Project: AIDriven Archaeological Site Mapping

Project Statement:
Build an AI-based platform that analyzes satellite and drone imagery to assist archaeologists in segmenting ancient ruins and vegetation, detecting and classifying artifact structures, and predicting erosion-prone zones. This system will support conservation planning and archaeological research.

Outcomes:
Understand the preprocessing and use of satellite/drone imagery.
Develop deep learning models for semantic segmentation and object detection.
Implement predictive modeling for terrain erosion analysis.
Deliver insights via a dashboard with spatial visualizations.

Dataset Sources:
[Google Earth Pro](https://www.google.com/earth/versions/earthpro)
[OpenAerialMap](https://openaerialmap.org)
Custom annotated images (manually labeled or via QGIS/Labelbox)

Modules:
1. Data Collection and Annotation
2. Preprocessing and Augmentation
3. Semantic Segmentation of Ruins and Vegetation
4. Object Detection and Classification of Artifacts
5. Terrain Erosion Prediction Model
6. Model Evaluation and Tuning
7. Dashboard and Final Presentation

Milestone 1: Dataset Collection and Preparation (Weeks 1–2)
Week 1:
Identify and download satellite/drone images from OpenAerialMap and Google Earth
Research and define annotation schema for ruins, vegetation, and artifacts
Week 2:
Annotate images using Labelbox or a similar tool.
Preprocess and augment data: normalization, resizing, train-test split.

Milestone 2: Segmentation and Object Detection Models (Weeks 3–4)
Week 3:
Implement and train the U-Net or DeepLabV3+ model for segmenting ruins and vegetation.
Validate with IoU and Dice Score.
Week 4:
Implement YOLOv5 or Faster R-CNN for artifact detection and classification.
Evaluate the model using mAP and class-wise precision/recall.

Milestone 3: Terrain Erosion Prediction (Weeks 5–6)
Week 5:
Collect or derive terrain features (e.g., slope, vegetation index, elevation).
Prepare labeled data for erosion-prone vs stable areas.
Week 6:
Train XGBoost or Random Forest model.
Evaluate using RMSE and R^2 Score; integrate with map data.

Milestone 4: Evaluation, Visualization, and Final Reporting (Weeks 7–8)
Week 7:
Build an interactive dashboard with Streamlit or Dash.
Integrate segmentation, detection, and erosion predictions.
Week 8:
Compile final documentation and model performance reports.
Deliver final presentation and demo.

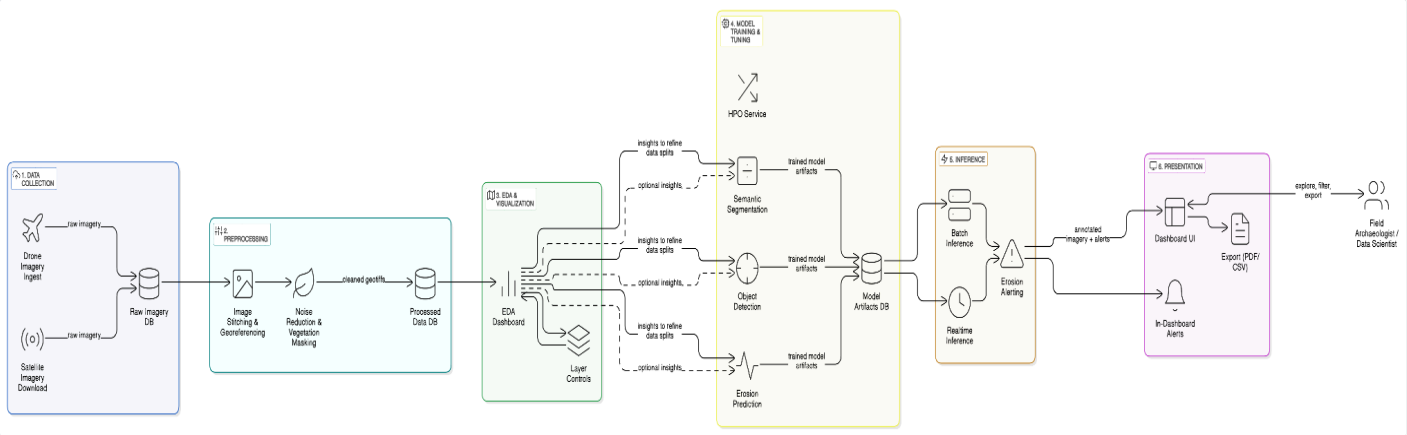
Workflow:
1. Acquire and annotate imagery
2. Preprocess and split the dataset
3. Train segmentation and detection models
4. Predict erosion zones using terrain features
5. Overlay and visualize results on a map dashboard

Tools & Tech Stack:
Language:
Python

Libraries:
Pandas, NumPy
OpenCV, Rasterio, scikitlearn
Folium, GeoPandas, Matplotlib, Seaborn
Streamlit or Dash (dashboarding)

ML/DL Frameworks:
TensorFlow or PyTorch
UNet / DeepLabV3+ (Segmentation)
YOLOv5 / Faster RCNN (Object Detection)
XGBoost / Random Forest (Erosion Prediction)

Architecture Diagram:



Evaluation Criteria:
Milestone Completion:
Timely delivery of modules for segmentation, detection, and prediction.
Clear documentation and dataset pipeline.

Model Performance:
Semantic Segmentation: IoU, Dice Score.
Object Detection: mAP, Precision, Recall.
Erosion Prediction: RMSE, R^2 Score.

System Integration and Visualization:
Effective overlay of model outputs on satellite imagery.
Functional dashboard for archaeologist interaction.

Presentation and Reporting:
Structured documentation of pipeline and outcomes.
Compelling demo and stakeholder-oriented report.