Photographic Environment Independent Multiview Face Detection and Tracking Using Template Generation by Genetic Algorithm

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1 Abstract

This paper explains photographic environment independent multiview face detection and tracking. The photographic environment means a variety of illumination conditions, backgrounds, appearances of objects, and qualities of images in this thesis. The multiview face detection and tracking in these photographic environments is a difficult problem. In order to address this research task, novel methods using template generation and template matching with genetic algorithm (GA) are proposed.

In the first chapter, introduction of this thesis is described. For example, research backgrounds, tasks, and approaches of the proposed methods are explained.

The second chapter explains the theoretical background. Since the proposed methods are based on template matching, which is a basic object detection method, the procedure of this method is firstly described. Next, the problem of this approach is pointed out. Because the author tries to solve this problem using evolutionary computation method which include genetic algorithm (GA), particle swarm optimization (PSO), and differential evolution (DE), these algorithms are explained. After that, how to apply the evolutionary algorithms to template matching is described. Finally, the performances of GA and PSO on template matching for frontal face detection and tracking are compared.

In the third chapter, high-speed multiview face detection and tracking using effective template generation and search by GA is described. The multiview face detection and tracking is a difficult task since the face appearance three-dimensionally and continuously varies. Recent related works address this problem using a machine learning method and large image datasets. However, this approach requires hard work and long time because many images for training and testing must be collected and manually annotated one by one. In order to avoid this, the author proposes a novel method as the following. First of all, one 2D face model is manually created. Next, three parameters to generate templates, which correspond to the pitching and yawing face, are defined. After that, these parameters are set as chromosomes of individuals of GA. Similar to this, geometric transformation parameters such as parallel translation, scale, and in-plane rotation are also introduced as the chromosomes. By simultaneously optimizing these parameters using GA, suitable template, which can detect a target face, and location in the target image can be obtained. For the experiment, the author created a video dataset and its ground truth, and the proposed method and related works are compared. As a result, the effectiveness of the proposed method is confirmed.

The chapter four explains the multiview face tracking on privacy protected videos. This research is a practical research of the chapter three. The research objective is to track a multiview face on privacy protected videos. There are some methods to generate privacy protected videos like blurring and pixelating. These methods are certainly able to protect privacy, nevertheless tracking a face is difficult since some local features such as edges and corners are lost. In order to solve this problem, a novel preprocessing filter, which can generate privacy protected videos and preserve the original pixel values, are proposed. Also, multiview face tracking method, which is template matching with GA and uses color histograms as a feature to track, is proposed. Since the color histograms of the multiview face are almost common, the multiview face can be achieved by setting the color histogram of the frontal face as the template and localizing the face on the target image. For the experiment, a video dataset and its ground truth are created, and

the proposed method and related works are compared. From the experimental results, the proposed method achieves better tracking performance.

The chapter five describes the conclusion of this research.