

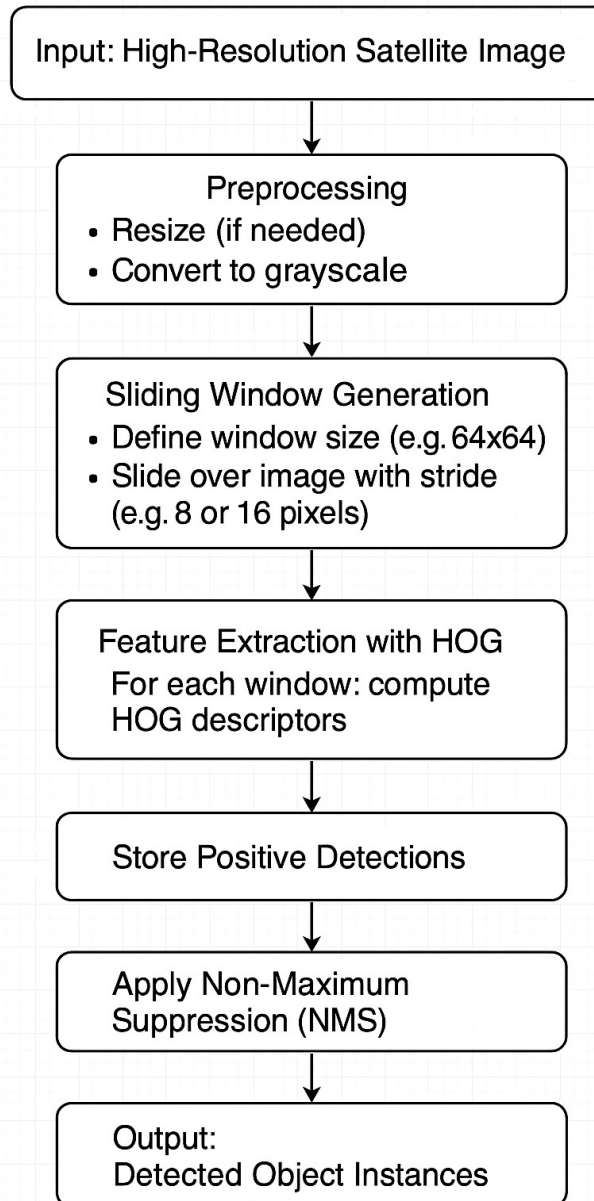
ADVANCED SATELLITE IMAGE PROCESSING PROJECT

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PROBLEM STATEMENT

Implement the Histogram of Oriented Gradients method and extract different instances of an object from (high resolution satellite) input image. (For example, buildings)



IMPLEMENTATION

- 1. Importing Libraries

```
from skimage import exposure # For contrast enhancement of HOG visualization.
import matplotlib.pyplot as plt # Plotting HOG features and detections.
from sklearn.svm import SVC # Support Vector Classifier (SVM).
from sklearn.model_selection import train_test_split # Train/test data splitting.
from imutils.object_detection import non_max_suppression # To remove overlapping detections.
```

- 2. HOG Detector Class

```
python
```

```
class SatelliteHOGDetector:
    def __init__(self, cell_size=16, bin_size=9, block_size=2):
```

Initializes HOG settings.

- cell_size: granularity of HOG grid.
- bin_size: number of angle bins
(e.g., 0-180° split into 9 bins).
- block_size: block normalization
for lighting invariance.

IMPLEMENTATION

3. Compute HOG Features

```
def compute_hog(self, img, visualize=False):
```

- Converts color image to grayscale if needed.
- Applies the HOG algorithm using the specified parameters.
- If visualize=True, it also returns an image showing the gradient pattern.

