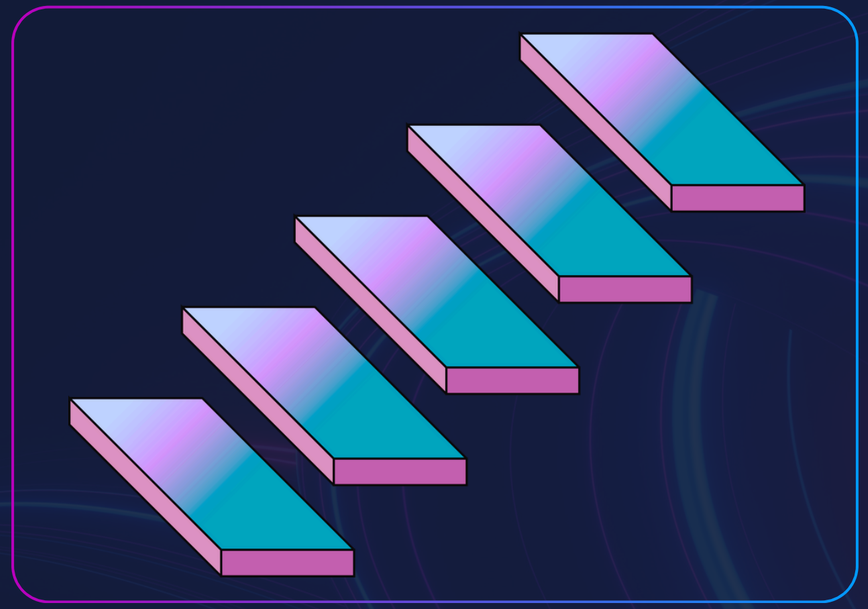
Stairs Counting project



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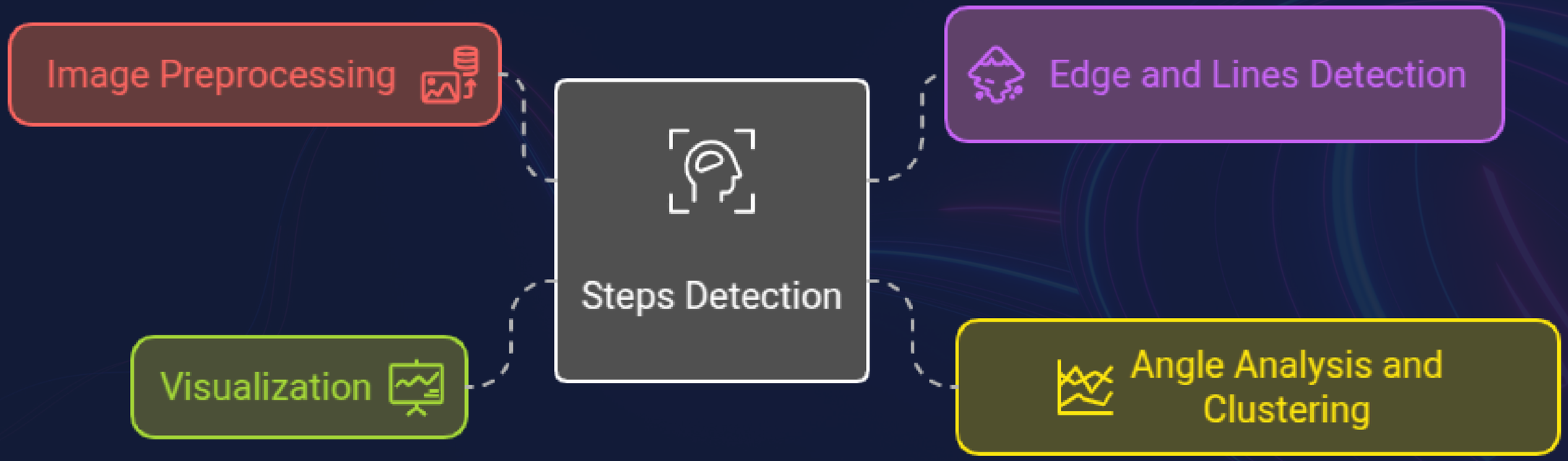
Introduction

A Computer Vision Approach To Detect and Count the number of stairs.

Why does Stair Count Matters?

