

Image Based Search Engine-Like System for Monitoring Fauna Flora

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Abstract: *Content Based Image Retrieval method will be used to match the image of the query with the existing image in the database and or the image on the internet. Similarity measurements are performed using the Euclidean distance function. The image to be used is an image with JPEG format. The use of image or image feature in searching for image in a database and or internet can not be avoided, this is because searching the image by using keyword or text is very biased and the result is far from expected. Search engine-like to monitor the decline in numbers and detect the presence of new types of fauna and flora in Indonesia. Image searching was Carried out by using color and shape features. Search engine-like is expected also to be developed into image based search engine using CBIR method. In this work image searching was deployed using color and shape features. We used not less than 5,000 flora (plants) and 5,000 fauna (wildlife) images. The experimetns show that in term of precission and recall, effectivity of retrieval are 60% and 30% respectively.*

Keywords: Search engine; flora; fauna; CBIR; retrieval; searching

1. Introduction

Searching and surfing on the internet has become part of our daily lives, where the web browser has changed the way in searching and interacting with information. Search engine technology provides a standard interface with unlimited amount of information on the internet. Search engines can be considered as a radar that leads to a particular site or page. Once the search engines find the page (site) referred, then the search engine provides information sought by the user. Continually, user may then browse the site or continue to another link. Search engines are defined as a web page or web site that collects and organizes all content on the internet [4], here the user enters a query or query that cools, then the search engines will provide links to the content that they want.

The problem until now still become attention of experts in the search for a still image in a database and the internet using text or keywords, but the resut is still far from the expectations. Text-based search techniques become impractical for two reasons: large and subjective image base sizes in interpreting images with text. To avoid this, there is an alternative in image searching by applying content base image retrieval (CBIR). This CBIR technique is a content-based image search technique that deals with the characteristics of an image set. With the application of CBIR method, it is expected that image processing will be as easy as processing text data. Yahoo (www.yahoo.com) is one of the longest search engines (since 1994), followed by Infoseek, AltaVista (www.altavista.com), AlltheWeb (www.alltheweb.com), Ask Jeeves (www .ask.com), and Google.

This work was carried out to solve searching problem of image searching in the internet which recently still deployed by text based. Since image searching recently using text, the results are far from expectation. Therefore in this work we

proposed a method to solve the problem by using image as a query to searching band retrieve flora and fauna images from image database. In this work we deploye conten based image retrieval method to search in nthe database.

By using content based image retrieval technique we proposed, the problem of image retrieval using text can be cover up. The problems of image retrieval using text which some weakness such as unexpected images retreved, user have to type keywords, and no measurement to calculate retrieval accuracy. When using text or keyword to find flora and fauna images, it means user look for keyword or legend of images not the content of image which pixels.

This paper consits of 5 sections, the first is introduction, and second describes . and explores previous works related to this work. The thrd section explains method used in this research, results and descission wiil be probided in section 4 and finally section 5 explaines conclusionn ofb teh experimens and fture work.

2. Related Works

2.1. Search Engine

Search engine basically used the user to search for information on the web, which uses the stages of searching that can be explained as follows [4] i). *query formulation*, ii). *Selection*, iii). *Navigation*, iv). *Query modification*. Meanwhile, many types of search engine architecture developed to date, but at first search engine architecture introduced by (Iqbal, 2015), illustration of search engine architecture can be seen in Figure 1.