4. Training the SVM

```
def train(self, X, y):  
    self.classifier = SVC(kernel='linear', probability=True)  
    self.classifier.fit(X, y)
```

IMPLEMENTATION

5. Sliding Window Object Detection

```
def detect_objects(self, img, window_size=(256, 256), stride=32, threshold=0.7):
```

6. Dataset Loader

```
def load_ucmerced_data(...):
```

7. Plotting HOG for Debugging

```
def plot_hog_comparison(...):
```

8. Main Pipeline

```
def main():
```

9. NMS Step (Key Part)

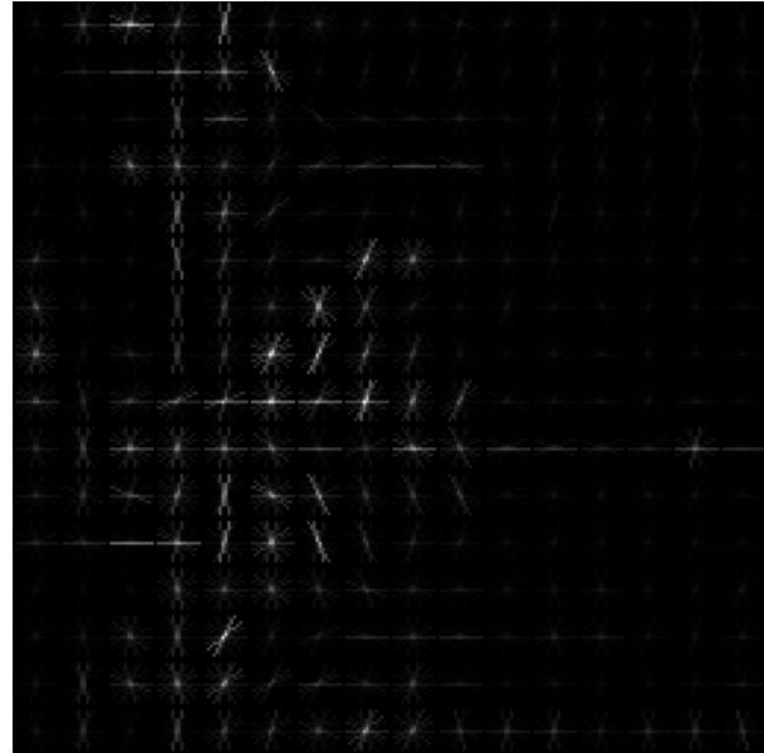
```
pick = non_max_suppression(boxes, scores, overlapThresh=0.3)
```

