Generating a Land Cover Map for Lebanon

Using Sentinel Hub's eo-learn & GEE's Dynamic World

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Agenda

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01

Introduction

Overview

• Land cover mapping is essential for environmental monitoring, urban planning, and resource management.

• This project focuses on generating a Land Cover Map for Lebanon using:
    • Sentinel Hub's eo-learn (for a single-time land cover classification).
    • Google Earth Engine's Dynamic World (for time-series land cover changes).

Objectives

- Develop a land cover classification map for Lebanon.
- Implement a time-series analysis to observe land cover changes.
- Utilize Sentinel-2 satellite data and machine learning techniques for classification.
- Compare the results from eo-learn and GEE Dynamic World.

Data Sources

- Sentinel-2 Imagery (Optical satellite images with high spatial resolution).
- Sentinel Hub's Land Cover Data (Pre-labeled datasets).
- Dynamic World (Google Earth Engine) (Real-time land cover classification).

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Tools & Technologies

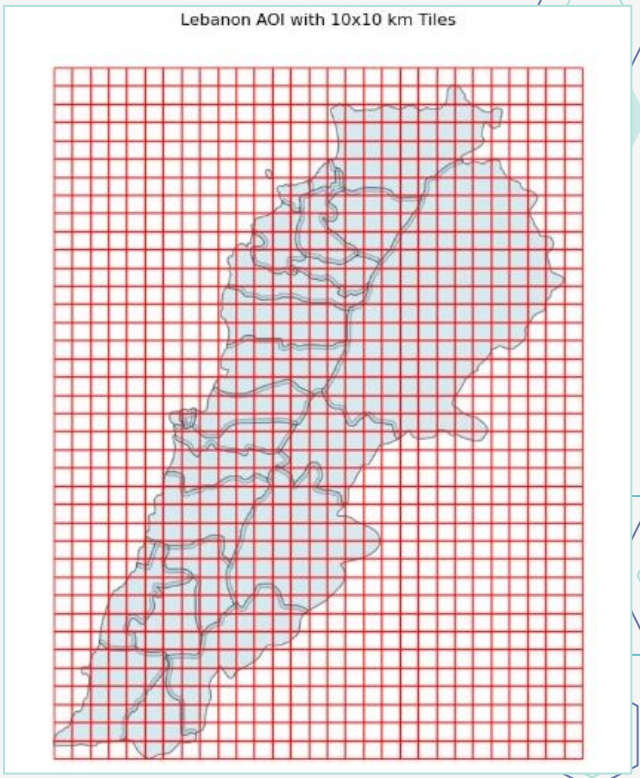
Libraries and Tools

- Python (eo-learn library for data processing).
- Jupyter Notebook (Running the scripts).
- Google Earth Engine (GEE) (For cloud-based analysis).
- QGIS / Matplotlib (For visualization).

Workflow Overview

Approach 1: Using Sentinel Hub's eo-learn

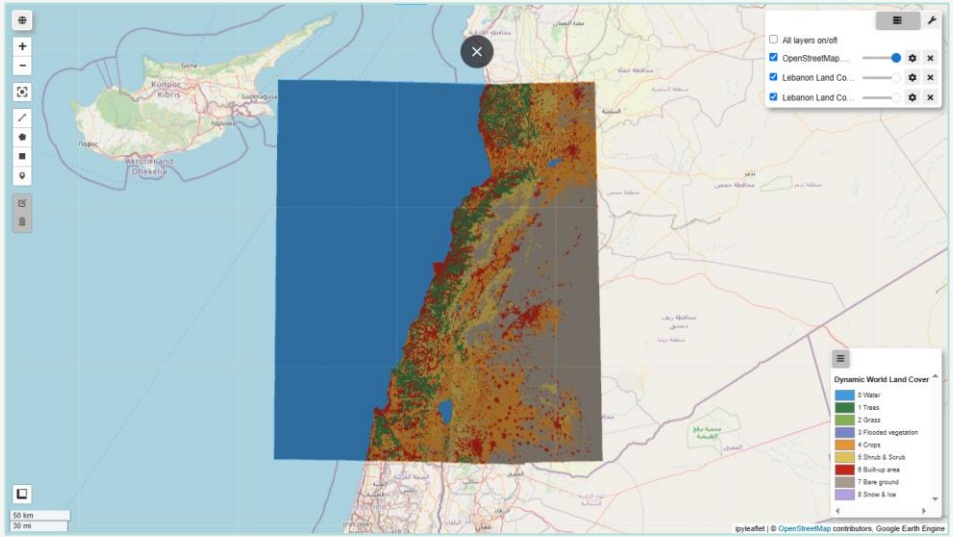
1. Define the Area of Interest (AOI) – Lebanon's boundaries.
2. Data Preparation – Download Sentinel-2 images.
3. Feature Engineering – Compute indices (NDVI, NDWI).
4. Train Machine Learning Model (Random Forest).
5. Classify Land Cover and generate the final map.