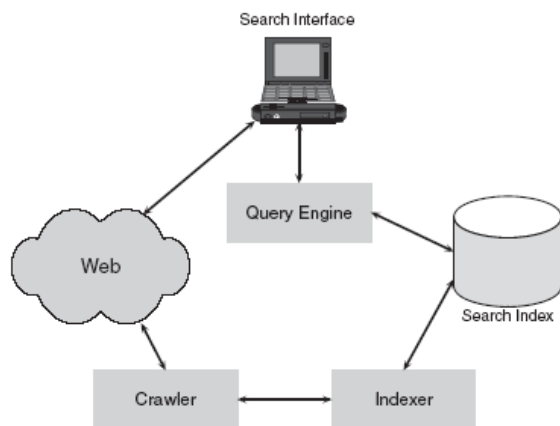


Figure 1. Search engine architecture

2.2 Content Based Image Retrieval (CBIR)

Content-based image retrieval applications have been widely used in many areas of life such as biomedical, criminal, military, commerce, cultural, educational, entertainment, and agricultural fields. Many projects and research have been undertaken, such as those done by IBM (<http://www.qbic.almaden.ibm.com>), Virage (www.virage.com), AltaVista, (www.altavista.com), Yahoo (www.yahoo.com), and Google (www.google.com). In CBIR to determine the resemblance of an image in a database with a reference image is to calculate its Euclidean distance. According to [6] there are four sizes to calculate the similarity, which is based on the similarity of color, shape, texture and structure. The content of an image consists of features of perception (colors, shapes, textures, and structures), features of spaces, roles, views, and features of impressions and emotions.

3. Research Method

The method of application development used in this work is Waterfall model. It includes implementation, testing, and maintenance [10]. Whilst, for process system model is described in with form of system development life cycle. It consists of requirements, analysis, design, and flowchart of general process model. [11], [12] stated that analysis is done to determine the problems occurred, and an automatic security on the door by recognizing the face through the technique of Content Based Image Retrieval (CBIR).

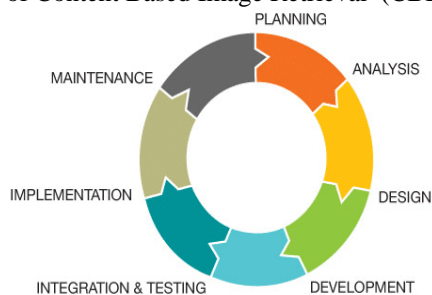


Figure 2: System development steps

The system development system as illustrates in figure 2 can be explained as follow, [12]:

- Planning step deliveries estimating as well as scheduling and tracking the application,

- Analysis step, face image data analysis and design of similarity and application
- Development step, in this step coding application and was carried out as well as feed back also be finished
- Integration and testing step, integration each modul such as matching similarity, and graphics user interface were integrated,
- Implementation, as all steps carried out the application system is ready to deploy in real word.

In order to find flora and fauna images using CBIR technique, we first apple pre-processing to images by resizing metdod dengan membuat image size menjadi 640 pixels. Futhermore, to make image quality better, noise reduction approach was carried out by using

To measure the effectiveness of image searching was carried out by using precision and recall, precision is the number of similar imagery that is called divided by all retrieved images. Medium Recall is the number of invoked imagery divided by the number of images in the category,[2]

$$p = \frac{a}{z} \quad r = \frac{b}{y}$$

Where **p** is precision and **r** is recall, while **a** is the number of relevant or similar imagery, **z** is the sum of all the called images, and **y** the number of relevant images present in the database. The value of precision or recall itself is not enough to provide information, because the recall value will be made 1 by calling all the images in the database. Similarly, precision can be made high by calling multiple images.

Where **p** is precision and **r** is recall, while **a** is the number of relevant or similar imagery, **z** is the sum of all the called images, and **y** the number of relevant images present in the database. While to measure the efficiency image retrieval technique is calculated using the following equation:

$$\text{Error rate} = \frac{\text{an irrelevant amount of images being invoked}}{\text{total of called image}}$$

$$\text{Retrieval-efficiency} = \frac{\text{Total of called image}}{\text{Total of called image}}$$

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2.3 Matching Citra JPEG Using Content

In this research, the image used is image with JPEG format. In JPEG images, images are divided into blocks (8x8 matrices), image indexing is done by merging N blocks into a single block and each block acts as a space in a combined block. The indexing key will have 64 elements and each element has one location. Key indexing can be calculated using the following formula.

$$hi = \frac{\sum_{i=1}^N (DCTi)^2}{N}$$

Where hi is the i element of the vector, and the indexing key can be explained as follows:

$H_1 = \{h_0, h_1, \dots, h_{63}\}$, while to calculate Euclidean distance can be calculated by the formula, $d(hq, hk) = \left(\sum_{i=1}^N \frac{|h_i^q - h_i^k|}{64} \right)$, $d(hq, hk)$ is the distance between image query and image in the database.

