A Study of Sub-Pattern Approach in 2D Shape Recognition Using the PCA and Ridgelet PCA

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ABSTRACT
In the area of computer vision and machine intelligence, image recognition is a prominent field. There have been several approaches in use for 2D shape recognition using shape features extraction. This paper suggest, subspace method approach. Normally in the earlier methods proposed so far, an entire image is considered in the training and matching operation, with sub pattern approach a given image is partitioned in to many sub images. The recognition process is carried out in two steps, in the first step the Ridgelet transform is used to feature extraction, in the second step PCA is used for dimensionality reduction. For recognition efficiency rate a test study is conducted by using seventeen different distance measure technique. The training and testing process is conducted using leave-one-out strategy. The proposed method is tested on the standard MPEG-7 dataset. The results of Ridgelet PCA are compared with PCA results.

KEYWORDS
2D Object Recognition, Distance Measure Techniques, Modular Approach, Principal Component Analysis, Ridgelet Transform, Subspace

INTRODUCTION
Computer vision is a field in which machines are trained and equipped with the ability to depicting human vision in the machines that is to make the machines view and recognize objects in a scene. In the recent year computer vision have made enormous progress in this field to achieve high quality visual perception and object recognition. To recognize an object, there are several properties that can be used for the purpose of recognition and classification, like object shape, object color, object texture and object brightness. Of all these properties shapes is the most intrinsic feature used for recognition of objects. Shape representation is done using two major approaches, one the boundary based approach

Helin.D, Bulent.S and Yucel. Y (2010), proposed a method using subspace approach, which solves the ambiguity of pose normalization with continuous PCA coupled with the use of feasible axis labeling and reflection (p.865). Bribiesca. E and Wilson.R.G (1997), presented an approach for 2D shape object dissimilarity. The shape of the different objects to be compared is mapped to a representation invariant under translation, rotation and Scaling (p. 107). Bandera et al. (1999), proposed an algorithm, where contours are represented by their curvature function, decomposed in the Fourier domain as linear combination of a set of representative object and object are identified by multilevel clustering (p. 49). Kumar and Rockett (1997), proposed a method representing scaling, translation and rotation based on the invariance properties of angle of the triangle, which are used to construct signature histogram of local shape (p. 235). Guerra. C (1998), presented an approach using reconfigurable mesh architecture with horizontal and vertical broadcasting. The object models are described in terms of a convex/concave multi scale boundary decomposition that is represented by a tree structure (p. 83). Khalil and Bayoumi (2000), proposed a method to recognize 2D object under translation, rotation and scale transformation, using the technique based on the continuous wavelet transform and neural networks (p. 863). Mcneill and Vijaykumar (2005), present a corresponding-based technique for efficient shape classification and retrieval. Shapes are represented by a large number of points on the boundary, the points lie at fixed intervals on the boundary or radial angle, which gives a robust description of shapes (p. 1483).

Belongie et al. (2002), present a method to measure similarity between shapes, and exploit it for recognition. In this framework it solves for correspondences between points on the two shapes, by using the correspondence to estimate an aligning transforms (p. 509). Sun et al. (2008), proposed a method that employs the eigen-values of covariance matrix, re-sampling, and autocorrelation transformation to extract unique features, and then use minimum euclidean distance method and back propagation neural networks for classification (p. 1966). Nam et al. (2008), presented a scheme for similarity-based leaf images retrieval. The method compares the effective measurement of leaf similarity, by considering shape and venation features (p. 245). Arodz.T (2005), proposed a method using the radon transform properties to drive the invariant transformation involving translation compensation, angle representation and 1-D Fourier transform (p. 183). Daliri and Torre (2007), proposed an algorithm based on dynamic programming to find the object match (p. 1782). Nemeth et al. (2009), proposed a method to align two binary images, by estimating the parameter of a homograph (p.2170). Song (2010), proposed an algorithm that uses bipolar model for computing shape similarity. It uses trees to represent model structure of a region (p.286). Shi.J and Xu (2012) presented an algorithm to achieve 2D image shape manipulation by real-time control. By dividing the shape into regular equilateral triangles mesh. (p. 432). Li and Liu (2012), proposed a method on deformation of the 2D shapes by holomorphic coordinates that directly take user specified points. (p.443). Lovato et al. (2014), presented a method that uses biological sequence alignment tools to classify 2D shapes, the semantic of the 2D shape scenario are accounted by tailoring the biological parameter. (p.2335). Gewali and Hada (2015), proposed a method for constructing polygonal shapes from given point sites by modeling polygons with holes using inward denting approach. (p.708). Virmani et al. (2016), proposed a method for early prediction of breast density by two computer aided diagnostic (CAD) systems that has been compared for classification of breast tissue density. (p.159). Nandi et al. (2015), presented a survey on medical image processing adopting the principal component analysis. (p.45).

From the literature survey conducted, it is witnessed that, the methods developed so far on 2D shape based object recognition have their own merits and demerits. So a thorough observation was made and a conclusion was drawn that, an ample amount of research work can be done and new methods...
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