Side Face Contour Extraction Algorithm for Driving Fatigue Detection

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Abstract. Fatigue-driving detection, which employs pattern recognition measure to discover driver's fatigue stat, is considered as a key technique to improve road safety. However, the widely used frontal face recognition systems bring some problems, such as low recognition accuracy, poor real-time ability, and high algorithm complexity. As a very efficient supplement, in this paper, a side face contour extraction algorithm is proposed, which is composed of side face basic extraction, image correction and side face contour extraction. Experiment results show that proposed algorithm could extract nose and chin contour line from side face image effectively and this lay a good foundation for fatigue state's real-time tracking application.

Introduction

Road transportation safety is a 'grand challenge' problem for a modern industrial society with close to a billion vehicles on the road today, and a doubling projected over the next 20 years. Traffic accidents have been taking tens of thousands of lives each year, outnumbering any deadly diseases or natural disasters [1]. A number of studies in the world have shown that some bad driving behaviors, including fatigue driving, are the main causes of traffic accidents. Therefore, researchers are committed to developing new techniques to detect fatigue-driving state and put forward corresponding alarm methods. It is generally accepted that pattern recognition is an effective measure in fatigue driving detecting process, while related techniques, such as face location detection [2], eye detection [3][4], etc., are considered as key issues in this field of research.

The mainstream device to monitor the driver state is a video camera. And the mainstream driving fatigue detecting methods focus on eye, mouth and head posture detection from frontal images of human face [2]. However, due to the individual difference of human face, frontal images analysis always involve a series correction techniques, which should bring a relative long decision time and reduce the system in real-time. Furthermore, the ambient illumination is considered as another serious impact factor. The variation of frontal face image, brought by the ambient illumination, is even bigger than the variation between the face images from different bodies [5].

To overcome the shortage of frontal images fatigue detection, in this paper, a side face recognition method is proposed. Unlike frontal image detection, proposed method focus on the relationship between facial profile and driver fatigue status, and make decision according to the profile change of nose, mouth and chin.

The rest of the paper is organized as follows. Section 1 presents the flowchart of proposed side face recognition method. Section 2 presents corresponding illumination adaptive techniques; while section 3 gives the accuracy enhance method. The facial contour extraction measure is described in section 4. At last, section 5 draws some conclusions and gives directions for further research.

1. Flow of proposed side contour extraction algorithm