

## FACE IMAGE RETRIEVAL BASED ON CONCENTRIC CIRCULAR FOURIER-ZERNIKE DESCRIPTORS

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**ABSTRACT.** *This paper proposes a new method of concentric circular Fourier-Zernike descriptors (CCFZD) for face image retrieval. The descriptors creation consists of two main steps. Firstly, we convert the original square image into a circular image and then partition it into several concentric circular subimages in a new polar coordinate space. Secondly, we compute the local invariant Zernike moments for each concentric circular subimage and then apply the one-dimensional Fourier transformation on these Zernike moments to obtain the Fourier-Zernike descriptors. The experimental results on AR gray face database and ORL FERET mixed face database show that, compared with the traditional face retrieval features, the proposed descriptors are robust to different facial conditions of expression, pose, illumination and partial occlusion, and can greatly improve the retrieval precision and retrieval speed simultaneously.*

**Keywords:** Zernike moments, Fourier descriptors, Concentric circular Fourier-Zernike descriptors (CCFZD), Face image retrieval

**1. Introduction.** Content-based image retrieval (CBIR) has attracted much research interests with the rapid development of computer, multimedia and network technologies recently [1]. Nowadays we usually need to query a given face image from a large database to judge its identity for security reason, which is named face image retrieval. But as we all know, facial appearance varies largely with intrinsic factors such as facial expressions, make-up styles, and extrinsic factors such as pose change, illumination variation, and partial occlusion and so on. These factors will cause many difficulties for constructing robust face retrieval models [2]. Recently, some face descriptors have been proposed for face image classification and retrieval. Reference [3] proposed the second-order Eigenface (SEF) method for describing face symmetry and intensity variation. The second-order PCA Mixture Model (SPMM) method was developed in Reference [4]. Reference [5] used the DCT-based Embedded Hidden Markov Model (EHMM) for face features description. However, these features seem to be weak because they mainly describe a holistic pixel distribution of the image, which is sensitive to pose and expression variation [2].

Compared with color and texture, shape is one of the most important features used in CBIR systems due to its invariance to image rotation, illumination variation and partial occlusion, which makes it quite suitable for characterizing the robust face features [1]. The shape description features usually can be divided into two categories, the region-based shape features and the contour-based shape features [6]. The region-based shape