Real Time Pedestrian Detection

Jasper Vicenti, 2006
Overview

• Preparing the data
• Training the detector
• Testing the detector
• Results
Positive Sample Extraction

- From the labeled data, we use Matlab to separate positive samples from background data, with aspect ratio 1:2

- Negative samples are randomly derived from non-labeled data (green boxes)
Example of 1 Positives
Example of I Negatives
Example of IR Positives
Example of IR Negatives
Object Detection

- Implements a variation on the Viola-Jones 2001 paper [1, 2]

- *Boosted Cascade of Weak Classifiers* trained from positive and negative samples

- Each stage of cascade will reject at least 50% of the negative samples and keep at least 99.95% of the positive samples
Haar-like Features

- Basic set of features used in the training of our detector
Example of Intensity Features

- First six (of 19) features used in first stage of intensity
Example of IR Features

- Features used in first stage of IR detector
# Training Data and Results

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Negative</th>
<th>Stages</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intensity</strong></td>
<td>1,100</td>
<td>60,000</td>
<td>30</td>
<td>2,868</td>
</tr>
<tr>
<td><strong>IR</strong></td>
<td>500</td>
<td>45,000</td>
<td>18</td>
<td>416</td>
</tr>
</tbody>
</table>

- Performance: 2 fps for intensity
- Note: *Negative* is based on 2,000 negatives per stage for intensity, 2,500 negatives per stage for IR
Performance Evaluation

• Detector is run against a test data set separate from the training set

• Resulting bounding boxes are post-processed to merge overlapping boxes and eliminate outliers

• A precision-recall curve can be generated based on how many stages a given box survives in the classifier; a higher stage denotes greater confidence in that detection
Intensity Results

- Random sampling of boxes from indoor data set
Intensity Results

- Precision-Recall Curve
- Only including bounding boxes which survive beyond a minimum stage.

![Precision-Recall Curve Graph](image)
IR Results

- Random sampling of boxes from indoor data set
IR Results

• Precision-Recall Curve
Demo