Some CBIR applications using color histograms, color layouts, local textures, wavelet coefficients, and shapes are apps introduced by Smeulders [5] [3]. In general the matching algorithm can be explained as follows, for example there are two histograms I and M where each histogram has storage (bin) of n , then the intersection of the two histograms can be defined as follows:

$$H(I, M) = \frac{\sum_{j=1}^n \min(I_j, M_j)}{\sum_{j=1}^n M_j}$$

Due to the lack and excess of text-based and content-based retrieval images, some researchers have tried to combine the two for image search. There are many approaches have been used to combine text or keyword and content-based techniques for shooting. A simple method used for text-based and content-based retrieval. The separate and combining the results of the retrieval has been introduced by the authors [1] [7].

They introduced annotation-based imagery search, in this system need keywords as the beginning to speed up the search by utilizing text-based search technology. Unfortunately the keyword does not always exist, so if the keyword does not exist the word system will not be efficiency. Furthermore, this system tends to be biased because no keywords are used as the beginning of an image search. [6]

Since we used DCT or JPEG format images, an AC coefficient which is part DCT coefficients having a zero value, the element's feature is considered to be zero so that a vector of 64 elements will represent the pixel block texture feature. To characterize the texture features of all images, such vectors are then used as blocks to be used as indexing keys. For example there are as many as N blocks of DCT coefficients in an image, then the indexing key can be searched using the following equation:

$$H = \sum_{i=1}^{64} Ci$$

$$\sum_{k=1}^N (category)_k$$

Where $C_i = \frac{N}{64}$ is the to- i category between the 64 DCT coefficients.

Many approaches have been used to combine text or keyword and content-based techniques for shooting. Simple methods used with text and content-based retrieval separately and combine the resulting image results have been introduced by some experts, [1] [7]. To measure the similarity between the query image and the image in the database is done by calculating the Euclidean distance by using the equation as follows.

$$d(Q, I) = \frac{\sum_i (Q_i - I_i)^2}{M}$$

where Q and I is a query image and I is an inner image, while M stands for the number of content descriptor.

Results and Discussion

4.1. Context Diagram

The system to be designed is depicted using a context diagram. Before the CBIR system designed the database of the Fauna image created with each image given index. The image is input into the CBIR system and the query image is inputted. After that the CBIR system will do searching on the image. If the image you are looking for is similar to the image database then the CBIR system will provide the same image report. The process flow is illustrated in the context diagram in Figure 2, the following:

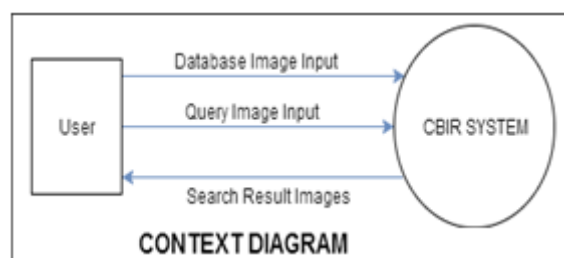
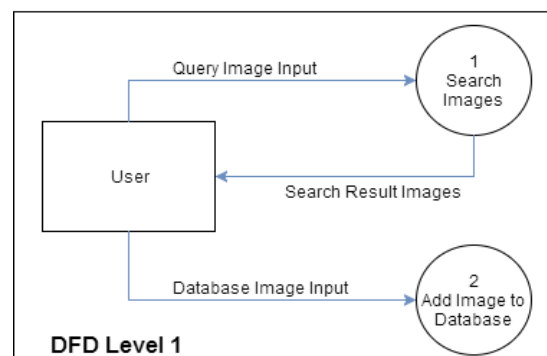


Figure 2: Context Diagram

4.2. Desain Data Flow Diagram (DFD)

The level 1 DFD design illustrates the details of the stages in the context diagram. The built system consists of two subsystems, namely: search image and add image to database. search image function to facilitate user in search of certain image, while add image to database function to make addition of image into database, as shown in picture 3, following:



