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Comparison Result of Songket Motives Retrieval through Sketching Technique with Keyword Technique

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Abstract - Songket is an iconic Malay artistic tradition with a strong historical essence. The fine weaving that makes up the songket's texture is what makes it stand out from the rest of the fabric. A literature study showed that more than 300 songketmotifs had been produced since the beginning and these were stored digitally aspart of a preservation effort. Preliminary studies of 10 websites that promote and trade in songket in Malaysia reveal that preserving the motif was not their priority since they only focus on selling the product. The website only provides a keyword search for the customer to find songkets based on their finished motifs. The biggest drawback is that the user is not aware of the abundance of motifs, making the search less efficient. A previous study also shows that there is no website that provides a repository of songketmotif information as part of a long term preservation effort. This study will focus on the results of a comparison of songketmotifs retrieved by using a sketching technique with the keyword technique. The method of study is to analyse existing songket websites and image retrieval techniques. The results of this study show that the retrieval of songketmotifs was higher using sketching techniques than keyword techniques. Eighty per centof the results for the sketch query were higher than the keyword based query. The sketch based image retrieval technique will make it easier for users to access and retrieve songket motif images more easily.

Keyword - *Image retrieval, Information Retrieval, Songket Motif.*

1. Introduction

Malaysians have inherited many rich varieties of fine arts, handed down from their ancestors. The arts of weaving, embroidery, *tekat* and engraving are synonymous with Malaysian societies,which are made up of various races and cultures. Malay fine art practices include: braiding, batik arts, *puakumbu*, *songket*, *tekat*, *dastar* fabric, woven arts, beads, engraving and copper arts [11].

Songket is a part of Malay cultural heritage and a legacy of fine art with a lot of special qualities that should be preserved. In order to do this, songketmotifs are being digitalized using motif image shape recognition technology [7]. Previously, a keyword search was being used to search for the motifs but this was not very efficient because the keyword did not match with the motifs in the repository [7]. Moreover, the keyword search is limited by the user's knowledge as it requires them to input the particular name or type of the motif; something that is rarely known to the public [8]. This limitation renders the keyword search almost useless, preventing efficient access to the database, as songketmotifs have a huge number of names[8].

For cartoon images, it is proven that image retrieval techniques using sketch are far superior to keyword searches and more user friendly [5]. Generally, almost all research done on image retrieval techniques using sketch-based technology for images supports the idea of using the sketch technique to help the user find the desired image easily and efficiently [6].This study assumes that sketching techniques can help users who do not know the exact names and types of songketmotifs to retrieve the desired motifs easily and efficiently. The main goal is to develop a prototype of a method of songketmotif retrieval by using a sketching technique**.**

The paper is organized into five sections: the introduction, related studies of existing sketching techniques, methods, conceptual model and conclusion.

2. Related Studies of Existing Sketching Techniques

Sketch Based Image Retrieval (SBIR) research started as early as the 1990s [2], but the extent of the studies was limited by issues such as the fact that sketches made by the users could not be matched with the images in the repository. Extracting the sketch made by the user into the system was not an easy task [1]. This problem can be solved by matching the user's sketch with the important curves present in the songketmotifs. Raw curve-based algorithms can be used to extract the user's sketch to calculate the similarities between the curves contained in the repository system. Fig. 1 shows important curves (borders) which will be matched with the songketmotif images.

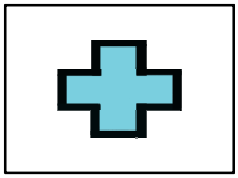


Fig. 1 Border shows the important curves sketched by the user

The algorithms used to calculate the accuracy of the query image to images in the repository is:

$$Sim(Q+I) = \sum_{xq \epsilon Q1} wq*s(xq,I) + \beta sim_{tag}(Q,I) \quad (1)$$

where SIM (Q + I) is the similarity between the tag and the label, with query panel is a text description of the songket motifs images, where cosine similarity is used. β is an external parameter used to balance the query sketch with visual queries. This study uses a SIM (Q, I) as the position of the image in the panel data [4].

Research was done on sketching techniques applied to cartoon images drawn by children who did not know how to read or write but could find their favourite cartoon image by sketching how they remembered it [5]. The program in question, Sketch2Cartoon (*Clipart Finder*), stored more than one million clipart images from the internet. Asides from sketching techniques, Clipart Finder also supports keyword searches and multi-touch controls where users can input their query from multiple positions using their fingers or a supplied pen. Fig.2 shows the search results from Clipart Finder.

