

Content Based Image Retrieval System using Template Matching

Chivelkar Aimen^[1], Mulani Huda^[2], Kashid Pramil^[3], Shabana Tadvil^[4]

1, 2, 3 B. E Students, Computer Engineering Department, M. H. Saboo Siddik College of Engineering, Mumbai University, India.

4 Assistant Professor, Computer Department, M. H. Saboo Siddik College of Engineering, Mumbai University, India.

Abstract—For years, we have referred to images as a reliable and a more accessible source of information. The main object of this paper is to propose an efficient way to process this large database of information with the approach of Content Based Image Retrieval. In this paper, we propose an approach to develop a system in which visual features of a specific image are extracted and stored as a “template”. These templates are used as a measure of comparison to the query image and finally a list of exact or similar images is produced to the user based on the images present in the targeted database. Even if identical images are not present, the system retrieves similar images as well.

Keywords—*template matching; feature extraction; threshold; correlation;*

I. INTRODUCTION

The overall objective of any Content Based Image retrieval System is to extract the features of the query image and provide an output image that matches it visually. The extracted part of the image acts as a measure of similarity which in our case is in fact the template. Basically any part of an image that delivers a specific summary of its property can be counted as a feature. This can be the texture, colour, shape or even a part of the image. The main advantage of Image based retrieval is the fact that the user does not have to specify the requirement of the search like tags, links or text. The basis of matching and retrieval are in fact the explicit features of the image itself.

Comparison and matching is an integral and perhaps the most important stage of the process of the whole system. It is based on this stage that the nature of the result is determined. The list of images retrieved should have complete or partial resemblance to the input image. If the output produces a complete relevant result then the system is said to be fully efficient.

Content Based Image Retrieval is rapidly gaining focus around the world due to the increasing size of image databases. It provides for an easy to use interface for users as well as efficient management of bulk image data.

II. RELATED WORK

A. Existing System

Systems previously introduced which are partially or completely similar to our proposed technique are discussed below.

- **QBIC:**

Query By Image Content (QBIC) is a image retrieval system developed by IBM, Almaden Research Centre. It is a system that provides a multi-feature extraction approach for filtering queries. It supports image queries as well as user-provided sketches making it highly user friendly.

- **VIRImage Engine:**

Based on primitive features of an image such as structure, colour or texture, VIRImage Engine is an Image retrieval system developed by Virage Inc and performs its system process by a pixel driven method.

- **VisualSEEK:**

This is a Content based Image Retrieval system developed by the Department of Electrical Engineering, Columbia University. Its functionality is based on colour feature of an image as well as the spatial position of pixels.

- **NeTra**

Developed by the Department of Electrical and Computer Engineering, University of California, it is a complicated retrieval system as it extracts the colour, texture, spatial position, shape of an image as well as supports image segmentation.

- **MARS**

MARS or Multimedia Analysis and Retrieval System is an image retrieval system that supports the extraction of colour, shape, texture and spatial layout of an

image. It was developed by Beckman Institute for Advanced Science and Technology, University of Illinois.

- **Viper:**

Viper or **Visual Information Processing for Enhanced Retrieval** was developed at the Computer Vision Group, University of Geneva. It supports both colour as well as texture matching.

III. PROPOSED SYSTEM

A. Working

Content based Image Retrieval System requires implementation in two major parts i.e. user interface and core processing unit. As said before, for processing of the image we use template matching technique.

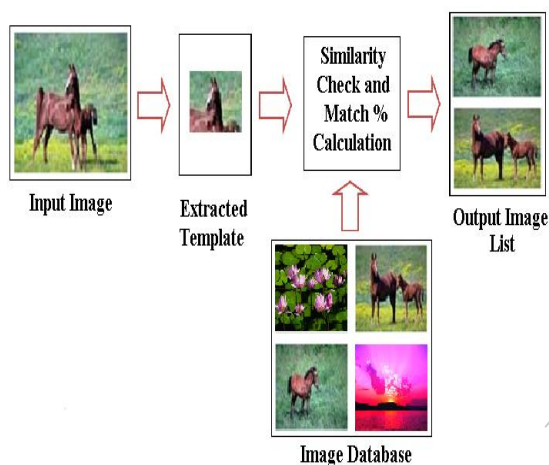


Fig. 1:Basic Concept of System

Template matching process is implemented using Normalized Cross Correlation (NCC). We use NCC as it provides for better processing when brightness or contrast of the input image is not feasible. As the process continues the images will be compared according to their spatial layout as well as their pixel position. In special cases, the extracted template is also scaled or rotated or both. Once the matching percentage is calculated, the indexed images are stored in the database and retrieved as the output. The result is a list of identical or similar images of the input image.

