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A GENERIC APPROACH TO CONTENT BASED IMAGE RETRIEVAL USING DCT AND CLASSIFICATION TECHNIQUES

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Abstract

With the rapid development of technology, the traditional information retrieval techniques based on keywords are not sufficient, content - based image retrieval (CBIR) has been an active research topic.Content Based Image Retrieval (CBIR) technologies provide a method to find images in large databases by using unique descriptors from a trained image. The ability of the system to classify images based on the training set feature extraction is quite challenging.

In this paper we propose to extract features on MRI scanned brain images using Discrete cosine transform and down sample the extracted features by alternate pixel sampling. The dataset so created is investigated using WEKA classifier to check the efficacy of various classification algorithms on our dataset. Results are promising and tabulated.

***Keywords* :**CBIR, Datamining, DCT, IB1, Naïve Bayesian, Random tree, Brain images.

1.Introduction

With the rapid development of technology, the traditional information retrieval techniques based on keywords are not sufficient, content - based image retrieval (CBIR) has been an active research topic.Content Based Image Retrieval (CBIR) technologies provide a method to find images in large databases by using unique descriptors from a trained image. The ability of the system to classify images based on the training set feature extraction is quite challenging.

Various techniques for CBIR have been proposed based on wavelet transform co efficient distribution [1]. unlike other time frequency transformations, the function basis is not defined by the wavelet method. So choosing the mother wavelet adapted to studied images is the obvious choice. Classical wavelets have been tested (Haar,Daubechies 9/7, Le Gall 5/3, Daubechies 4-tap orthogonal...)., In 1994, Sweldens introduced a convenient way to satisfy all the desired properties of wavelets by reducing the problem to a simple relation between the wavelet and scaling coefficients. This approach is called the lifting scheme. It permits to generate any compactly supported biorthogonal wavelet. An interesting property of biorthogonal wavelet filters is that they allow a perfect reconstruction of decomposed images. All the more, the lifting scheme makes the wavelet transform faster, hence it is use in the Jpeg-2000 compression standard.

Gaussian mixture models [2], have been used extensively in many data modeling applications. Using them for the CBIR problems allows us to bring to bear several powerful features of the GM modeling methodology, such as modeling flexibility and easy training, that make it attractive for a wide range of applications.

Other popular techniques include Neuro fuzzy techniques [3] and algorithms based on edge detection[4]. Features extracted from images include color extraction using hue saturation values and Texture extraction.

2.Proposed Methodology

In this paper it is proposed to use the discrete cosine transform with alternate pixel reduction on MRI brain scan to create the dataset. The dataset so created is resampled the data before knowledge discovery is made using Bayesian function, Random forest and IB1.

The block diagram of the proposed method is shown in figure 1.

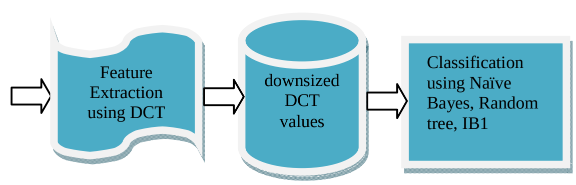

Figure 1. The Feature extraction and classification proces

3.Discrete Cosine Transform

A discrete cosine transform (DCT) expresses a sequence of finitely many data points in terms of a sum of cosine functions oscillating at different frequencies. DCTs are important to numerous applications in science and engineering, from lossy compression of audio and images (where small high-frequency components can be discarded), to spectral methods for the numerical solution of partial differential equations. The use of cosine rather than sine functions is critical in these applications: for compression, it turns out that cosine functions are much more efficient (as explained below, fewer are needed to approximate a typical signal), whereas for differential equations the cosines express a particular choice of boundary conditions.

In particular, a DCT is a Fourier-related transform similar to the discrete Fourier transform (DFT), but using only real numbers. DCTs are equivalent to DFTs of roughly twice the length, operating on real data with even symmetry (since the Fourier transform of a real and even function is real and even), where in some variants the input and/or output data are shifted by half a sample. There are eight standard DCT variants, of which four are common.

The most common variant of discrete cosine transform is the type-II DCT, which is often called simply "the DCT"; its inverse, the type-III DCT, is correspondingly often called simply "the inverse DCT" or "the IDCT". Two related transforms are the discrete sine transform (DST), which is equivalent to a DFT of real and odd functions, and the modified discrete cosine transform (MDCT), which is based on a DCT of overlapping data.

4.Data Mining

Data mining refers to *extracting or "mining" knowledge from large amounts of data*. Data mining involves an integration of techniques from multiple disciplines such as database and data warehouse technology, statistics, machine learning, high-performance computing, pattern recognition, neural networks, data visualization, information retrieval, image and signal processing, and spatial or temporal data analysis. By performing data mining, interesting knowledge, regularities, or high-level information can be extracted from databases and viewed or browsed from different angles [5]. The discovered knowledge can be applied to decision making, process control, information management, and query processing. Therefore, data mining is considered one of the most important frontiers in database and information systems and one of the most promising interdisciplinary developments in the information technology.