Fig. 2ClipartFinder sample results [5]

The image is retrieved based on other sketches which were also found to match in application with significant scaled repository [3]. The study supports the idea that the user can find their desired songketmotifs based on a sketch alone. The sketch technique can also help filter the relevant image from the database as it only matches the image in the database with the image in the user's mind [6]. One study [6] suggests a query framework as shown in Fig. 3 which can improve the results of image retrieval through sketching.

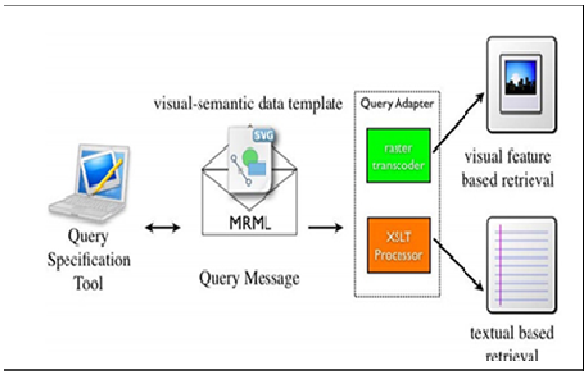


Fig. 3 Query framework [6]

From the statement above, we can deduce that the sketching technique is suitable for use in songketmotif queries and image retrieval. The technique can eliminate the need for lengthy and cumbersome keywords to describe the desired image, thus making the result even more a product of what was defined by the user. Based on the literature review, the sketch techniques can be applied to image retrieval techniques. Further results should be measured concerning image retrieval to determine its recall and precision values.

The process of obtaining the values of recall and precision is introduced in a study by Cran field. This study aimed to compare the results in order to formulate and reach a new method. Recall is all the access revenue earned by the system, while precision was a result of the determination of the suitability of the results provided for drawings used in the search [9].This is discussed in greater length in section 3.4. Once the process of determining the recall and precision is known, the results of the recall can be divided into three categories.

The recall category concerns whether the image or document is relevant, irrelevant or whether the image is uncertain [9]. In general, the relevant documents are specified by the user, for example, if the user enters a cross-shaped sketch and produces an image repository that has the shape of a sketch, the result is considered relevant by the user and the results are not consistent with the remaining sketches which are treated as irrelevant. The results are categorized as access was a little unsure, but not close to resembling sketches. Fig. 4 shows an example of the determination of relevant, irrelevant and uncertain images in order to reach the result. The image shaped in the image space is considered relevant while the image in the space is an unsure image. The next image, in the form of space

is treated as irrelevant.

Fig. 4 Relevant, not relevant and unsure image

Related studies on sketch techniques, recall and precision as well as the determination of the relevant image, are an essential part of this study because the selection technique allows researchers to continue their studies at the next step. The research methods section is a description of this study.

3. Method

This study using a rapid prototyping as a method and has four main stages which are preliminary analysis, design, development and testing. The preliminary analysis is detailed in Section 3.1.

3.1 Preliminary analysis

A preliminary analysis looked at 10 existing songket websites' search techniques and gathered information regarding songket. Table 1 summarizes the evaluation of the websites and the information gathered about their motifs, history and songket products. The search method used is a keyword search and navigates to the information available on the website.

Table 1: Summary of evaluation

No	Web site	Search method	Content
1	InstitutKraf Negara (www.ikn.gov.my)	Text	Malaysia National Craft Institute contents.
2	Visit Terengganu(www.fvisit-terengganu.net)	Text	Terengganu tourism and promotional website.
3	SongketModen(songketmoden.com)	Text	Songket products commercial page.
4	WarisanBudayaMelayu(malaysiana.pnm.my)	None	Malay fine arts webpage
5	AzizahSongket Terengganu(azizahsongket.wordpress.com)	Text	Songket products commercial page.
6	Songket Restaurant(www.songketrestaurant.com)	None	Songket-themed restaurant commercial page
7	BibahSongket(www.bibahsongket.com)	None	Songket products commercial page.
8	AtikahSongket TTDI(www.atikahsongket.com)	None	Songket products commercial page.
9	Aura Batik(aura-batique.blogspot.com)	None	Songket products commercial page.
10	Kain Songket.com(kainsongket.com)	None	Songket products commercial page.

