Heavy Artillery Detection

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1. Problem

The goal of this project is to identify heavy artillery damage in satellite images and drone footage. War moves quickly and identifying locations of combat and damage more quickly can help both organizations that help displaced persons as well as accurate reporting amidst the fog of war.

2. Why

During conflicts organizations such as the United Nations need to be able to track where damage is occurring so that they can efficiently get resources to people in need. Additionally, the fog of war makes reporting on actual incidents and damage very difficult. Monitoring satellite imagery and drone footage for heavy artillery damage can get accurate information to organizations that help those affected as well as those who are trying to understand if their family is alright, if their homes and businesses have been affected, as well as the general public trying to understand what is truly happening. This project hopes to automate the process of identifying heavy artillery damage to buildings in images. While there are some products which do this, they are expensive and smaller journalists can not afford subscriptions to these services.

3. Success

Because of the unbalanced nature of the dataset, false positives are difficult to limit, so lowering false positives while keeping accuracy high will be one of the key success indicators.

4. Audience

The audience for this project would be members in the United Nations that would extend aid to displaced persons as well as other government and aid organizations. Small news organizations and independent journalists such as Malcontent News.

5. Data

To begin with I am using the UNOSAT damage analysis for Aleppo, Syria. This will be the labelled data of damaged buildings. The associated geotiff files will be pulled from Google Earth to start with. UNOSAT also has labelled data from the ongoing Ukraine conflict, however, I am currently unable to procure the associated satellite imagery files. I have contacted several people in an attempt to gain these images, and hopefully throughout the course of this project, I will be able to add these additional datasets.

6. Model

To begin with, I will be utilizing the models used in "Monitoring War Destruction from Space Using Machine Learning." Mueller [2021] Their two stage model is available for use, which I intend to use as a start. Because I am using this custom option, it will likely not be pre-trained. After this first attempt, I would like to continue to try other models suck as YOLO v-7 and other newer CNN options, which would start with pretrained weights and utilize transfer learning.

7. Accuracy Metric

In addition to accuracy, I intend to closely watch the false positive rate as that can destroy the usefulness of the predictions.

8. MLOps Stack Requirements

As I am unfamiliar with many of the tool possibilities and the differences between them, the stack will likely change over the course of the project, but I am going to record my tentative stack:

- Data Analysis:
- Experimentation: Jupyter, python
- Feature Store:
- Code Repository: git
- ML Pipeline: Ray
- Metadata Store:
- Model Registry:MLflow
- Model Serving: FastAPI
- Model Monitoring: Prometheus, Grafana
- CI/CD: Github Actions

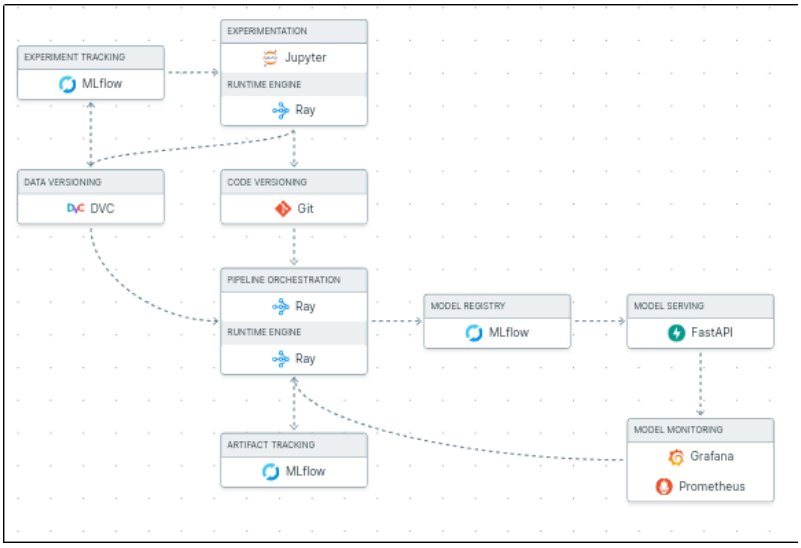

Figure 1. MyMLOps graph displaying the tentative chosen stack

References

Mueller, H. (2021). Monitoring war destruction from space using machine learning. *Proceedings of the National Academy of Science*, 118(23).