Face detection with a sliding window

Assignment 3

Steps:

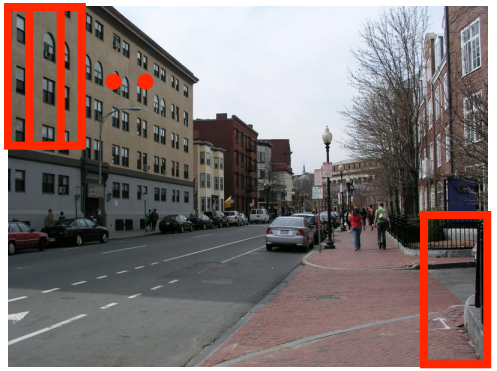
1. Extract fixed-sized window at each position and scale
2. Compute HOG (histogram of gradient) features within each window
3. Score the window with a linear SVM classifier
4. Perform non-maxima suppression to remove overlapping detections with lower scores
5. Evaluate performance

Sliding window

Test image patch at each location and scale

Sliding window:

A simple alignment solution



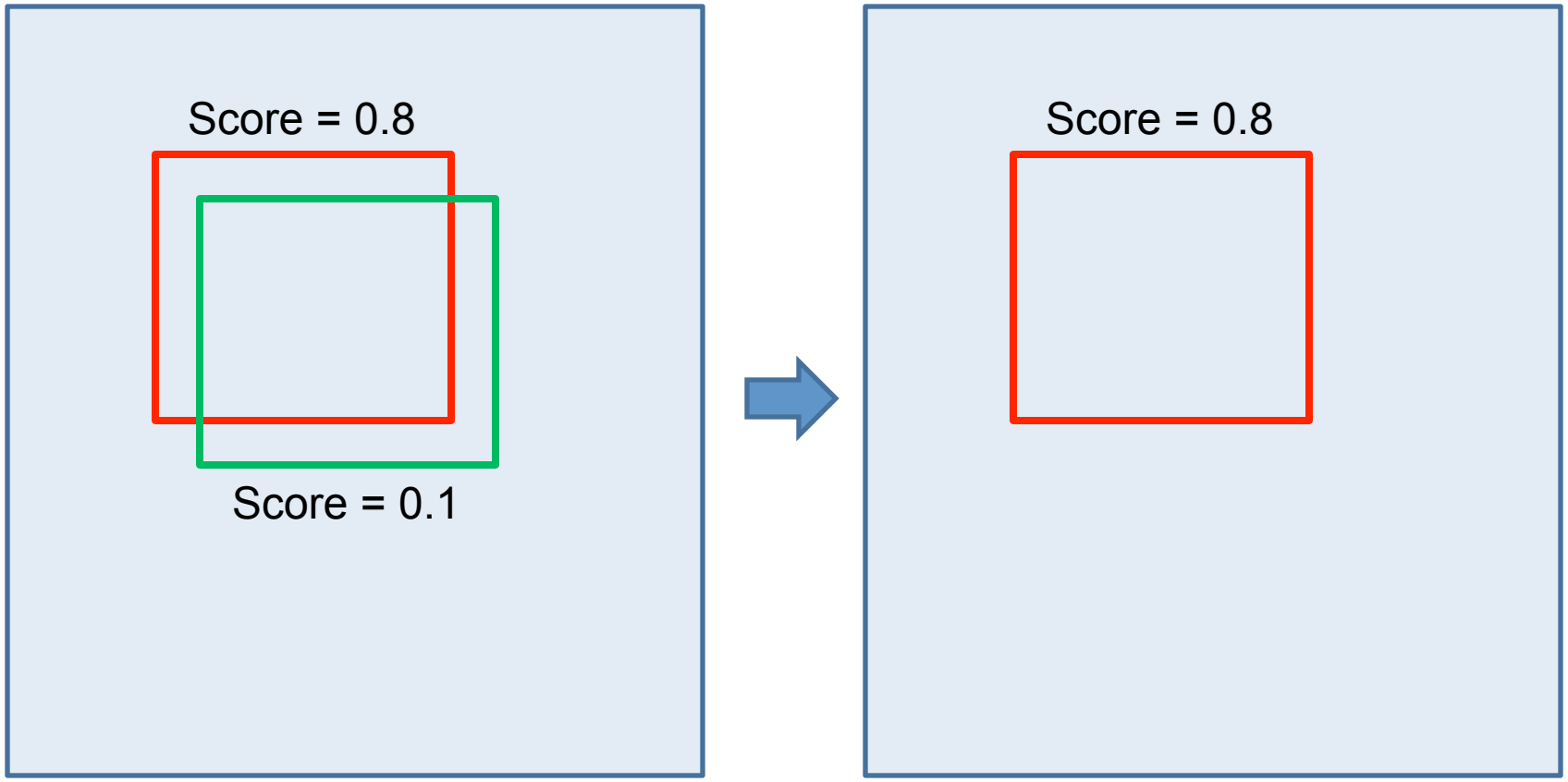
Sliding window