- Accessibility
- Accident prevention
- Robotics

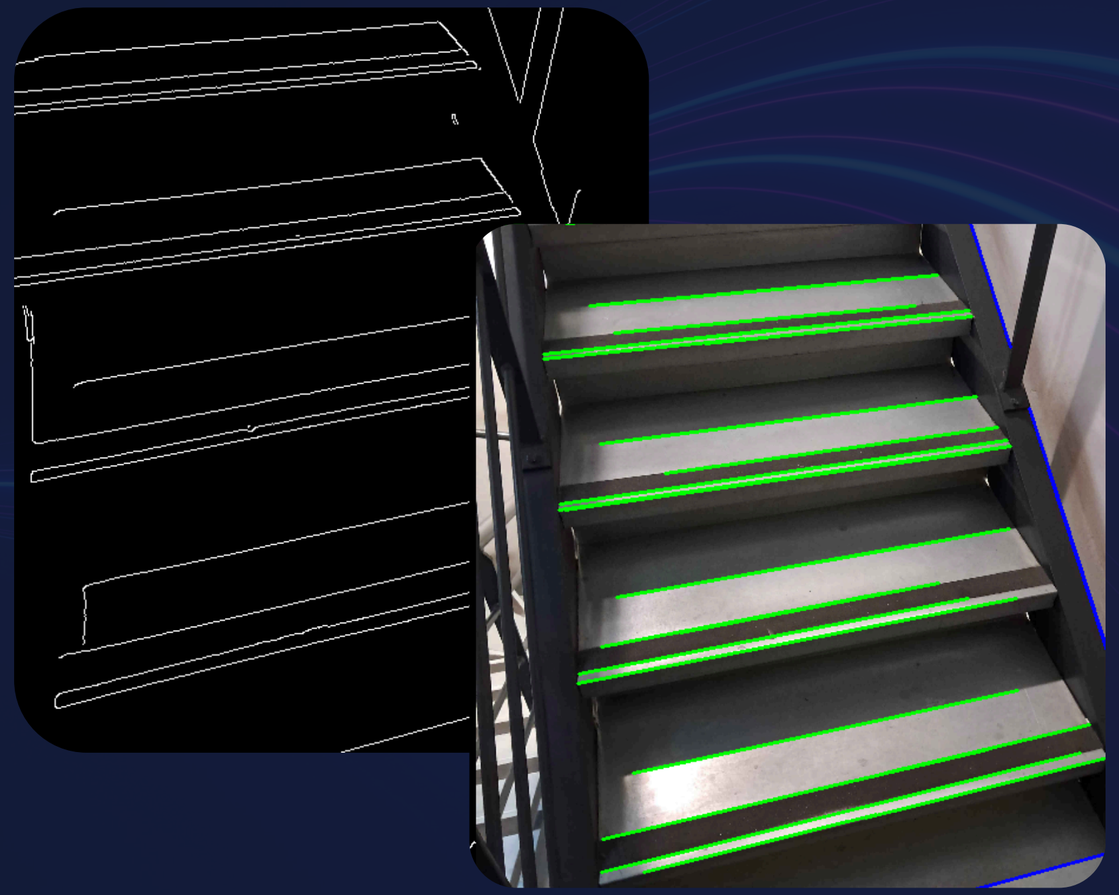
RoadMap of our computer vision approach



Our Approach 1/3

Pre - Processing ：

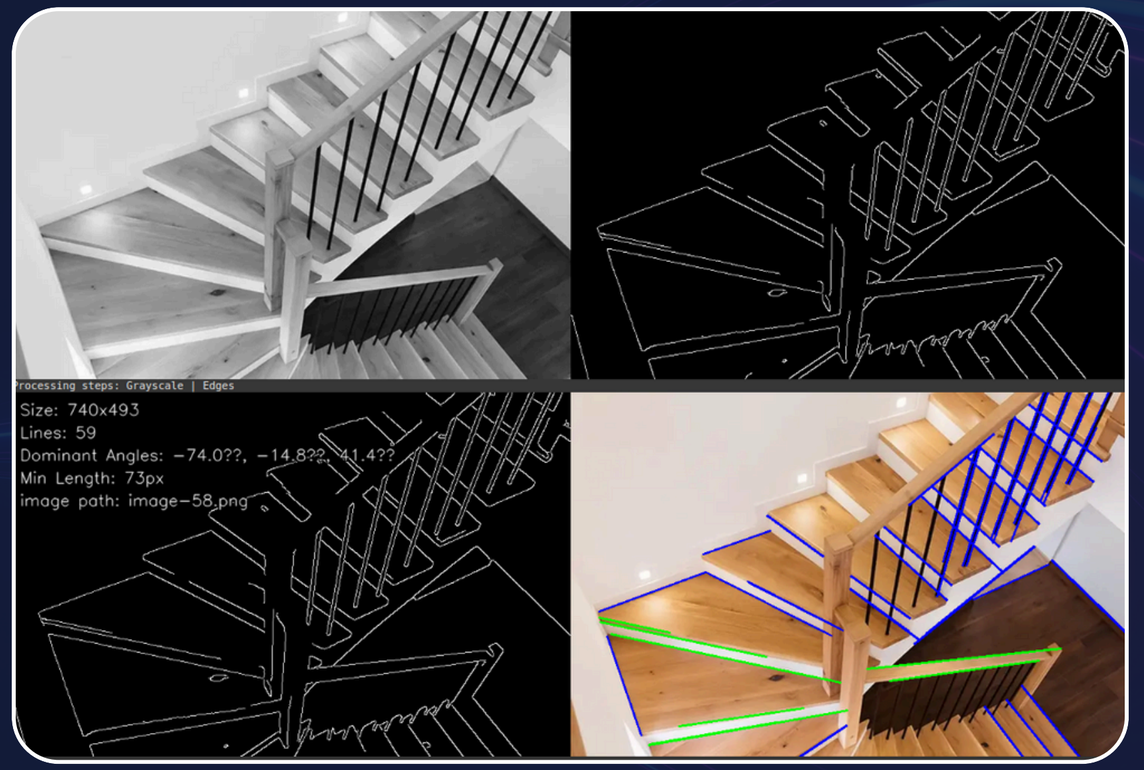
- Resize image
- Convert to grey scale