B. Features

The following are the highlighted features of the Content Based Image Retrieval System proposed in this paper

- **Multi-Platform**

We use OpenCV as our core development software which is majorly based on C/C++. Thus the Content Based Image Retrieval System will also run on any platform which can process C/C++ language.

- **Efficient**

The proposed system uses normalized cross correlation as its core algorithm which decreases the dependability on features of an input image such as brightness, sharpness and contrast. This contributes to provide feasible results.

- **Accurate**

Sometimes we see that the image may be similar but not identical. In this case we may also need to alternate the template image. This is implemented by providing the functionality of scaling or rotating the extracted feature to precisely match an image and thus give an accurate result.

- **Output is based on Match Percentage**

The retrieved result is stored and shown as an end result only when the match percentage obtained is either equal to or higher than a specified threshold value.

- **Simple Interface**

A key feature is that the Graphical User Interface is simple and easy to use. The user only needs to provide the system with the query image. Thus the interface as a whole provides a very user friendly environment.

IV. IMPLEMENTATION DETAILS

The design of the system proposed in this paper involves implementation of the Graphical User Interface (GUI) or the front end and the Core Image Processing phase or the backend.

A. Front End

The front end/GUI is developed using C#.Net software. The interfaces needed to be developed are mainly the initial window (where the user provides the query image), a confirmation window (to confirm whether the user wants to continue with the process or go back) and a result window (which shows the user the list of retrieved images). It is in this phase that the user provides the system with the query image.

B. Back End

This phase is the core algorithm implementation where the image is processed. The system needs to be programmed in such a way that it is initialized with a direct connection to one or more database(s) of images. We use OpenCV software to process, compare and store the required images. It is here that we implement the template matching algorithm using NCC (Normalized Cross Correlation).[7] In this stage the query image as well as the database image are normalized and then correlated.

The image from the database is fetched. The query image is scaled accordingly and template matching is implemented. Template matching is basically the integration of a database manager to manage the fetched image and a matching process which determines the level of similarity of the two images based on the involved features. The result of the template matching stage is a similarity percentage which needs to be higher than a predefined limit or threshold. If the percentage of matching is higher than the limit, the image is retrieved as a resultant image else the image is either further scaled and rotated for more precision or rejected as a no match category. The system stores all the retrieved images through the database manager and displays a list of the retrieved images after completion.

We elaborate the design and working of our proposed Content Based Image Retrieval System with the following flowchart:

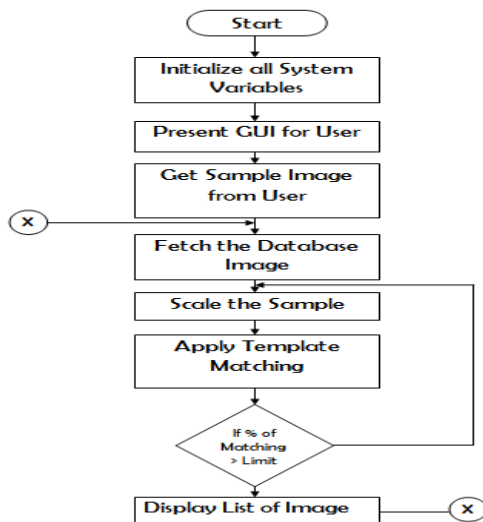


Fig.2: Flowchart for proposed system

V. APPLICATION

Content Based Image Retrieval is deemed useful in many fields and is increasingly gaining popularity due to its efficiency and simplicity. It is used in medical and scientific field for reference in previous discoveries, military field, mug shot database reference, device for surveillance flights

as well as entertainment. Content Based Image retrieval provides searches for any image comparison.

VI. CONCLUSION& FUTURE SCOPE

We have seen that Content based Image Retrieval is a popular and interesting topic but rather still in its research phase. In this paper, we have proposed a new and simple approach for the implementation of a Content Based Image Retrieval System so as to provide better usability, functionality and reliability.

No matter how good the software might be, there is always a room for improvement and the same thing is applicable for our software too. Since we have used a GUI based design, there is a lot of scope for future enhancement. If need arises the software can be connected to the internet easily without any major cost and thus the application can be shared and hosted on the internet. We can even modify the software to enable the user to retrieve a specific feature or a part of the image required rather than the image as a whole. Support for images as well as tags combined for further specified retrieval.

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