DFD Level 1

Figure 3: DFD Level 1 of the system

4.3. Flowchart Program

The process of adding the image into the database through several stages, namely: input image, preprocessing, image segmentation and extracting process. The stages are depicted in Figure 4, the following:

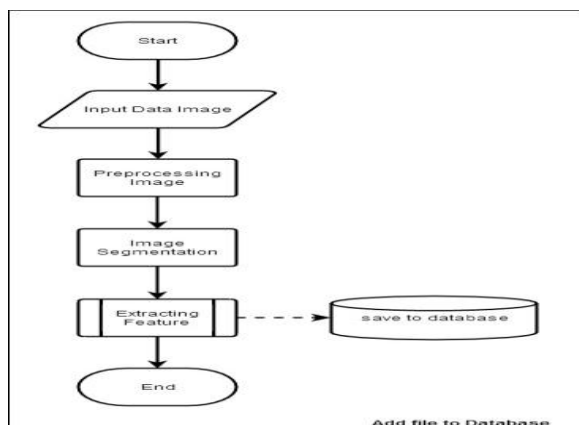


Figure 4: Flowchart Program Add Image

Adding image into database algorithm can be described as follow:

Input image data
Pre-processing
Image segmentation
Feature extraction and save into database

4.3.1 Flowchart Extract Feature

Process Extract Feature through several stages, namely: color quantization, histogram calculation, and the formation of feature vector. The stages are depicted in Figure 5, the following:

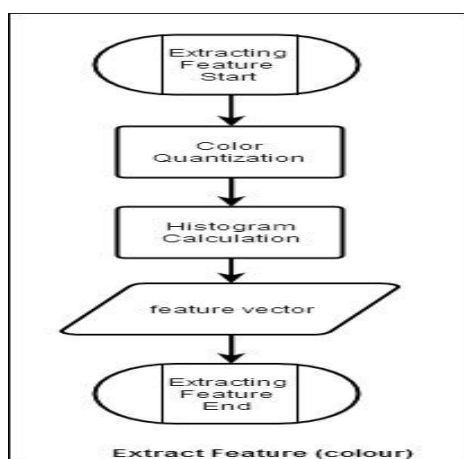


Figure 5: Flowchart Program Extract Feature

The process of Image Searching into the database was carried out through several stages, namely: image input, preprocessing, image segmentation, extracting feature and the process of compare similarity. The stages are illustrated in Figure 6. below:

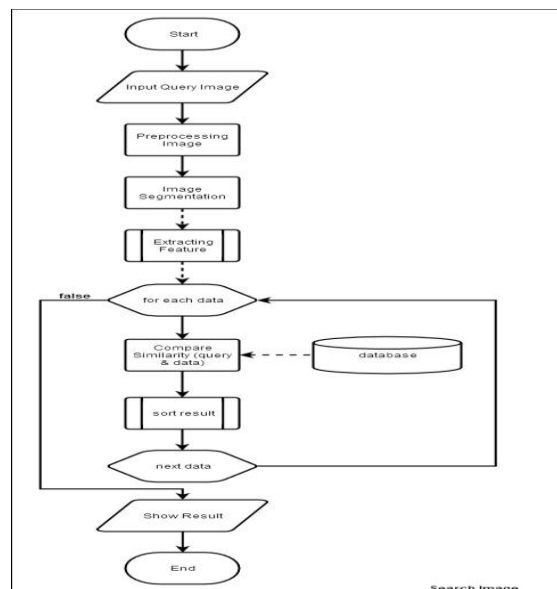


Figure 6: Flowchart of Image Searching

3.4. Main MenuIn the main menu there is a menu add images to the database, look for images and exit the program, as in the picture.