- Edge detection using Canny algorithme



Our Approach 2/3

Core Strategy :

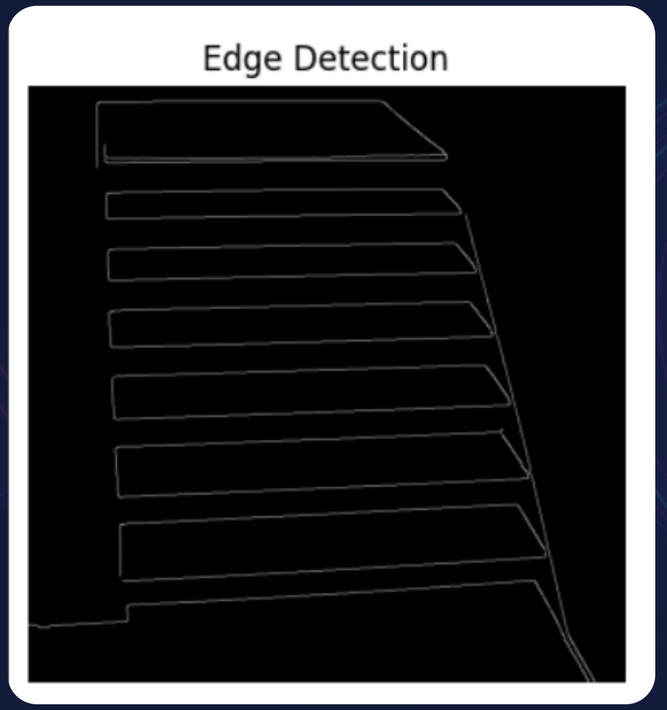
1. Detect lines using Hough transform
2. Analyze & Cluster Dominant Angles
3. Filter out the outliers
4. Visualize the results

