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Object Recogniton Based on Undecimated Wavelet Transform

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Abstract - Object Recognition (OR) is the mission of finding a specified object in an image or video sequence in computer vision. An efficient method for recognizing object in an image based on Undecimated Wavelet Transform (UWT) is proposed. In this system, the undecimated coefficients are used as features to recognize the objects. The given original image is decomposed by using the UWT. All coefficients are taken as features for the classification process. This method is applied to all the training images and the extracted features of unknown object are used as an input to the K-Nearest Neighbor (K-NN) classifier to recognize the object. The assessment of the system is agreed on using Columbia Object Image Library Dataset (COIL-100) database.

Key words: Object recognition, wavelet transform, K-Nearest Neighbor.

I. INTRODUCTION

Large amount of objects in images are recognized by human with small try, in spite of the fact that the image of the objects may vary by different sizes / scale, diverse viewpoints or even when they are translated or rotated. This assignment is still a test for computer vision systems. Over the years, extensive researches have been done for the recognition of objects in an image. In this section, the review of literature is given for OR. A rotation and validation invariant OR is explained in [1]. By utilizing local adaptive binarization and DoG channel, a binary image reserving spotless object boundaries is accomplished. OR is done by using neural network.

OR based on tree-based context model is explained in [2]. This pattern incorporates worldwide image features, dependencies between categories of object, and outputs of nearby detectors into one probabilistic structure. A method for OR by developing the popular bag-of-words methods from the following two aspects is presented in [3]. To make the semantic significant object parts, a fast method is approached by exploiting the geometric site allocation of the nearby salient regions. At last, multi-kernel learning framework is utilized to add extracted features. OR using Bayesian approach based on Gaussian process regression is discussed in [4]. To study the likelihood of image features, gaussian process regression is given. The selection of suitable camera parameters is formulated as a chronological optimization problem. A video surveillance OR algorithm is discussed in [5], in which improved invariant moments and length-width ratio of object are extracted as shape feature, while color histograms of object are used as color feature. Closed 2D curves are parameterized, and Fourier descriptors are utilized in [6] to create a set of normalized coefficients which are invariant under affine transformations. The method is recognized on silhouettes of aircraft.

Online kernel dictionary learning for OR is explained in [7]. An optimization model to concurrently execute prototype selection and kernel dictionary learning is approached. A row-sparsity regularization term on the representation matrix is introduced to make sure that only a few samples are used to recreate the dictionary. A method using hidden Markov models is described capable of dealing with severe part occlusions in different OR situations [8]. A hidden Markov model is developed for each probable class in an ensemble trained with database from each class example. Introduced the strategy for search space sorting and stopping criterion. In a multifaceted environment, simultaneous OR and tracking has been one of the challenging topics in computer vision and robotics [9]. The data-driven unfalsified control is discussed for solving this problem in visual servoing. It recognizes a target through matching image features with a 3-D model and then tracks them through dynamic visual servoing. The discussion in [10] is about an image as a local descriptor tensor and use a Multilinear Supervised Neighborhood Embedding (MSNE) for discriminant feature extraction. It includes: 1) a

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feature extraction approach denoted as the histogram of orientation weighted with a normalized histogram of gradients for local region representation. 2) an image representation framework denoted as the local descriptor tensor and 3) an MSNE analysis algorithm.

II. PROPOSED METHODOLOGY

The proposed system for the recognition using coil database is built based on UWT and K-NN classifier for classification. The main aim of the proposed system is to recognize object in an image efficiently. It is composed of two computational blocks; feature or information extraction, and classification. Figure 1 shows the flow of the OR system.

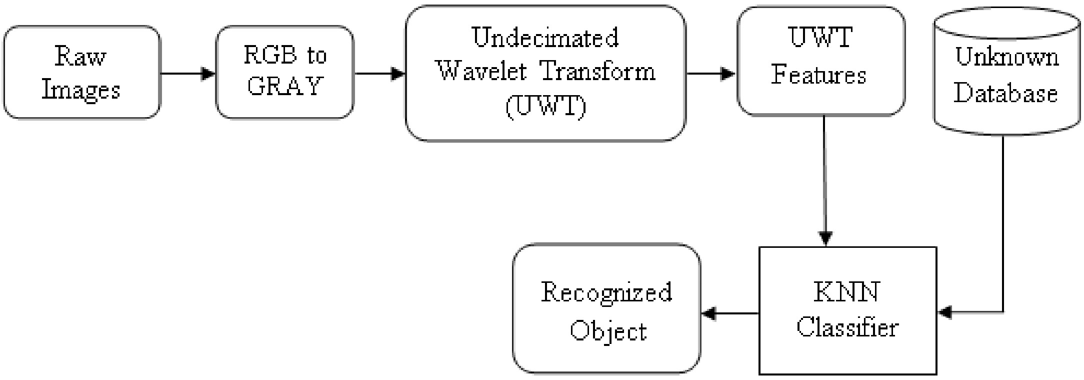

Figure 1: Proposed Object Recognition System

Development to DWT is the UWT in order to ease the major disadvantage i.e. lack of translation invariance of DWT. By taking the up and down samples in the DWT only, it was achieved. So, the UWT result contains the amount of coefficients in same as the amount of pixels in the input image at each step which entail more space for additional process and feature extraction might be complicated. The high dimensionality UWT coefficients space is decreased to avoid by fusion approach and the predefined number dominant features are selected for improved classification.

III. RESULTS AND DISCUSSIONS

In this section, the performance of the proposed system based on the undecimated features is discussed and verified. Features from UWT are given as input to the classification stage. K-NN is used as classifier to classify the images from the trained images to recognize the object. The classification accuracy is used to analyze the performance of the system. Figure 2 shows the sample objects in the COIL database. It consists of 100 objects of 128 x128 pixels resolution. Table 1 shows the accuracy obtained by the system.

Figure 2: COIL Database

Table 1: Performance of the UWT based object recognition system

UWT Resolution Level	Accuracy (%)	Sensitivity (%)	Specificity (%)
1	89.5	89	90
2	92	91	93
3	95.5	95	96
4	90.5	90	91
5	88.5	88	89

It is observed from the table 1 that the UWT based OR system provides 95.5% accuracy by using the features at 3rd level UWT decomposition and using training samples acquired.

IV. CONCLUSION

In this paper, an approach for OR based on UWT features is presented. Undecimated coefficients are used for feature extraction. Obtained features are applied to the classification stage. KNN classifier uses the trained images from the feature extraction stage as references and classifies the test objects. The classification performance of the UWT based system is evaluated by using classification rate in percentage. Experimental results show that the proposed approach produces 95.5% accuracy.

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