

FACE RECOGNITION BY HUMAN AND BY COMPUTER: TWO SIDES OF THE SAME COIN, OR NOT

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ABSTRACT

Human perception is fine-tuned to detect and recognize face images with great precision, compared to all existing face recognition algorithms running on most efficient computers that exist. Can we learn from human perception to improve the performance of face recognition by a computer? Or, is it that such a biologically-inspired approach, or biomimetic, is not a good idea at all in this context?

In this talk, we will start by introducing some interesting facts in human perception and recognition of faces. We will then present examples of image analysis techniques that are inspired by human perception. Comparing these techniques with face recognition algorithms based on conventional pattern recognition techniques, we identify some promising research directions.

A CASE STUDY

As humans, we are good at recognizing faces that we are familiar with, and distinguishing them from possibly millions of faces that we have never seen. Even with appearance variations due to expressions, viewpoints, hairstyles, etc., we can recognize faces with great precision. However, when we are asked to identify unfamiliar faces by looking at frontal-view images, such as in identifying the photo on a credit card, our performance is much lower [1]. Experiments have shown that a “3/4-view” image, the face viewed at a 45-degree angle, provides much better identity information than frontal- or profile-view images [2]. A 3/4-view image provides critical information of the face such as the nose height and

the ear shape. Therefore, if we can create a 3D face model, either manually or using shape-from-shading or shape-from-motion techniques, and animate the 3D model to create face images of various poses, we should be able to improve the performance of face recognition, either by human or by computer.

Research has shown that faces in video are easier to identify than faces in still images [3]. One reason is that a lot of artifacts in still images, due to either camera noise or low resolution, can be reduced if viewed as video. Another reason is that video provides information about the 3D structure of the face and how facial gestures vary with expressions. These results suggest that the performance of face recognition algorithms may benefit from using video as input, instead of frontal-view still images.

Compared to still images, 3D face models allow us to render face images at different poses and under various illumination conditions. Supported by evidences in literature, we conjecture that, by creating and animating a 3D face model, we may improve accuracy of face recognition algorithms.

REFERENCES

- [1] Pike, G., Kemp, R. and Brace, N., “The psychology of human face recognition,” *IEE Electronics and Communications: Visual Biometrics*, 00/018, pp.12/1-12/6, 2000.
- [2] Bruce, V. and Valentine, T., “The basis of the 3/4 view advantage in face recognition,” *Applied Cognitive Psychology*, 1, pp. 109-120, 1987.
- [3] Lander, K. and V. Bruce, “Recognizing famous faces: Exploring the benefits of facial motion,” *Ecological Psychology* 12(4), pp. 259-272, 2000.