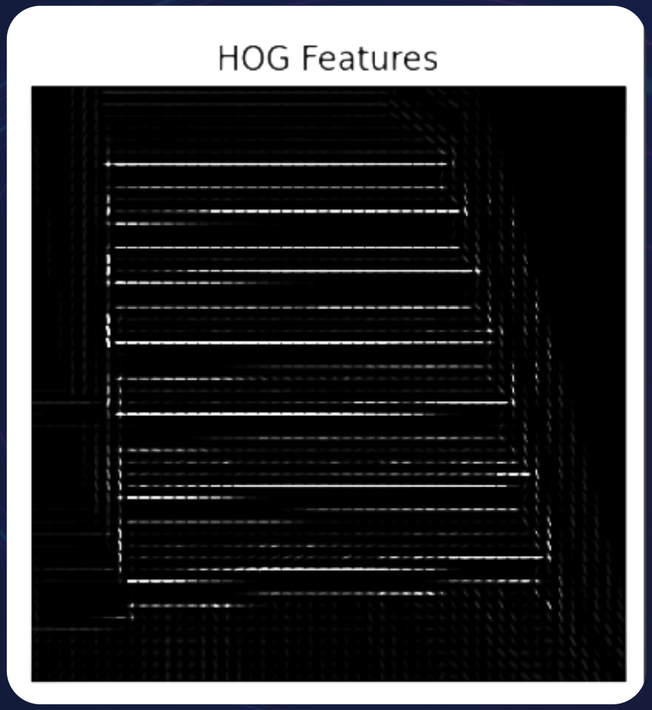


Our Approach 3/3

Integration With Machine Learning

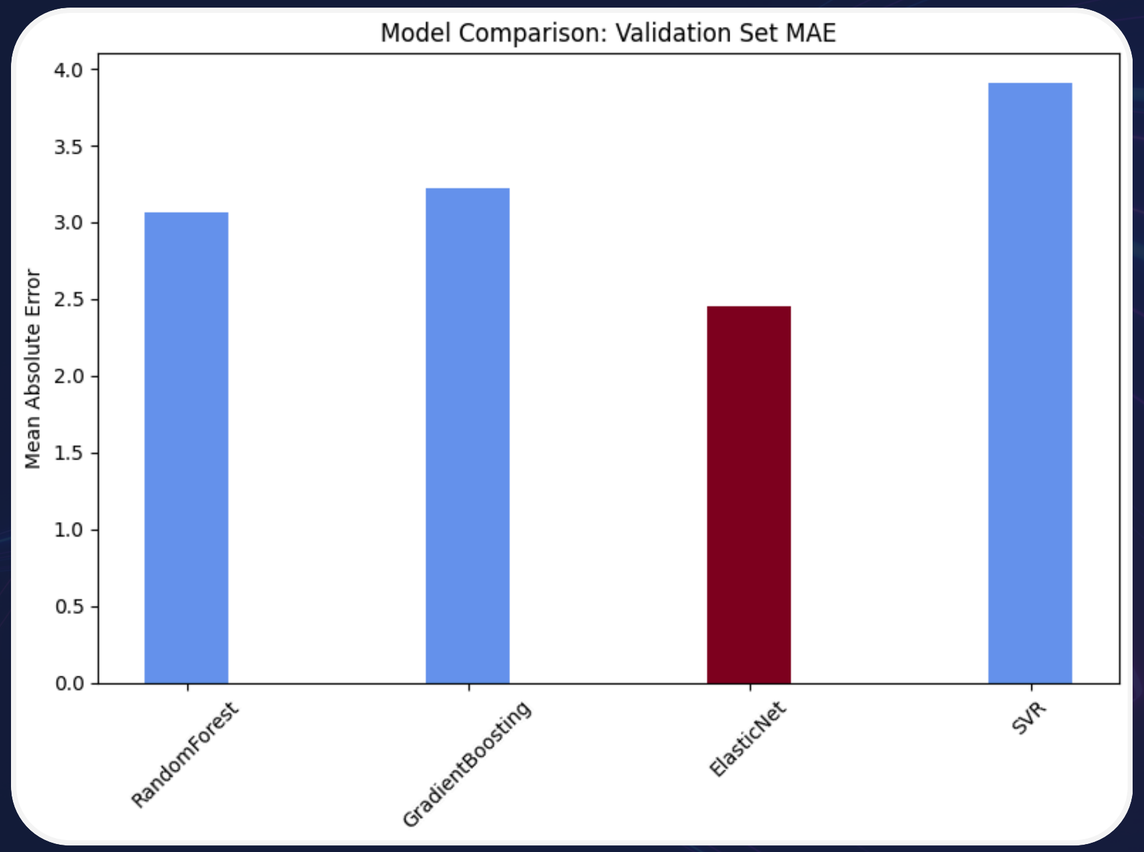
- Feature Extraction Using HOG feature
- ElasticNet ML
- Train / Validate / Test
- Score Results using MAE





Evaluation 1/4

- Effective pre processing
- Testing different ML models : RandomForest, Gradient boosting, SVR, ElasticNet.
- Calculating and comparing the MAE results with the splited dataset on the best ML model