3.1.1 Analysis

Table 1 shows that six websites did not provide a search option and information can only be accessed through word links. The six websites are: WarisanBudayaMelayu, Songket Restaurant, BibahSongket, AtikahSongket TTDI, Aura Batik and Kain Songket.Com. Four websites provide text-based search options in addition to wordlinks. The websites are: InstitutKraf Negara, Visit Terengganu, SongketModen and AzizahSongket Terengganu. An analysis of these 10 websites showed a keyword-based search option is ineffective as users must know the exact name of the motifs for the results to be reliable and usable and it is almost impossible for every user to know every motif in the repository. This study aims to develop a prototype for a songketmotif image retrieval system which considers information concerning the motifs, history and songket products. Using the sketch technique, the user no longer has to memorize the motifs' name but still manages to retrieve the desired products easily. A sketch technique used in image retrieval is a sub category of content-based image retrieval. In this study, the outline of the sketch will be matched with images in the repository and the system can be developed using JavaScript, CSS and HTML.

3.2 Design

In the design phase, there are two significant aspects; interface and repository. The user interface is developed in accordance with the guidelines derived from RBWDUG[10]. An interface which is also based on existing sketch-based search engines such as artmight.com, tattmight.com, clipardo.com, search-by-drawing.franz-enzenhofer.com,www.nciku.com,www.yellowbridge.com/chinese/characterdictionary.php,www.chinese-tools.com/tools/mouse.html,kanji.sljfaq.org/draw.html,www.emolecules.com,artmight.com, tattmight.com and labs.systemone.at/retrievr. The repository design is based on Code Project and Microsoft Database Design Basic.Table 2 shows the guidelines used in the design of the interface and repository system.

Table 2: Interface and repository guidelines

No	Interface Guidelines	No	Repository Guidelines
1	Design processes and evaluation	1	Determine the purpose of the database
2	Hardware and software	2	Find and organize the information required
3	The home page	3	Divide the information into tables
4	Page layout	4	Turn information items into columns
5	Navigation	5	Specify primary keys
6	Scrolling and paging	6	Set up the table relationships
7	Heading, title and label	7	Refine the design
8	Links		
9	Text appearance		
10	Lists		
11	Image		
12	Writing web content		
13	Content organization		
14	Search		

Based on these guidelines are used as interface design sketched Fig. 5.

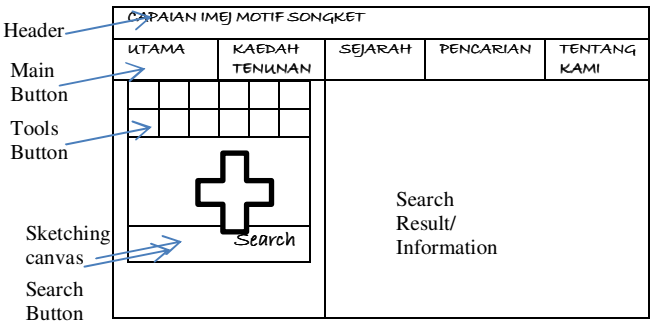


Fig. 5 Interface design

The repository design is shown in Fig. 6. Content information ranging from names, images and history of songket motifs.

Name*	Image	History
Bunga Tepung Talam		Nama motif inidiambildaripadakuihtradisionalmelayu. Bentuknyasepertirombusdan di bahagiantengahdihiasidengan motif yang lebihkecil. Iadisusunsecaraberselangdengansatulagi motif lainuntukmembentuksongketbungapenuh.

Fig. 6 Repository design

Once the design of the interface and repository based on the guidelines has been set up, the development can continue, as shown in section 3.3.

3.3 Development

The development phase implements the sketching technique to match the songketmotifs using a friendly user interface and accessible repository. This prototype has a primary drawing feature such as a pencil tool to draw the desired motif and more easily erase unwanted parts, and a clear canvas tool to clear the whole drawing area.

The user only needs to draw the basic features of the motif such as rectangles or circles and if there is any issue with the sketch, it can be rectified using the tools supplied. Users can also start a new search using the refresh button to return to the sketch interface. Fig.7 shows an example of a sketching canvas user interface.

