Project Proposal

Team Name:

APPS

Your Team:

Member Name	Tech Stack / Role	Devfolio Id
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Problem Statement:

Automation of drill core rock sample lithology logging

Inspiration for this Proposal:

Our team has witnessed firsthand how the traditional way of logging drill core samples from the Earth can be slow, costly, and sometimes inaccurate. This inspired us to choose our project: automating the process of identifying the different types of rocks in these samples, also known as lithology logging. This project represents our commitment to advancing how we understand our planet, merging technology with geology to uncover Earth's secrets more swiftly and clearly. By using technology to speed up and improve the accuracy of this process, we can help geologists and scientists uncover the Earth's stories more efficiently.

Project Description / Implementation Details:

GeoVisionPro revolutionizes geological exploration at drill rock sites. With powerful AI-driven technology, it automates the rock detection process, saving time and enhancing accuracy. Geologists can easily scan, analyze, and identify rock samples using advanced algorithms. The Global Geological Map allows users to share drill locations and rock findings,

fostering collaboration and data integrity through blockchain technology. It's the ultimate tool for geologists to streamline their work and connect with a global community of rock enthusiasts. Our application is built on the MERN stack— the Frontend Part is Html, CSS, Javascript and React.js and the Backend Part is MEN stack - MongoDB, Express.js, and Node.js—integrating advanced technologies for a seamless user experience and robust functionality. Leveraging its component-based architecture, we craft a modular UI facilitating easy navigation and interaction. On the backend, Node.js and Express.js provide a scalable infrastructure for user authentication, data processing, and API communication, while MongoDB offers flexibility for storing user data and rock and cluster images. Key to our app is the integration of machine learning algorithms like Natural Language Processing (NLP) -- NLP technologies are employed to retrieve relevant data from the virtual drill library and GIS when users scan a rock. This ensures that users receive valuable information and insights about the geological findings they encounter, enhancing their research and understanding. Also for Fracture and joint detection, developed using TensorFlow and PyTorch, enabling fast and responsive diagnosis directly on the client side. The image capture using Hough Transform(by OpenCV) will be used for line and curve detection. Further CNN and YOLO will analyse the boundaries and features. Litho contact Transition will be analysed by scikit-learn and K-means Clustering. Contour Analysis, Fourier Description of shape Analysis Algorithm will be used to determine the roundness. The parameter will also be analysed by YOLO for better result. Additionally, Algorithms like Gabor and LBP (local binary patterns) will be used to detect cementing material.

Impact on Society:

- **Automated Core Sample Analysis**: Geologists conducting fieldwork can quickly analyze core samples using the web's computer vision techniques. By scanning the samples, they receive instant and accurate information about rock types, grain size, colour, and other properties, aiding in real-time lithological analysis.
- **Educational Virtual Reality Experience**: Students and researchers can use the Virtual 3D Projection feature to explore virtual rock samples. They can interact with different rock types, inspect fractures and joints, and understand lithological characteristics in a visually engaging manner, enhancing their geological education.
- **Research Database Access**: Researchers working on lithological studies can access the Virtual Drill Library, which contains a vast repository of research papers and rock information. They can gather data on specific lithological formations, aiding in in-depth analysis and comparative studies.
- **Enhanced Field Surveys with GIS Integration:** During field surveys, geologists can use the GIS Integration feature to overlay geological findings on interactive maps. This helps them visualize lithological variations in the context of geographical locations, assisting in comprehensive geological mapping and exploration.

Tech Stack / Technologies Used:

- Frontend: Html, CSS, Javascript, React.js
- Backend: Node.js, Express.js
- Database: MongoDB
- Machine Learning: TensorFlow.js, Pytorch, scikit-learn, CNN, OpenCV, YOLO

Tentative Timeline:

Start Date	End Date	Milestones
01-04-23	05-04-23	1. Set up project environment 2. Research existing solutions 3. Define project scope and requirements
06-04-23	10-04-23	1. Implement user authentication 2. Develop image capture functionality 3. Integrate machine learning models for disease detection
11-04-23	18-04-23	1. Design user interface 2. Implement plant tracking feature 3. Test and debug application 4. Finalize documentation 5. Prepare for submission

Challenges:

- **Accuracy and Precision**: Ensuring the automated system can identify and classify various rock types as accurately as a trained geologist can be challenging. Differentiating between closely related rock types requires high precision.
- **Integration of Machine Learning Models:** Developing accurate CNN API and integrating them seamlessly into the webapp.
- **Data Quality**: The quality of data, especially from imaging technologies, needs to be high enough for the AI to make accurate identifications. Poor quality data could lead to incorrect logging.

- **User Interface Design:** Creating an intuitive and user-friendly interface that caters to the diverse needs of Geologists.
- **Scalability:** Ensuring that the application can handle a large volume of users and data without compromising performance.

Conclusion:

In conclusion, automating drill core rock sample lithology logging presents a promising leap forward in geological exploration. Despite facing challenges like ensuring accuracy, integrating technology, and gaining user trust, the potential benefits of faster, more efficient, and precise rock analysis are immense. This project not only aims to revolutionize how we understand the Earth's subsurface but also to pave the way for more sustainable and informed resource extraction.