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Faster Pedestrian Recognition Using Deformable Part Models

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Abstract : Deformable part models achieve high precision in pedestrian recognition, but all publicly available implementations are too slow for real-time applications. We implemented a deformable part model algorithm fast enough for real-time use by exploiting information about the camera position and orientation. This implementation is both faster and more precise than alternative DPM implementations. These results are obtained by computing convolutions in the frequency domain and using lookup tables to speed up feature computation. This approach is almost an order of magnitude faster than the reference DPM implementation, with no loss in precision. Knowing the position of the camera with respect to horizon it is also possible prune many hypotheses based on their size and location. The range of acceptable sizes and positions is set by looking at the statistical distribution of bounding boxes in labelled images. With this approach it is not needed to compute the entire feature pyramid: for example higher resolution features are only needed near the horizon. This results in an increase in mean average precision of 5% and an increase in speed by a factor of two. Furthermore, to reduce misdetections involving small pedestrians near the horizon, input images are supersampled near the horizon. Supersampling the image at 1.5 times the original scale, results in an increase in precision of about 4%. The implementation was tested against the public KITTI dataset, obtaining an 8% improvement in mean average precision over the best performing DPM-based method. By allowing for a small loss in precision computational time can be easily brought down to our target of 100ms per image, reaching a solution that is faster and still more precise than all publicly available DPM implementations.

Keywords : autonomous vehicles, deformable part model, dpm, pedestrian detection, real time
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