Test image patch at each location and scale

Window size does not change when scale changes

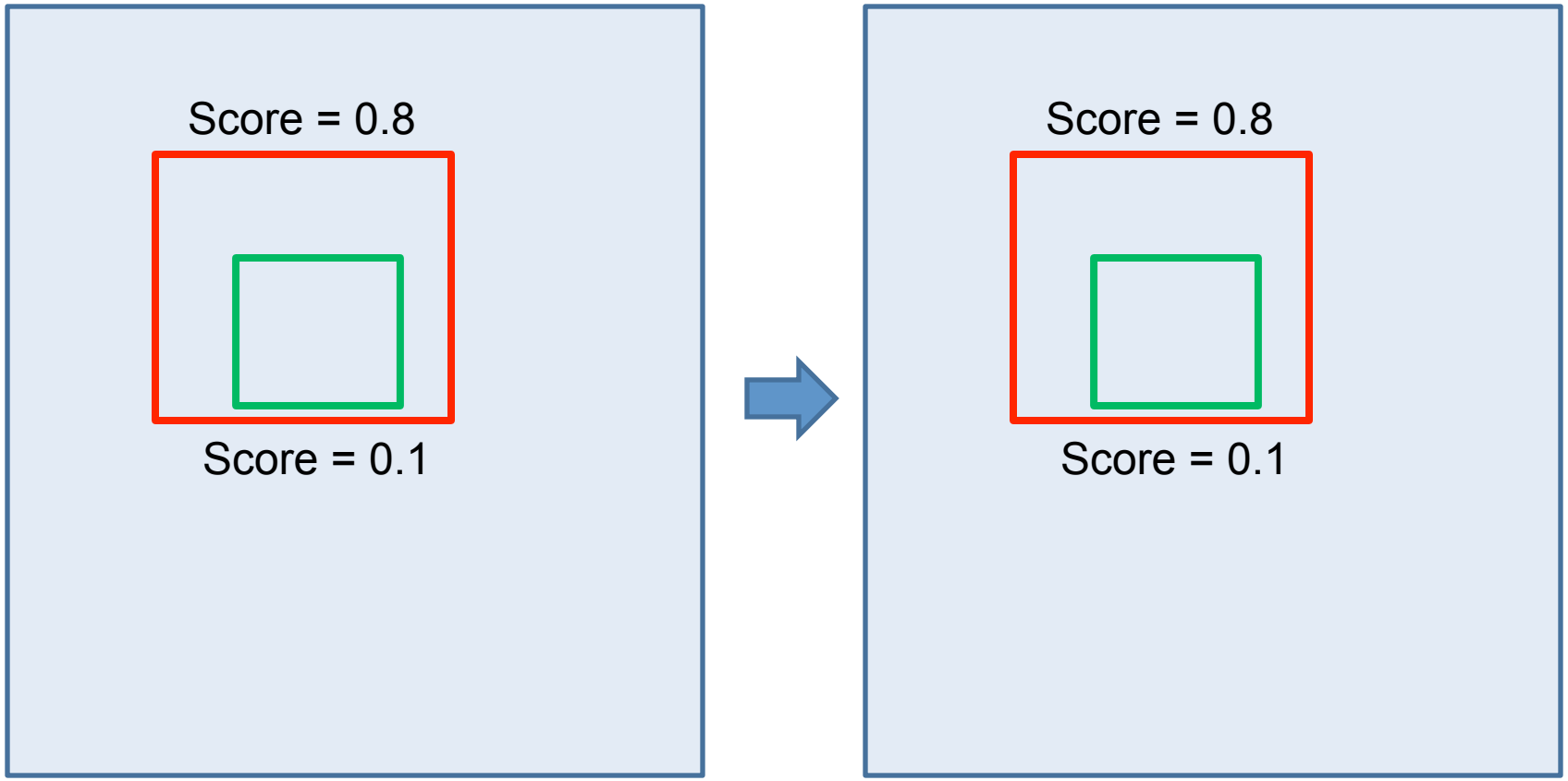
Non-max suppression

Resolving detection scores



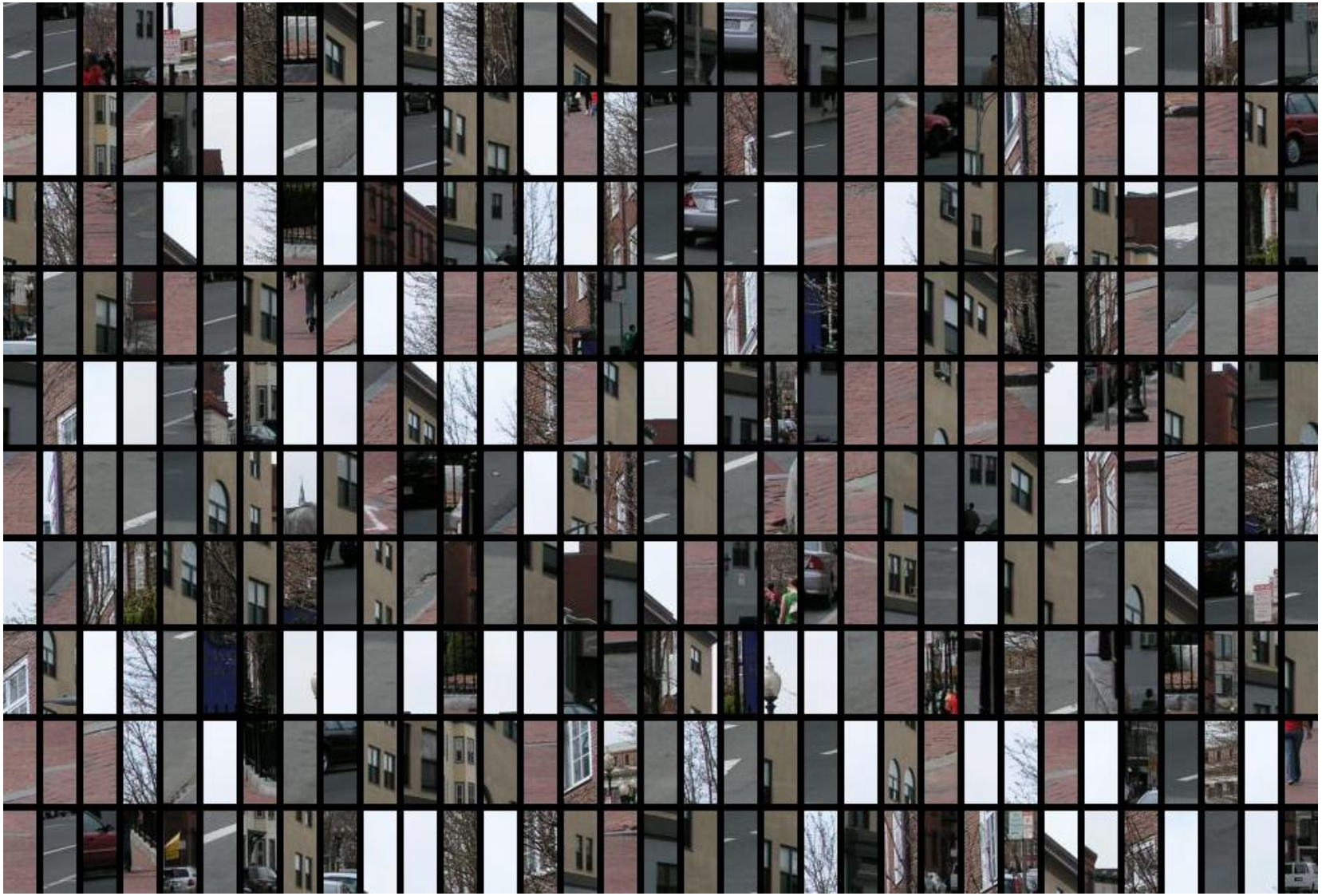
Non-max suppression

Resolving detection scores



“Overlap” score is below some threshold

Each window is separately classified



Linear SVM classifier

1. Use “VL Feat” Matlab toolbox
2. “vl_trainsvm” returns a confidence value
3. This confidence value is used to score the decision

How to measure performance?

