

River and Bike Trail Identification Using YOLO

Computer Vision Team

April 2, 2025

Overview

This project aims to use aerial imagery and computer vision techniques to automatically identify two primary environmental features: rivers and bike trails. We will employ the YOLO (You Only Look Once) model, leveraging transfer learning to detect and classify these features from drone or satellite imagery.

Goals

- Develop a robust object detection model to identify rivers and bike trails.
- Create a labeled dataset consisting of aerial images annotated with bounding boxes for trails and polygons for rivers.
- Evaluate model performance using relevant metrics such as precision, recall, Intersection-over-Union (IoU), and mean Average Precision (mAP).
- Prepare a presentation and written report summarizing the findings and potential future work.

Tools and Frameworks

- **YOLOv5 / YOLOv8** – Object detection framework for training and inference.
- **PyTorch** – Deep learning library for implementing YOLO models.
- **Annotation Tools:** CVAT, LabelImg
- **Data Augmentation Techniques:** Rotation, cropping, scaling, brightness adjustments, etc.
- **Evaluation Metrics:** Precision, recall, IoU, mAP

Sprint Plan

Sprint 1: Dataset Preparation

- Gather aerial images from Mr. Howard or public datasets.

- Set up annotation tools and label initial images with bounding boxes for trails and polygons for rivers.
- Prepare repository and documentation for collaborative work.

Sprint 2: Model Training

- Train a YOLOv5 or YOLOv8 model using the labeled dataset.
- Evaluate baseline performance and identify areas for improvement.

Sprint 3: Model Optimization

- Expand dataset by labeling additional images.
- Optimize hyperparameters and improve data augmentation techniques.
- Compare performance of YOLOv5 and YOLOv8 if applicable.

Sprint 4: Finalization and Presentation

- Conduct final training and evaluation.
- Prepare presentation slides and written report.
- Discuss future work opportunities.

Stretch Goals

- Detecting additional features such as vegetation patches, streambanks, and trail crossings.
- Implementing segmentation-based models if time allows.

Labels

The following labels will be used to track progress:

- **Data Collection** – Gathering and organizing datasets.
- **Annotation** – Labeling images for model training.
- **Model Training** – Training YOLO models.
- **Model Evaluation** – Assessing model performance.
- **Optimization** – Tuning hyperparameters and improving accuracy.
- **Documentation** – Writing reports and preparing presentations.
- **Vegetation Detection** – Detecting vegetation patches (stretch goal).
- **Streambank Detection** – Detecting streambanks (stretch goal).
- **Trail Detection** – Detecting trails and crossing points (stretch goal).