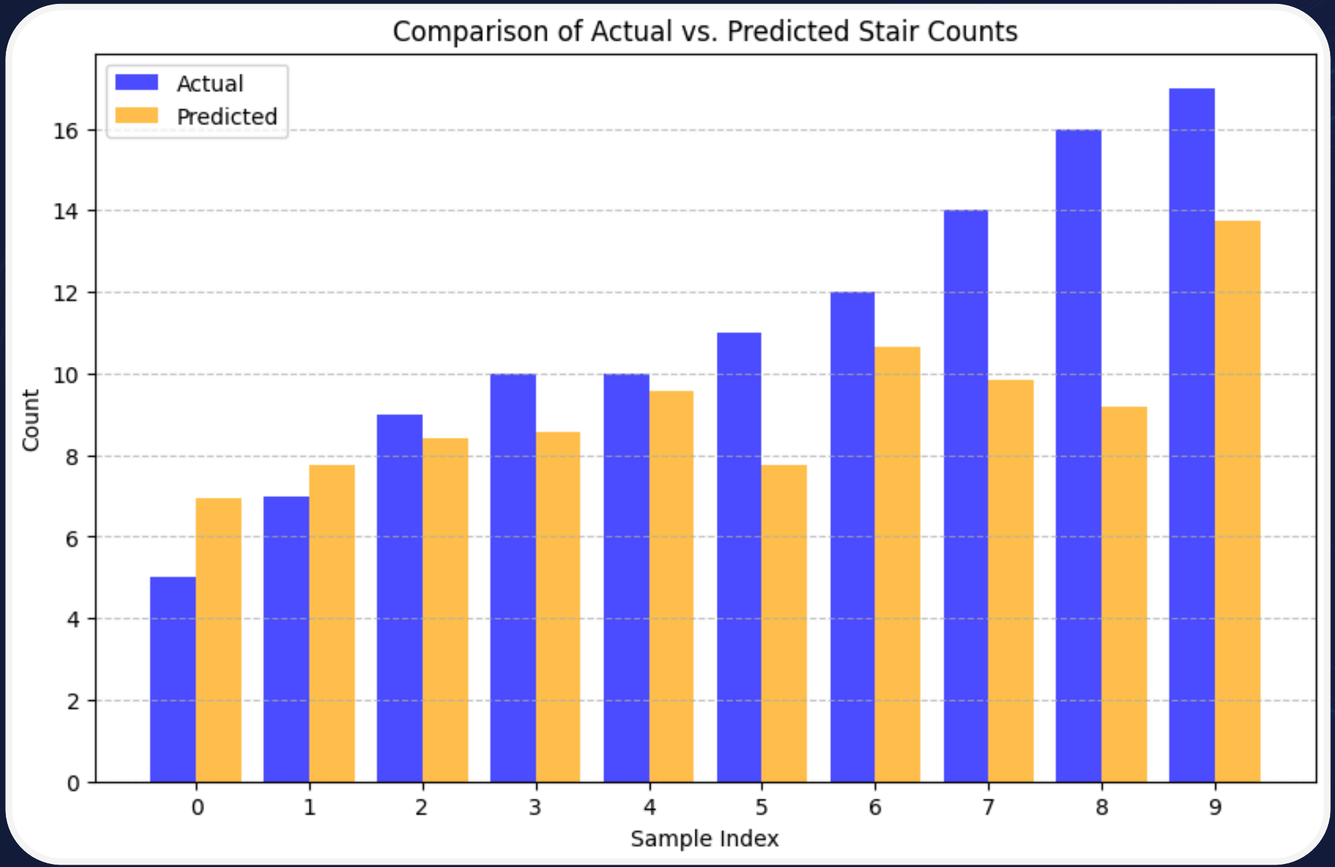
Evaluation 2/4

Why ElasticNet?

- Performs better on correlated features .
- Gives clear coefficients that show how each feature influences the outcome.
- It can select relevant features and shrink others toward zero.

- Much Faster as opposed to non-linear ML such as Random Forest which grows multiple decision trees, making it computationally expensive, especially when hyperparameter tuning is involved.

Evaluation 3/4



Evaluation 4/4

The goal is to predict the number of steps in a staircase (numerical value not a categorcal), which is a quantitative value, this makes it a regression problem.

Hence the reason behind “Mean Absolute Error (MAE) evlaluation, to measure how far off the predictions are from the ground truth.

```
Evaluating models on validation set...
Model: RandomForest, Validation MAE: 3.0641
Model: GradientBoosting, Validation MAE: 3.2215
Model: ElasticNet, Validation MAE: 2.4508
Model: SVR, Validation MAE: 3.9046

Best model: ElasticNet with Validation MAE: 2.4508
Test Set MAE with ElasticNet: 2.3943
```

Our Best MAE Score Is : **2.39**

Conclusion

In this project we were able to get promising results using the ElasticNet model that provided the lowest MAE values

Faced challenges:

- Fine tuning the hyper parameters
- Feature extraction algorithms
- Machine learning model choice

Future Work:

- Rotation Invariation
- Ensemble Models
- CNNs
- More Data

Thank You

FOR YOUR ATTENTION

ANY QUESTIONS?