Table 1: Precision and recall

query	Precision	Recall	query	Precision	Recall
1	0,1	0,7	13	0,6	0,2
2	0,2	0,0	14	0,6	0,5
3	0,2	0,1	15	0,7	0,5
4	0,2	0,0	16	0,8	0,1
5	0,2	0,2	17	0,8	0,2
6	0,4	0,2	18	0,8	0,2
7	0,4	0,3	19	0,8	0,1
8	0,4	0,3	20	0,8	0,3
9	0,5	0,1	21	0,8	0,2
10	0,5	0,4	22	0,9	0,7
11	0,5	0,5	23	0,9	0,0
12	0,5	0,4	24	0,9	0,1
			25	1,0	0,2
Average	0,6	0,3			
Min	0,1	0,0			
Max	1,0	0,7			

Table 1 shows of 25 image queries made in this work, form the table we can calculate that average of precision and recall are 60% and 30%, respectively. The result of this work is quite good since effectivity greater than 50% in term of precision. Besides that the work also produce a tool or conrent based image retrieval application application which easy to use and very user friendly. Snapshot graphics user interface of the tool can be examined at figure 6-9.

In the add picture menu there is the first step menu add more images than one image, add images by way of one image. The second step there is a menu create or select index. Create the latest index, rename the index, delete the index and gi

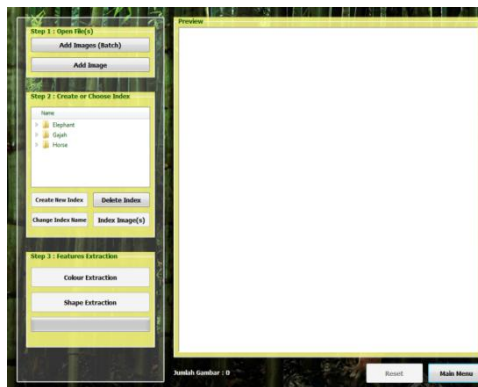


Figure 7: Screen shot of adding image

In the first step of the search menu there is an open query menu image preview. For the second step after the image is displayed then do extraction for color or extraction for shape. The third step of the search menu, with the search menu by color image and search by image shape, select according to the search color or shape. After a search with color / shape then the image will be displayed.



Figure 7: Main menu of search engine-like application

Figure 7 shows snapshot mainn menu of application built by using java. Whilts, figure 8 shows 15 images retrieved by quering a flower image.

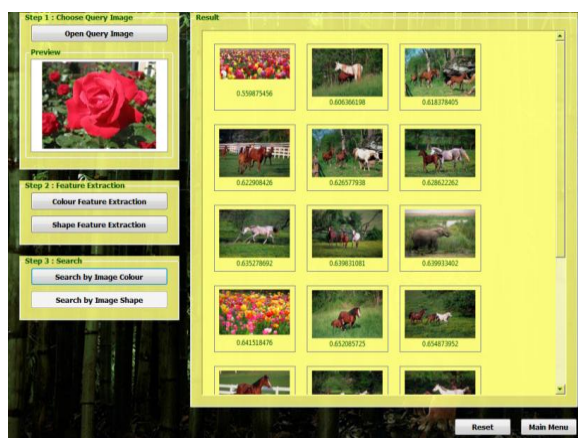


Figure 9: Screen shot of image searching

As mention before eventhough our algorithm is not so accurate to perform image retrieval, tools is very good and user friendly. The results of the color search, with the HSV

color type (Hue, Saturation and value) values contained from the search results of the image is the value between the comparison of the image histogram inputted with images in the database. For the form, the value contained from the search results similarity of the image is a comparison of the value of contours.

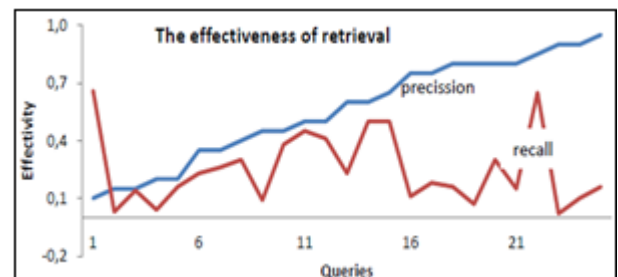


Figure 10: The effectivity fauna and flora retrieval

The works demonstrate performance of algorithm is quite good and accurate, from table 1 we can say that the effectivity of image retrieval is acceptable in term of precision and recall. The precision of image retrieval was 60% or 0.60 while recall is 30% or 0.3. Actually this effectivity could be improved by applying pre-processing step such as resizing, scaling, and uniforming image format. More over tool or application created in this work is very user friendly as easily to run on multi platform software since the application built using Java. By applying 25 queries into system, we found that a tiger image shows an excellent precision value which 100% with recall 20%. However the lowest precision was produced by flower image, it is 10% in precision and 0% in recall. Figure 9 illustrates relation between precision and recall of our algorithm when 25 queries created and input into application system.