1. *Precision-Recall* curve (generated based on confidence scores)

Precision = TP / (TP+FP)

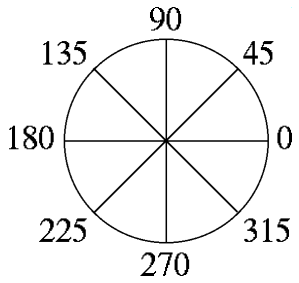
Recall = TP / (TP+FN)

TP: True positives, FP: False Positives, FN: False Negatives

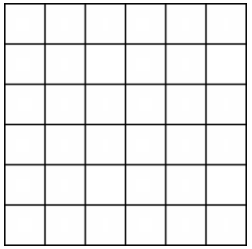
2. *Average Precision*

- **Histogram of gradient orientations (HOG)**

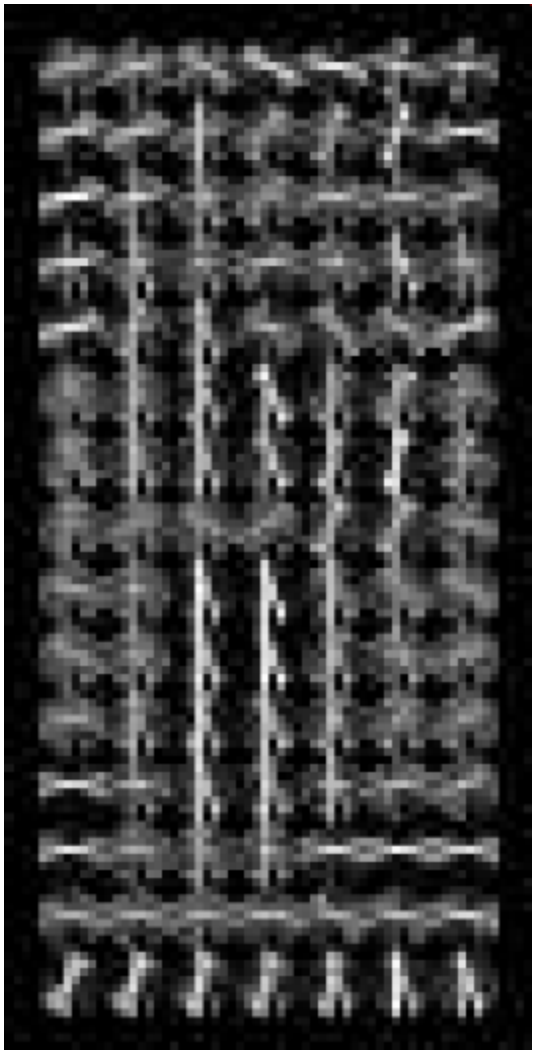
Orientation: 9 bins
(for unsigned angles)



Histograms in
k x k pixel cells



  - Votes weighted by magnitude
  - Bilinear interpolation between cells
  - Use “vl_hog” function



Navneet Dalal and Bill Triggs, Histograms of Oriented Gradients for Human Detection, CVPR05

Design challenges

- How to efficiently search for likely objects
  - Even simple models require searching hundreds of thousands of positions and scales
- Feature design and scoring
  - How should appearance be modeled? What features correspond to the object?
- How to deal with different viewpoints?
  - Often train different models for a few different viewpoints
- Implementation details
  - Window size
  - Aspect ratio
  - Translation/scale step size
  - Non-maxima suppression