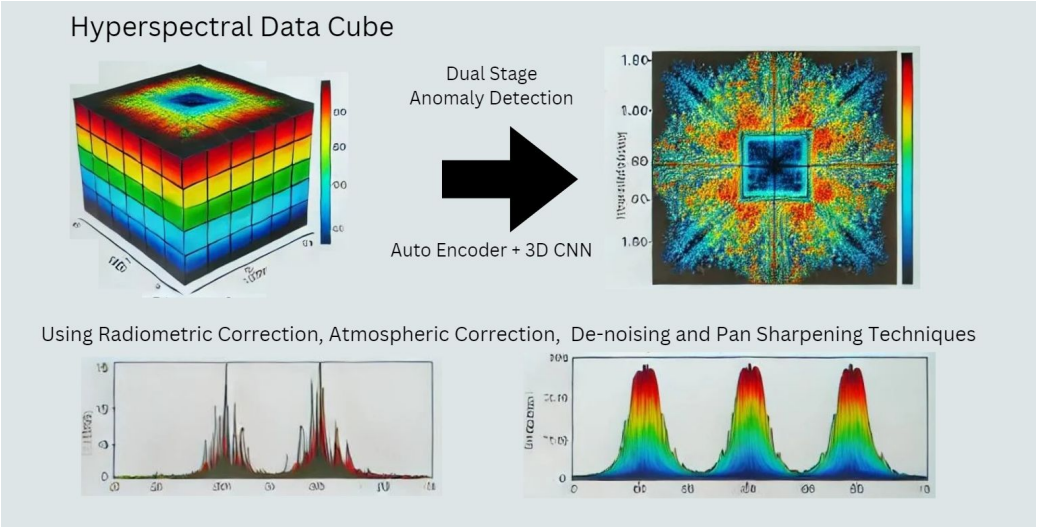
- Our solution proposes a **deep learning model** optimized for processing hyperspectral data to **detect anomalies**. By utilizing **pre-processing** techniques such as **de-noising**, **fusion**, and **radiometric/atmospheric correction**, the data will be prepared for **anomaly detection**.
- The model will identify **spectrally distinct pixels**, allowing for the **detection of targets of interest** in the data.

Uniqueness in idea:

- Dual Stage Anomaly Detection using Autoencoder and 3D CNN.
- Comprehensive preprocessing pipeline to enhance data quality.



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TECHNICAL APPROACH

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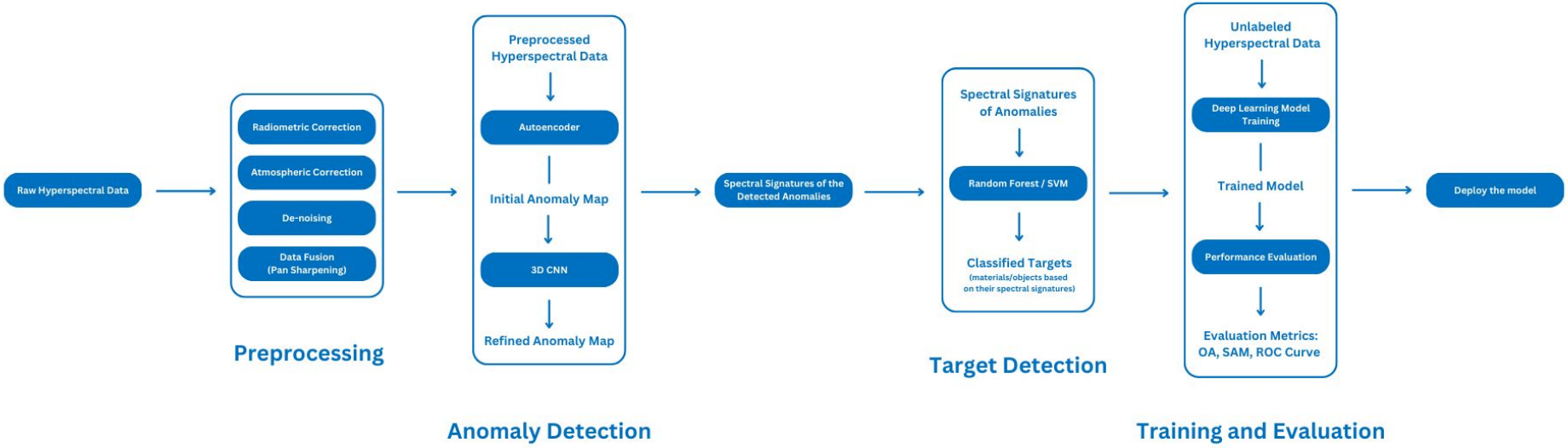

Detailed Technical Architecture Link

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FEASIBILITY AND VIABILITY

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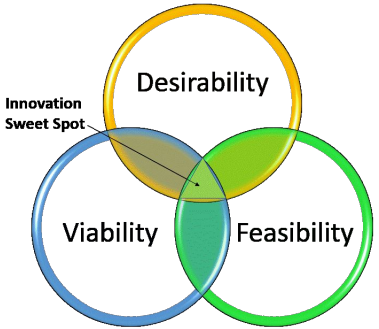
Feasibility of the Idea:

- The solution is feasible due to the availability of open-source hyperspectral datasets and well-documented AI/ML frameworks.
- Preprocessing techniques such as atmospheric correction and de-noising are well-established in hyperspectral data analysis, making implementation straightforward.



