

Accepted Manuscript

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Using Frontal Face Detector and Symmetry Extension

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PII: S0262-8856(18)30128-8
DOI: doi:[10.1016/j.imavis.2018.07.003](https://doi.org/10.1016/j.imavis.2018.07.003)
Reference: IMAVIS 3708
To appear in: *Image and Vision Computing*
Received date: 17 August 2017
Revised date: 16 May 2018
Accepted date: 27 July 2018

Please cite this article as: Yu-Hsuan Tsai, Yih-Cherng Lee, Jian-Jiun Ding, Ronald Y. Chang, Ming-Chen Hsu , Robust In-Plane and Out-of-Plane Face Detection Algorithm Using Frontal Face Detector and Symmetry Extension. *Imavis* (2018), doi:[10.1016/j.imavis.2018.07.003](https://doi.org/10.1016/j.imavis.2018.07.003)

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Robust In-Plane and Out-of-Plane Face Detection Algorithm Using Frontal Face Detector and Symmetry Extension

Yu-Hsuan Tsai¹, Yih-Cherng Lee¹, Jian-Jiun Ding¹, Ronald Y. Chang², and Ming-Chen Hsu¹

¹ Graduate Institute of Communication Engineering, National Taiwan University, Taipei, Taiwan

² Research Center for Information Technology Innovation, Academia Sinica, Taipei, Taiwan

r04942105@ntu.edu.tw, d04942009@ntu.edu.tw, jjding@ntu.edu.tw, rchang@citi.sinica.edu.tw,

anong9420@gmail.com

Abstract

Face detection plays an important role in many computer vision applications. In recent years, much research has focused on extending the well-established Adaboost face detector algorithm for multi-view face detection. However, detecting in-plane and out-of-plane rotated faces simultaneously is still a challenging task today. In this paper, a very robust multi-view face detection algorithm, with its core functionality based on frontal face detection, is proposed to simultaneously detect in-plane and out-of-plane rotated faces. Moreover, only the training data in the frontal face is needed and we do not require the training data from different in-plane or out-of-plane rotation angles. In the proposed algorithm, first, techniques such as the skin filter and entropy rate superpixels (ERSs) are applied to obtain face candidates. Then, angle compensation and refinement are applied to improve the accuracy of face detection in the in-plane case. Moreover, the symmetry extension technique, i.e., extending the face candidate with its flipped version to create a face similar to the frontal one, is applied to detect out-of-plane faces without the need of training data. Simulations on the FEI, Pointing'04, BaoFace, Group, Utrecht, and WWW datasets demonstrate the proposed algorithm's effectiveness and superior performance as compared to state-of-the-art face detection methods.

Index Terms—face detection; in-plane rotation; out-of-plane rotation; symmetry extension; superpixel based face candidate.

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