

COMP6223 Computer Vision

Subverting Face Detection

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1 Introduction

This report highlight the different ways the Viola-Jones Haar Cascade Face detection algorithm can be subverted. This is achieved through applying specially orchestrated make-up at designated parts of the face and also wearing clothing which occludes certain aspects of the face whilst still remaining recognisable by a human.

2 Subverting by applying make-up on the face

Taking into account the way the Viola-Jones Haar Cascade Face Detection algorithm (referred to as Face Detection algorithm henceforth) works, one can carefully curate features on the face to trick the algorithm into not detecting a face.

One of the ways this is achieved is with the knowledge that the face detection algorithm uses a window where the average intensity of the rectangular window divided into 3 parts with the middle part being the nose and the other windows being the eyes; it expects a darker region on the sections over the eyes than the section over the nose.

Taking this into account, white face make-up is applied over the eyes and dark face make-up is applied over the nose bridge. With these special effects applied, when the rectangular window slides over the face, this should create some form of noise over the image resulting in higher intensity values over the eyes and a lower value over the middle section; the algorithm should then misclassify this region. As shown in image 1, there is no bounding box over the face as the algorithm has misclassified this as not a face.



Figure 1: Applying make-up to subvert the algorithm

3 Subverting by partially occluding the face

The Face detection algorithm takes into account the location of the eyes, nose and mouth. By partially occluding the face as shown in image 2a and image 2b, the

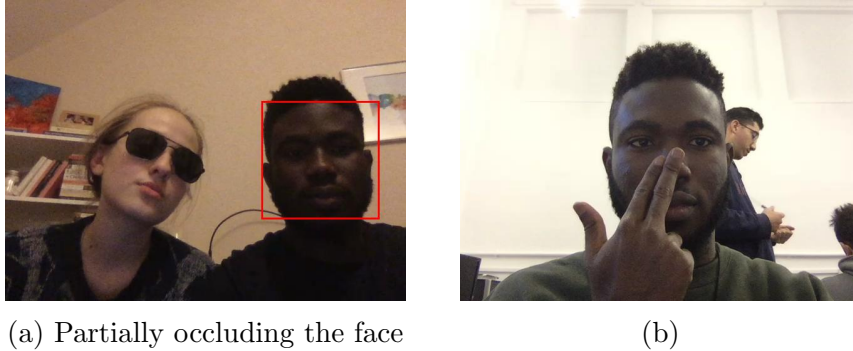


Figure 2: Viewing images at different scales

algorithm is unable to locate the eyes in the image. This is due to the occlusion of the required features necessary to identify a face such as the dark glasses in image 2a and the finger over the nose in image 2b; As these occlusions also affect the intensity values in the targeted parts of the face.

4 Conclusion

Whilst the Viola-Jones algorithm is not the current state of the art, it was one of the first algorithms to run in real time. Numerous algorithms have been further proposed as improvements over the Viola-Jones algorithm such as Feature Point detection, Bag-of-Words models, Histogram-of-oriented gradients (HOG), Deformable Parts Models, Exemplar models and Deep Convolutional Networks with DeepFace by Facebook [1] being one of the best performing algorithms.

References

- [1] Yaniv Taigman, Ming Yang , Marc'Aurelio Ranzato and Lior Wolf. *DeepFace: Closing the Gap to Human-Level Performance in Face Verification*. Conference on Computer Vision and Pattern Recognition (CVPR), 2014.