# Bi-weekly Report: Forestify Research Project

Period: February 1st, 2024 - February 12th, 2024

Introduction:
Forestify Report - 2/12/2024

Over the past two weeks, our team has made significant progress in the development of Forestify, our web application aimed at utilizing machine learning to map areas prone to desertification. This report outlines the key activities and achievements during this period.

1. Data Exploration:
At the onset of the project, we conducted extensive research into potential data sources to support our machine-learning algorithms. Initially, we explored data sources such as ArcGIS and Google Earth Engines (GEE). After careful consideration and consultation with Professor Tingting, it was determined that GEE would be the optimal platform for our project due to its rich repository of geospatial data and robust analytical capabilities.

2. Task Assignments:
Based on the recommendations provided by Professor Tingting, the team was divided into specific roles to streamline our efforts efficiently:

Asad was tasked with exploring and collecting data using Google Earth Engines.
Jun took the responsibility of exploring ArcGIS to gather insights into its potential utility for our project.
Azfar and Arhum collaborated on the development of the front-end and back-end components of the Forestify web application.

3. Progress and Achievements:

Data Collection & Pre-processing:
Google Earth Engine (GEE) Authentication: We successfully authenticated and initialized a Google Cloud connection to our Google Earth Engine project using Google's OAuth2 for secure authentication, ensuring access to GEE's vast satellite imagery databases.
Area of Interest (AOI) Definition: We defined an AOI targeting the Canadian geographic region for forestation analysis, with plans to dynamically adjust it in a backend application to cater to different regions based on user input or predefined criteria for forestation monitoring.
Satellite Data Retrieval:
Sentinel-1 Data: We fetched Sentinel-1 Ground Range Detection (GRD) images, filtering them by the AOI, date range, instrument mode (IW for high-resolution coverage), and polarization ('VV' polarization for vegetation and soil moisture insights) to analyze forest density and health over time.
Sentinel-2 Data: We retrieved Sentinel-2 multispectral images, applying filters for the AOI, date range, and cloud coverage, selecting images with less than 20% cloudiness. The selected bands were particularly useful for vegetation analysis, allowing for the observation of chlorophyll content, plant health, and biomass estimation.
Data Preprocessing: We performed a simple preprocessing step by calculating the mean of the image collections from both satellites, acting as a noise reduction technique for more stable dataset analysis.

Frontend & Backend Development:
User Authentication: Work has begun on implementing user authentication for both frontend and backend components.
Map Visualization: We defined visualization parameters for both Sentinel-1 and Sentinel-2 data and generated map IDs and access tokens for composite images representing average conditions over specified periods. These images were then embedded in an HTML file for display on a web map using Leaflet.

4. Challenges Faced:
Challenges related to data preprocessing and algorithm optimization.
Coordinating tasks and ensuring effective communication among team members.
Selecting appropriate technologies for project development, with a focus on leveraging Google products for the Google Solutions Challenge.

5. Next Steps:
Setting up Machine Learning Algorithms: Initiate training of machine learning models using collected data.

Continuous Collaboration: Maintain regular team meetings and collaboration sessions to ensure alignment on project goals and address any emerging challenges proactively. Seek insight and opinion from Professor He in a general meeting.
In conclusion, the past two weeks have been productive for our team as we advance toward the development of Forestify. Despite challenges, we remain committed to our objectives and look forward to further progress in the upcoming weeks.

Submitted by: Arhum, Azfar, Asad, Jun