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Content based Image Retrieval by using the Bayesian Algorithm to Improve and Reduce the Noise from an Image

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I. Introduction

Medical informatics is the sub-discipline of health informatics that directly impacts the patient physician relationship. It focuses on the information technology that enables the effective collection of data using technology tools to develop medical knowledge and to facilitate the delivery of patient medical care. The goal of medical informatics is to ensure access to critical patient medical information at the precise time and place it is needed to make medical decisions. Medical informatics also focuses on the management of medical data for research and education.

CBIR Content based image retrieval Content-based image retrieval (CBIR), also known as query by image content (QBIC) and content-based visual information retrieval (CBVIR) is the application of computer vision techniques to the image retrieval problem, that is, the problem of searching for digital images in large databases. Content based image retrieval is opposed to concept based approached.

"Content-based" means that the search will analyze the actual contents of the image rather than the metadata such as keywords, tags, and/or descriptions associated with the image. The term 'content' in this context might refer to colors, shapes, textures, or any other information that can be derived from the image itself. Thus a system that can filter images based on their content would provide better indexing and return more accurate results. The term Content-Based Image Retrieval (CBIR) seems to have originated in 1992, when it was used by T. Kato to describe experiments into automatic retrieval of images from a database, based on the colors and shapes present. Since then, the term has been used to describe the process of retrieving desired images from a large collection on the basis of syntactical image features. The techniques, tools and algorithms that are used originate from fields such as statistics, pattern recognition, signal processing, and computer vision.

A better way to search is Content-based Image Retrieval.

1. CBIR consists of two elements:
   a. A feature extraction algorithm that describes the content of each image;
   b. A retrieval algorithm that uses the features to retrieve images according to a query.
2. Successful retrieval algorithms always work interactively with the user by a process called relevance feedback.

Feature Extraction 1

1. A computer extracts features of an image, to do with colour, texture, location and shape of objects.
2. These features (hopefully) describe well the content (or semantics) of the image.
3. This can be done off-line and needs to be done only once.
4. Searching the database is based on these features and a "similarity measure" between them.
5. This is a decreasing function of a distance between their features.

Feature Extraction 2

1. An image X is a matrix {Xij | i = 1, . . . ,n1; j = 1, . . ., n2};
2. Xij is colour of pixel (i, j); colour is a 3-vector, for example in RGB-space Xij = (Rij, Gij, Bij) ∈ {0, . .255} ^ 3.
3. Feature vector of length d is f (X) ∈ Rd;
4. Distance between images X1 and X2 is d(X1, X2) = k f (X1) − f (X2) k;

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5. Similarity measure s(X1, X2) = exp(−d(X1, X2)) or d(X1, X2) −1 etc.

a) Bayesian Algorithm

The Bayesian Classification represents a supervised learning method as well as a statistical method for classification. It can solve diagnostic and predictive problems. This Classification is named after Thomas Bayes (1702-1761), who proposed the Bayes Theorem. Bayesian classification provides practical learning algorithms and prior knowledge and observed data can be combined. Bayesian Classification provides a useful perspective for understanding and evaluating many learning algorithms. It calculates explicit probabilities for hypothesis and it is robust to noise in input data. Bayesian algorithm is used to reduce the noise from an image .noise can be reduced by using the resultant PSNR (peak signal to noise ratio) and MSE (mean square error).

PSNR is most easily defined via the mean squared error (*MSE*). Given a noise free $m \times n$ monochrome image I and its noisy approximation K, *MSE* is defined as:

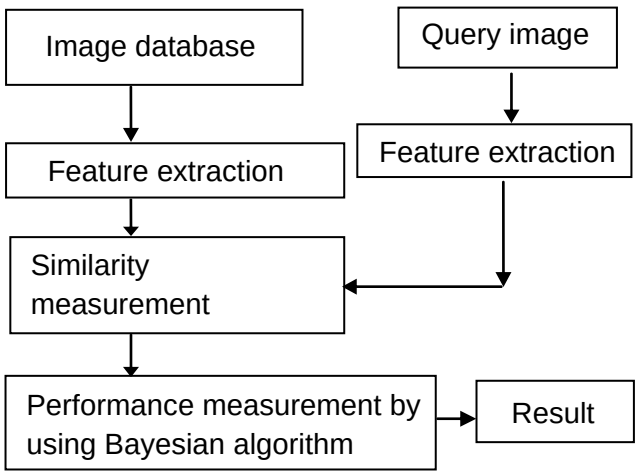
$$MSE = \frac{1}{m\,n} \sum_{i=0}^{m-1} \sum_{j=0}^{n-1} [I(i,j) - K(i,j)]^2$$

The PSNR is defined as:

$$\begin{aligned} PSNR &= 10 \cdot \log_{10} \left(\frac{MAX_I^2}{MSE} \right) \\ &= 20 \cdot \log_{10} \left(\frac{MAX_I}{\sqrt{MSE}} \right) \\ &= 20 \cdot \log_{10} (MAX_I) - 10 \cdot \log_{10} (MSE) \end{aligned}$$

Here, MAX_I is the maximum possible pixel value of the image.

Block Diagram



II. Methodology

The content-based image retrieval (CBIR), relevance feedback has been put on many efforts for the past few years, a new relevance feedback approach with progressive leaning capability. It is based on a Bayesian classifier and treats positive and negative feedback with different strategies.

According to the Bayesian algorithm firstly we take the image and applying the thresholding technique on that image .After the thresholding technique the given size of the image is changed or we can say that the given retrieved image is impact image and that impact on the retrieved image is defined by the MSE & PSNR. MSE is generally used to calculate the improve the performance percentage of the given image by using the thresholding technique and that result is SNR value. After calculating the MSE & SNR value we have to calculate the PSNR value by using the formula.

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Here, MAX_I is the maximum possible pixel value of the image.

When the pixels are represented using 8 bits per sample, this is 255. More generally, when samples

are represented using linear PCM with B bits per sample,

$$MAX_I \text{ is } 2^B - 1.$$

For color images with three RGB values per pixel, the definition of PSNR is the same except the MSE is the sum over all squared value differences divided by image size and by three. Alternately, for color images the image is converted to a different color space and PSNR is reported against each channel of that color space.

III. Conclusion

Analysis and improvement in CBIR using Bayesian approach by analyzing on the basis of texture, histogram equalization and edge density. Improving the quality and reduce the noise of retrieved image. The Bayesian algorithm provide the better result as compare to all other CBIR algorithm .In the future we can also work on DICOM images to improve the quality.

IV. Future Scope

According to this paper Bayesian is the best methodology for improving the image quality and also used in noise reduction.

In future work, also more improve the quality of an DICOM image with some another algorithm. It can also used in future with another algorithm for feature extraction.

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