IB1 classifier is a simple instance-based learner that uses the class of the nearest k training instances for the class of the test instances.

Naive Bayes is a simple probabilistic classifier based on applying Bayes' theorem (or Bayes's rule) with strong independence (naive) assumptions[6] . The Bayes's rule for multiple evidences is represented mathematically as

$$\frac{P(H|E_1, E_2 \ldots E_n) = P(E_1, E_2 \ldots E_n \mid H) \times P(H)}{P(E_1, \ldots, E_n)}$$

A random forest is an ensemble (i.e., a collection) of unpruned decision trees[7]. Random forests are often used when we have very large training datasets and a very large number of input variables (hundreds or even thousands of input variables). A random forest model is typically made up of many decision trees. The generalization error rate from random forests tends to compare favorably to boosting approaches, yet the approach tends to be more robust to noise in the training dataset, and so tends to be a very stable model builder, not suffering the sensitivity to noise in a dataset that single decision tree induction does. The general observation is that the random forest model builder is very competitive with nonlinear classifiers such as artificial neural nets and support vector machines. However, performance is often dataset dependent and so it remains useful to try a suite of approaches.

Each decision tree is built from a random subset of the training dataset, using what is called replacement (thus it is doing what is known as bagging), in performing this sampling. That is, some entities will be included more than once in the sample, and others won't appear at all. Generally, about two thirds of the entities will be included in the subset of the training dataset, and one third will be left out.

In building each decision tree model based on a different random subset of the training dataset a random subset of the available variables is used to choose how best to partition the dataset at each node. Each decision tree is built to its maximum size, with no pruning performed. Together, the resulting decision tree models of the forest represent the final ensemble model where each decision tree votes for the result, and the majority wins.

5.Dataset used in Our Research Work

Images were collected from a scan centre and the data was anonymized. These images were randomly added with images obtained from public datasets. Figure 2 shows some of the images used in our dataset.

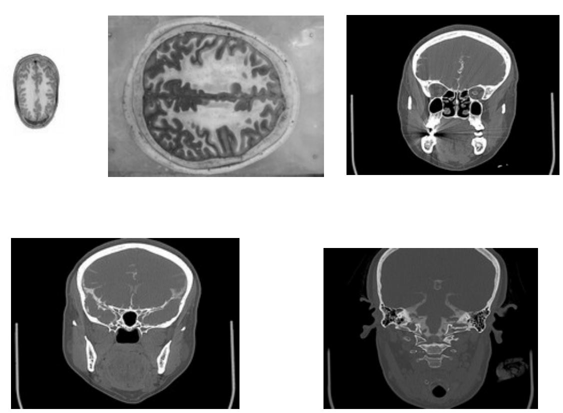

Figure 2. Some of the images used in our dataset.

6.Experimental Investigation

A customized tool was developed in LabVIEW 8.6 to convert a batch of images into their respective DCT. The data was downsampled. Figure 3 shows the screen interface of the LabVIEW GUI.

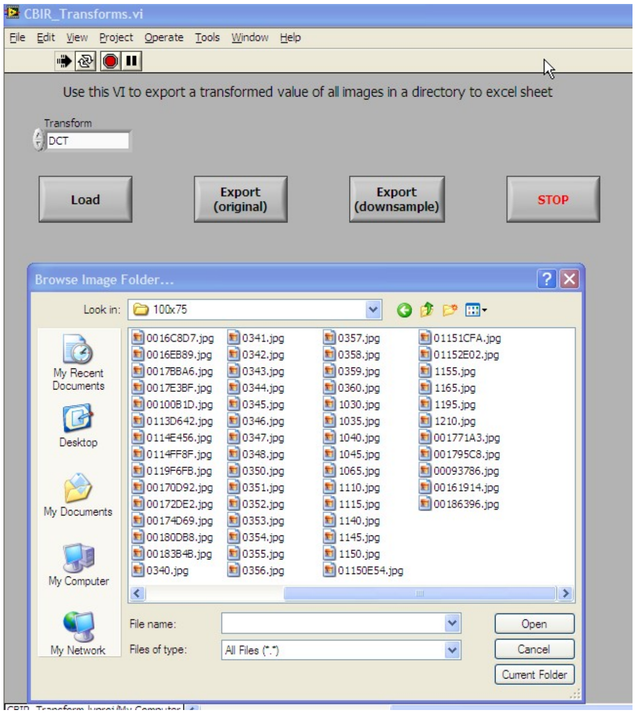

Figure 3: Software developed in LabVIEW

The dataset so created was resampled using WEKA and classified using Naïve Bayes, Random forest and IBI. The experimental results are shown in table 1.

Table 1: Comparison of classification accuracy

	% Correctly Classified	% Relative Absolute Error	% Root relative Squared error
Naïve Bayes	77.90	26.99	73.45
Random Tree	75.58	36.29	71.64
IB1	70.93	35.50	84.25

7.Conclusion

The outcome of the results using DCT for feature extraction is pretty promising. Further studies are required to study the efficacy of DCT methods with other known methods like Histogram and filtering techniques.

8.Reference

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