Histogram of Oriented Gradients

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How can we find a good representation for all these people?

How can we find a good representation for an interested point?
Introduction

• Find robust feature set that allows object form to be discriminated.

• Challenges
  – Wide range of pose and large variations in appearances
  – Cluttered backgrounds under different illumination
  – “Speed” for mobile vision

• Reference
Why HoG?

• Local object appearance and shape can often be characterized rather well by the distribution of local intensity gradients or edge directions.
Histogram of Gradient

- Dividing the image window into small spatial regions (*cells*)
- Cells can be either rectangle or radial.
- Each cell accumulating a weighted local 1-D histogram of gradient directions over the pixels of the cell.
Histogram of gradient
Normalization

• For better invariance to illumination and shadowing, it is useful to contrast-normalize the local responses before using them.

• Accumulate local histogram “energy” over a larger regions (“blocks”) to normalize all of the cells in the block.
Implementation

- 64*128 detection window
- Normalize gamma and color by RGB and LAB to normalize the energy of the cells.
- Linear SVM for object/non-object classifications.

Comparisons

Miss rate as the cell and block size changes.

Effect of number of orientation bins
Compressed Histogram of Gradients

- Feature compression is vital for reduction in storage, latency and transmission.

Compressed HoG

Patch

Gradients

Spatial binning

Gradient distributions for each bin

Histogram compression

CHoG Descriptor
Gradient Histogram Binning
CHoG: Huffman coding

Gradient distribution

Huffman tree approximates probabilities

Gradient binning
Search Strategies
Comparisons

Receiver Operating Characteristic

Correct Match Fraction

Incorrect Match Fraction

- SIFT (1024 bits)
- Huffman VQ–5 (50 bits)
- Huffman VQ–7 (88 bits)
- Huffman VQ–9 (171 bits)
Applications

- [http://www.youtube.com/watch?v=0HOO80RitVI&feature=player_embedded](http://www.youtube.com/watch?v=0HOO80RitVI&feature=player_embedded)
- [http://www.stanford.edu/~vijayc/publication.html](http://www.stanford.edu/~vijayc/publication.html)
Reference