Detector ensemble based on false positive mining for pedestrian detection

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Background

- Demand for vision based pedestrian detection
  - Collision avoidance systems, etc.
- Large variations in road environments make pedestrian detection difficult
  - Increase of false positives (FP)

Purpose

- Reduction of false positives caused by various visual structures in road environments

Proposed method (False positive tendency and detector ensemble)

Idea of detector

- Characteristic FPs are observed in each environment
  - Trees, utility poles, traffic signs, etc.
- Ensemble of detectors referring to false positive tendency
  - By clustering FPs commonly observed between environments

Capable to adapt to changes in environment

Training phase

- Baseline detector
- False positive mining
- Computation of correspondences between training images and false positive tendency
- Construction of detectors referring to false positive tendencies (H_a, H_b, H_c...)

Detection phase

- Detector for tendency A
- Detector for tendency B
- Detector for tendency C

Pedestrian detection

- Majority voting of detectors
  - Output a detection window only if voted by more than half of the detectors

Experiments

- Experimental setup
  - Dataset: Daimler Mono Benchmark dataset
  - Detector: HOG + SVM
    - HOG: 6,024 feature dimension
      (Cell size: 6 pixels, Block size: 5 cell)
    - SVM: LIBLINEAR’s default parameters
  - Clustering method: k-means clustering (k=5)
- Result
  - False positives significantly reduced
  - Accuracy increased by 9% when FPPF was 1.0

Example of false positive clusters

FROC curve

Conclusion

- Proposed a pedestrian detection method using a detector ensemble based on false positive mining
- Evaluated the accuracy and the effectiveness of the proposed method using the Daimler dataset

Future work

- Evaluation with a larger dataset
  - Caltech Pedestrian detection dataset, etc.
- Introduction of other training methods
  - Deformable Part Model (DPM), Deep Learning, etc.