# Deformable Part Model

### Strong low-level features based on histograms of oriented gradients (HOG)

### Efficient matching algorithms for deformable part-based models (pictorial structures)

### Discriminative learning with latent variables (latent SVM)

### Data mining hard negative examples

# 06 PASCAL person detection challenge Winner

#### 06-CVPR-Histograms of oriented gradients for human detection (N.Dalal and B.Triggs)

# Deformable model for object categories

#### 07-IJCV-Patchwork of parts models for object recognition (Amit)

#### 98-ECCV-A probabilistic approach to object recognition using local photometry and global geometry (Burl)

#### 07-CVPR-Spatial priors for part-based recognition using statistical models (Felzenszwalb)

#### 07-CVPR-Semantic hierarchies for recognizing objects and parts (Epshtein)

#### 05-IJCV-Pictorial structures for object recognition (Felzenszwalb)

#### 03-CVPR- Object class recognition by unsupervised scale-invariant learning (Fergus)

#### 73-Trasaction on Computer- The representation and matching of pictorial structure (Fischler)

#### 01-IJCV- Probabilistic methods for finding people (Ioffe)

#### 06-CVPR-Context and hierarchy in a probabilistic image model (Jin)

#### 04-IJCV- Object detection using the statistics of parts (Schneiderman)

# Non-deformable models

### Rigid templates (HoG)

###### 06-CVPR-Histograms of oriented gradients for human detection

### Bag-of-features

###### 07-IJCV-Local features and kernels for classification of texture and object categories: A comprehensive study

# Using HOG

#### 05-CVPR- A discriminative framework for modelling object classes

#### 01-IJCV- Probabilistic methods for finding people

#### 06-CVPR- Training deformable models for localization

# Latent SVM

### Non-convex training

### Semi-convex

### Convex once latent information is specified for positive training examples

### Hidden CRF

###### 07-PAMI- Hidden conditional random field

# Framework

### HOG extraction

##### The image is first divided into 8x8 non-overlapping pixel regions, or **cells**

Capture local shape properties

Invariant to small deformations

##### Compute gradient at each at each pixels, discretize into one of nine orientation bins

Pick the channel with highest gradient magnitude at each pixel

##### The histogram of each cell is normalized with respect to the gradient energy in a neighborhood around it. (2x2 block)

### Filters

##### ***F****: weights* for subwindos

##### ­­­ is a HOG pyramid

##### : a cell in the l-th level of the pyramid

##### HOG features in the subwindow of with top-left corner at

##### Score:

### Deformable Parts

##### For example, consider building a model for a face.

The root filter could capture coarse resolution edges such as the face boundary

The part filters could capture details such as eyes, nose and mouth

##### The model for an object with *n* parts

A root filter

Part models **,**

is the i-th part filter

is the relative position

is the box(subwindow) size

is the penalty for displacement

##### Placement of a model

, where

the level of each part is such that a HOG cell at that level has half the size of a HOG cell at the root level

score of a placement

, [-1,1]