# Histogram of Oriented Gradients (HOG)

## Theory

The Histogram of Oriented Gradients (HOG) is a feature descriptor used for object detection, particularly for detecting humans in images. HOG works by dividing an image into small cells, computing gradient orientations within each cell, and creating histograms of these orientations. These histograms are normalized across larger blocks to account for lighting variations and improve robustness. The resulting feature vector is used with a classifier (e.g., SVM) to detect objects like humans.

In human monitoring, HOG is effective for detecting pedestrians in surveillance footage or static images. Its strength lies in its ability to capture shape and edge information, making it robust to variations in appearance and lighting. However, it struggles with occlusions and complex backgrounds.

## Applications in Human Monitoring

- **Surveillance**: Detects humans in crowded scenes for security monitoring.
- **Crowd Analysis**: Counts people in public spaces for safety or urban planning.
- **Activity Recognition**: Identifies human presence as a preprocessing step for tracking or behavior analysis.

## Implementation Notes

- The `hog.py` script uses OpenCV's `HOGDescriptor` with a pre-trained SVM for human detection.
- **Input**: Image, video, or webcam feed.
- **Output**: Bounding boxes around detected humans, displayed in an OpenCV window.
- **Recommended dataset**: INRIA Person Dataset for training or testing.