Computer Engineering Department
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CMP Elective
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Satellite Imagery Project

Overview

Floods are one of the most devastating natural disasters that affect millions of people worldwide every year. The ability to quickly and accurately assess the damage caused by floods is crucial for emergency responders, disaster relief organizations, and government agencies to plan and allocate resources effectively.

Satellite imagery provides a unique and powerful tool for post-flood damage assessment, as it can cover large areas and capture high-resolution images of the affected regions. However, manually analyzing these images is a time-consuming and labor-intensive process, making it challenging to provide timely and accurate assessments.

The goal of this project is to develop an automated method for detecting post-flood damages in satellite imagery using machine learning and computer vision techniques. The proposed solution will allow for the rapid and accurate identification of damaged areas, enabling emergency responders to quickly prioritize their response efforts and allocate resources more effectively. The proposed solution can also be used to monitor the long-term impact of floods on the affected areas, allowing for more informed decision-making and better disaster preparedness in the future.

In summary, the proposed solution has the potential to make a significant impact in disaster response and recovery efforts, ultimately improving the lives of people affected by floods.

Goals

Detecting post-flood damages in satellite imagery is a challenging yet important task that has real-world applications. The idea behind the project is to leverage machine learning and computer vision techniques to automatically detect and classify the presence of flood damage in satellite images.

There are several dimensions to this project, including:

1. Image preprocessing: This involves preprocessing satellite images of the affected areas to remove any noise, artifacts, or distortion that may affect the accuracy of the analysis. (The images have different dimensions)
2. Feature extraction and selection: In this step, relevant features or patterns are extracted from the preprocessed images using any techniques you find fit. The selected features are then used as input to the classification model.
3. Classification: This step involves training a machine learning model to classify the images as either damaged or undamaged. The model is trained on a dataset of flood images, where there are 2 types of images either flooded or not.
4. Evaluation: Finally, the performance of the model is evaluated using metrics such as accuracy, precision, recall, and F1 score.

Dataset Description

The dataset we will be using for the flood detection consists of satellite imagery of different regions taken at different times. The dataset includes a mix of images with and without floods. The dataset has 2 folders (one for flooded images and one for non-flooded images)

Grading Criteria

This is a competitive project. The teams will be **ranked** based on the scores they get. You will be provided with the test set only **ONE DAY** before the final delivery. We will use **macro F1-score** as the metric for the ranking process. The overall grading will depend on the following:

1. The team rank (portion of the grade).
2. The approach you followed. This includes the following:
    a. The preprocessing techniques
    b. The features you used
    c. The models you trained
3. The workload division.

Project Instructions

- You will work in teams of 4.
- Your final submission only will be considered for the ranking process.
- There is a penalty for late submissions.
- Any sign of cheating or plagiarism will not be tolerated and will be graded **ZERO** in the project.
- Detects whether the image contains post flood damages or not.
    - Output: flood or no flood labels, the output also should include coloring the flooded segment (all flooded pixels) in the image
- Required:
    - At least one classical technique
    - At least one deep learning technique

Final Deliverables

1. Final Project Document containing the following:
    a. Project Pipeline
    b. A detailed description of each phase in your pipeline
        i. Data preprocessing
        ii. Feature extraction
        iii. Model training
    c. Evaluation: Report all the metrics in "Confusion matrix/Precision/Recall/F1-score/Accuracy/Omission error/Commission error" and finally output macro F1-score to obtain an overall score for all classes.
    d. Specify what model you used and the reason for choosing it.
2. Codes: All scripts you used.
3. The final Model: the weights of the model you used for submission. Use the framework you used for training the model default format when saving.
4. Presentation: you will use it for the final project discussion.