Number of HOG descriptors: 8100

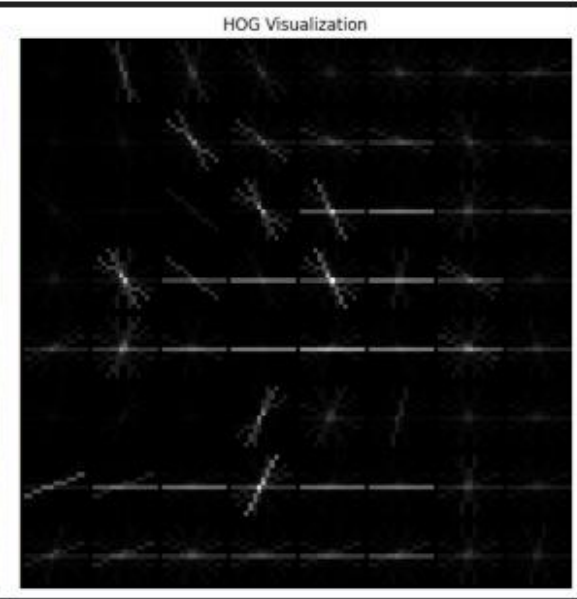
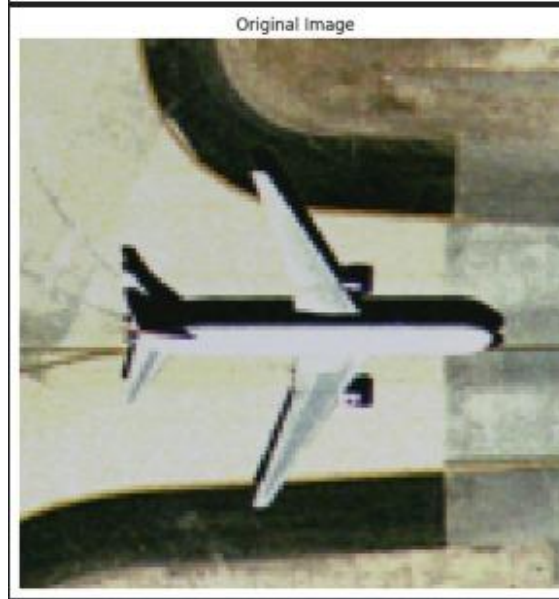
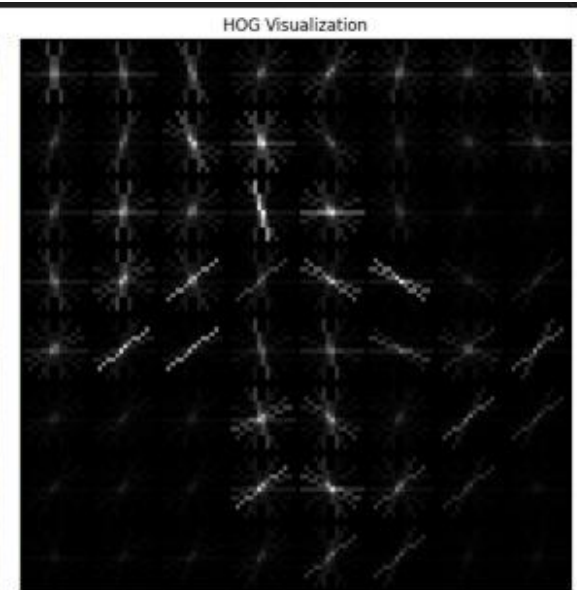
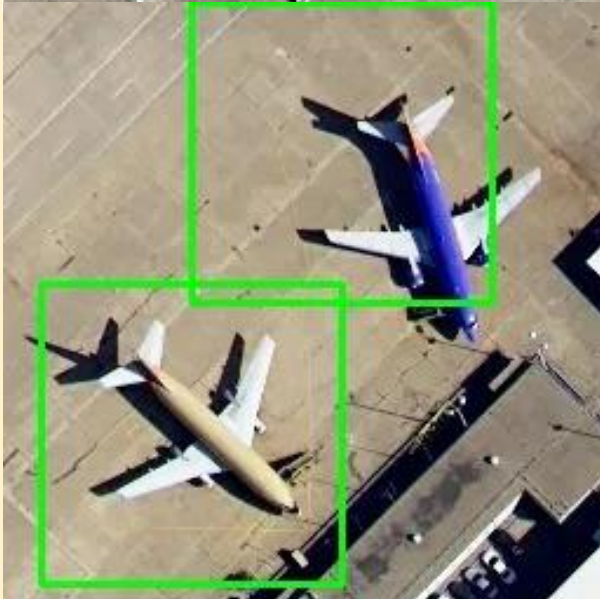
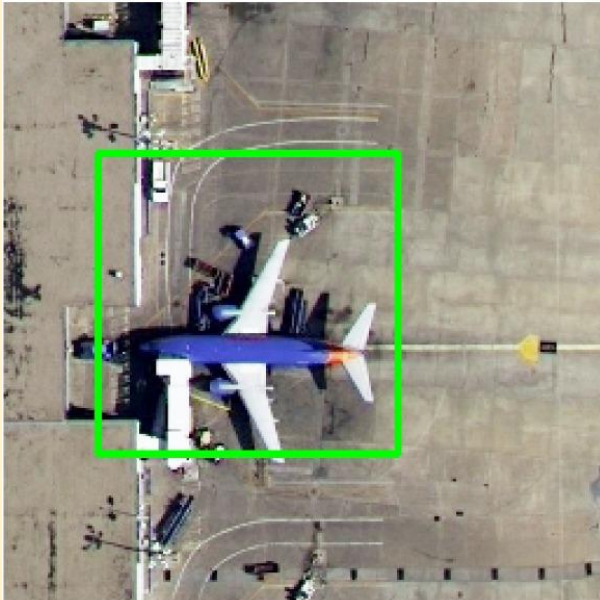
Original Image



HOG Visualization



RESULTS



Project Link :

<https://582ad8fba0a9d4dae4.gradio.live/>

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