The initial image database in this work built up by using existing queries. Therefore; a nonincremental learning procedure is required in order to build the index structure. When using the system, new cases may be stored in the data base. They should be integrated into the already existing image database. Therefore, we need an incremental learning procedure. Elements in the index structure are representations between graphs. We have considered similarity based on partial isomorphism as an important relation between these graph. It is possible to organize the index structure as directed graph because of this characteristic. In the following, we will define the index structure of the image database as a graph that contains the image graphs described above in the nodes:

Retrieval is carried out when an image is given as query to the system, first of all the image graph is constructed by the feature extraction unit. The query can be the high-level representation from the whole image or only one node representing one object. This representation is given to the image database as a query. Any similar case in the image database was employed by matching the current case through the index hierarchy. First the image representation with the same number of nodes like the query image representations is determined, then between the remaining set of images having similar representation and the query the part isomorphism relation is determined.

4. Conclusion

Implementation of Content Based Image Retrieval method in making search engine like image based for fauna is done through stages: system design, program flowchart and coding. Facilities provided in this prototype consists of menu image addition and image search. Menu adds the image into the data base to aims to enrich the content image in the database, while the image search menu to find images that have similarity (similarity) with the image sought (entered).

For the next future, this research will improve the effectivity by using segmentation technique before applying CBIR method. By segmenting object from background, we expects the effectivity of image retrieval will increase significantly. The next research also could be carried out by using more feature of image such as texture and shape features.

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References

[1] Besançon, R., Hède, P., Moellic, P.A., and Fluhr, C, "Cross-Media feedback strategies: Merging text and image information to improve image retrieval", 5th Workshop of the Cross-Language Evaluation Forum, CLEF 2004, LNCS 3491, 2005, pp. 709-717.

[2] Cho, W..C, dan D. Richards . 2004. Improvement of Precision and Recall for Information Retrieval in a Narrow Domain: Reuse of Concepts by Formal Concept Analysis, Proceeding WI '04 Proceedings of the 2004 IEEE/WIC/ACM International Conference on Web Intelligence IEEE Computer SocietyWashington, DC, USA©2004 ISBN:0-7695-2100-2

[3] Inoue. M and Naonori U, "Retrieving Lightly Annotated Images using Image Similarities", SAC'05, March 13-17, Santa Fe, New Mexico, USA 2005

[4] Levene, Mark. 2010. An Introduction To Search Engines And Web Navigation. John Wiley & Sons, Inc. Hoboken, New Jersey.pp78-89

[5] Smeulders, A., M. Worring, S. Santini, A. Gupta, and R. Jain, "Content-based image retrieval at the end of the early years", IEEE Transactions on Pattern Matching and Machine Intelligence, Vol.22, No. 12, 2000, pp. 1349-1379.

[6] Wang. X, L. Zhang, L.Zhang, F.Jing, W. Ma, "AnnoSearch: Image Auto- Annotation by Search", CVPR, 2006.

[7] Jones. G.J.F., Groves D., Khasin, A., Lam-Adesina, A. Mellebeek and Way, "Multilingual Information Access for Text, Speech and Images", 5th Workshop of the Cross-Language Evaluation Forum, CLEF 2004, LNCS

3491, Springer-Verlag GmbH, 2005, pp.653-663 Baca secara fonetik

[8] Jones. G.J.F., Groves D., Khasin, A., Lam-Adesina, A. Mellebeek and Way, "Multilingual Information Access for Text, Speech and Images", 5th Workshop of the Cross-Language Evaluation Forum, CLEF 2004, LNCS 3491, Springer-Verlag GmbH, 2005, pp.653-663