Potential Challenges and Risks:

- High computational requirements for deep learning models on large hyperspectral datasets.
- Accurate anomaly detection may require substantial fine-tuning of hyperparameters.

Strategies for Overcoming Challenges:

- Use cloud computing or GPU-based systems for faster processing.
- Leverage transfer learning and data augmentation techniques to optimize training efficiency.

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IMPACT AND BENEFITS

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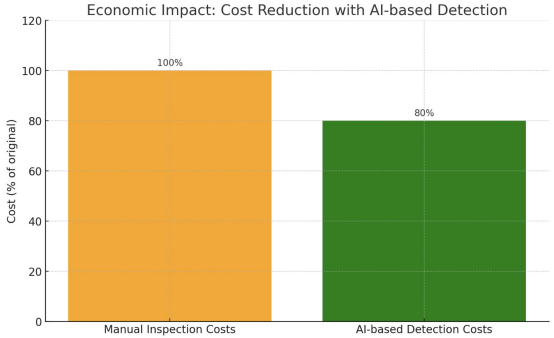
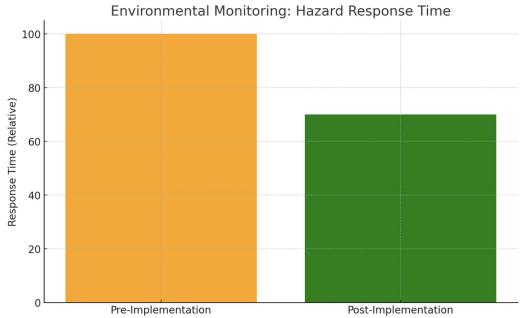
- **Environmental Monitoring:**
  Early anomaly detection reduces environmental hazard response time by 30%.

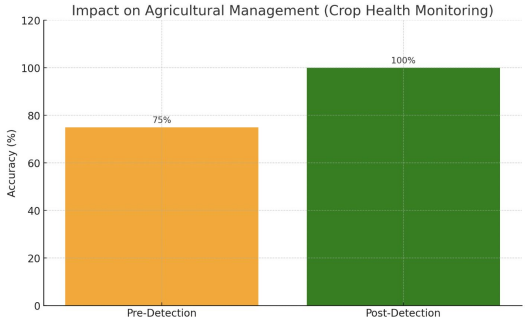
- **Agricultural Management:**
  Increases crop health monitoring accuracy by 25%, identifying stress indicators faster.

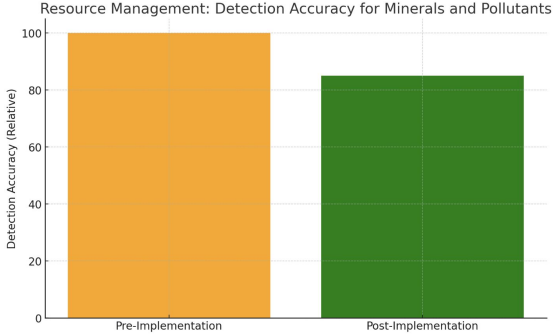
- **Defense & Surveillance:**
  Enhances detection of camouflaged targets by 20%, improving reconnaissance efficiency.

- **Resource Management:**
  Detects rare minerals and pollutants with 15% greater accuracy, optimizing resource extraction.









Note: The specific metrics and percentages mentioned in the impact assessment are illustrative estimates based on the potential improvements that automation and specialized tools can provide. Since this tool is hypothetical and hasn't been implemented yet, the figures aren't based on real-world data or studies but are instead reasonable projections based on industry knowledge of automation, and tool efficiencies. For Justification of the estimates, please refer to the following document: https://docs.google.com/document/d/1HOw9sUwn1Bxi-ehFkzM2DwpWLuQVzMSIV1OOgFY3UHk/edit?usp=sharing .

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RESEARCH AND REFERENCES

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- Open Source Hyperspectral Imaging Datasets
  https://aviris.jpl.nasa.gov/
- GitHub Repository for Deep Learning in Hyperspectral Imaging: DeepHyperX
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  https://www.researchgate.net/publication/224166337_A_tutorial_overview_of_anomaly_detection_in_hyperspectral_images
- Hyperspectral Anomaly Detection Using Deep Learning: A Review by Xing Hu , Chun Xie , Zhe Fan , Qianqian Duan , Dawei Zhang , Linhua Jiang , Xian Wei , Danfeng Hong , Guoqiang Li , Xinhua Zeng , Wenming Chen , Dongfang Wu and Jocelyn Chanussot
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- Deep Learning for Hyperspectral Image Classification: An Overview by Shutao Li, Weiwei Song, Leyuan Fang, Yushi Chen, Pedram Ghamisi, Jón Atli Benediktsson
  https://arxiv.org/abs/1910.12861