Workflow Overview

Approach 2: Using GEE Dynamic World

1. Import Dynamic World dataset into GEE.
2. Select Lebanon's AOI and define a time range.
3. Process the images and classify land cover.
4. Generate a time-series animation of land cover changes.



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Implementation

Techniques

Sentinel Hub's eo-learn

GitHub Repository:

- SI_LULC_pipeline.ipynb
- Land Cover Map Example

GEE Dynamic World

GEE Notebooks Used:

- Land Cover Time-Series
- Land Cover Classification

Results

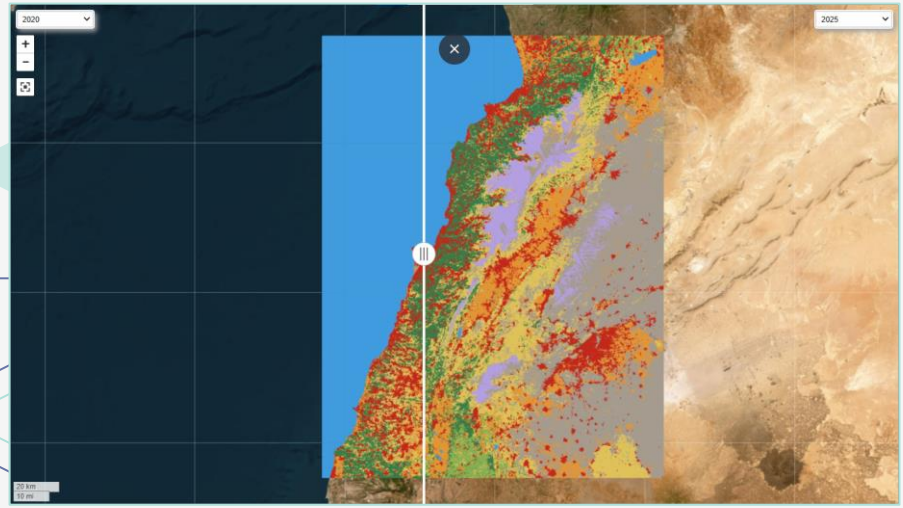
Expected Outcome:

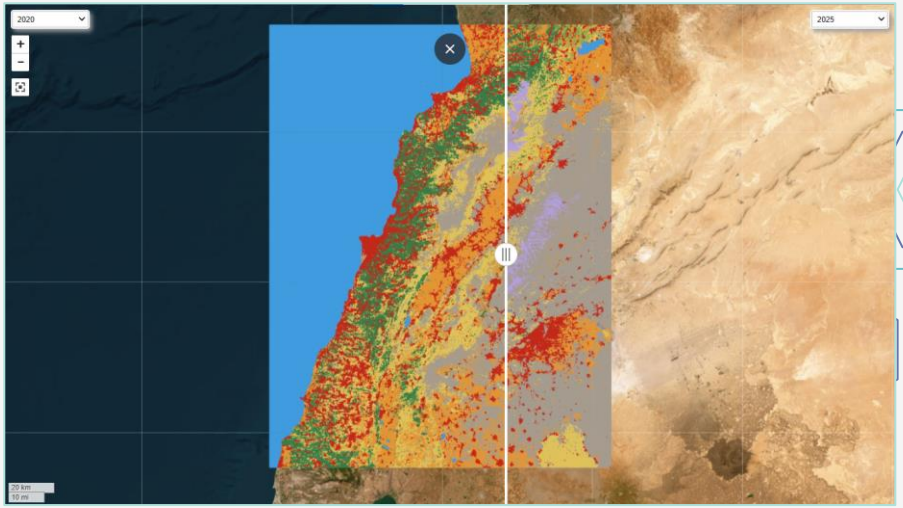
- A classified Land Cover Map identifying urban, forest, water, and agricultural areas
- Insights into land use patterns for better decision-making
- Support for environmental monitoring and urban planning

Results

Time-Series Land Cover Map

- Generated dynamic land cover maps over time.
- Identified land cover changes (e.g., urban expansion, deforestation).
- Time-lapse video shows land cover trends.





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Challenges

Challenges

- Data Preprocessing: Handling missing and cloudy images.
- Computational Resources: Machine learning training is time-intensive.
- Accuracy: Need for high-quality labeled training data.
- API Limitations: Sentinel Hub and GEE have rate limits.

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Future Improvements

Future Improvements

- Improve classification accuracy with Deep Learning models.
- Integrate multi-temporal analysis for better predictions.
- Use higher-resolution satellite imagery (Sentinel-3, Landsat-9).
- Develop a web-based dashboard for interactive visualization.

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Conclusion

Thank You