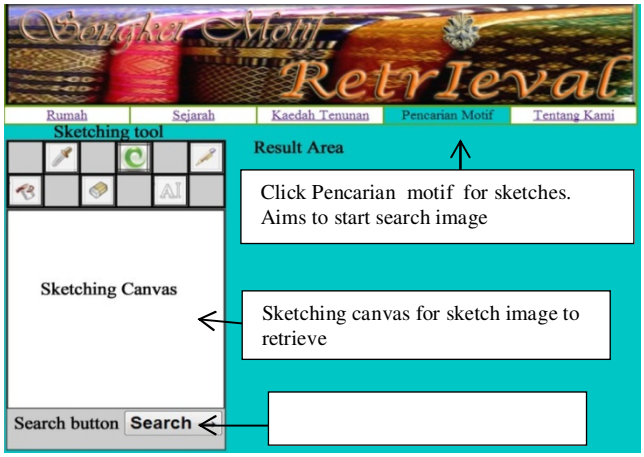


Fig. 7 Interface of image retrieval using sketching canvas.

Songketmotif images are collected and stored in the repository using the scanner to scan the images and are then enhanced using Adobe Photoshop for a higher image quality. In addition, songketmotif images are also gathered online using the Google and Yahoo search engines. A total of 324 songketmotif images were gathered and classified according to their name, image, information and history.

Each image in the repository has a unique ID and that is the name of the songketmotif. Fig. 8 shows some of the songketmotifs stored in the repository.

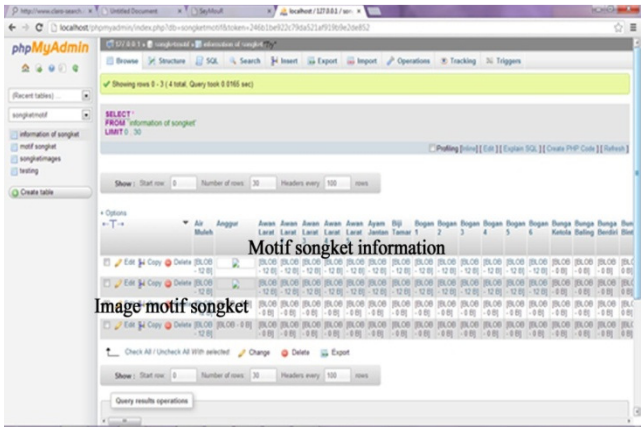


Fig. 8Songketmotif images stored in the repository.

3.4 Testing

Recall and precision methods are tested on the prototype to determine the accuracy and effectiveness of the system in retrieving the correct image from the repository. An algorithm developed by [9] is used to compare the search results as per the formula below:

$$\text{Recall} = \frac{|\{relevant\ documents\} \cap \{retrieveddocument\}|}{|\{relevant\ documents\}|}$$

$$\text{Precision} = \frac{|\{relevant\ documents\} \cap \{retrieved\ document\}|}{|\{retrieved\ document\}|} \quad (2)$$

3.4.1 Experiment setup

The method of determining the relevance of documents was tested on five expert users who had a good level of knowledge of songketmotifs image and names. The users involved in the evaluation of this test were graduate students of the Faculty of Information Science Technology UniversitiKebangsaan Malaysia (UKM) aged between 24 and 33 years of age and had experience in using search engines of websites to gain access to images and information.

Accordingly, users are given an explanation of the songket motifs image retrieval systems to be tested and then test them. The user searched for songket motif images by inserting ten sketches and keywords related to songketmotifs, and relevant documents were found based on the user's selection. Once the user is asked to make a sketch and image matching keywords entered by the results reach songket motifs images achieved by the system. The average results matching relevant images and irrelevant to five users can be found in Table 4 in the analysis. The next ten sketches and keyword queries used are shown in Table 3.

Table 3: Example for Sketch and Keyword query

No	Sketch	Keyword
1		Air muleh
2		Awanlarat
3		Unduklaut
4		Bungabogan
5		Madumanis
6		Bungabintang
7		Bungamangga
8		Tampukmanggis
9		Petakcatur
10		Kupu-kupu

After detailing how to obtain the recall and precision, these are described in 3.4.1.The recall and precision results are described further in section 3.4.2.

3.4.2 Analysis

A comparison of the average value of recall and precision calculation results for ten examples of the sketches and the keywords used in determining the effectiveness of the system are summarized in Table 4.

Table 4: Calculation of average values for precision and recall

Comparison 1	Test 1	Test 2	Test 3	Test 4	Test 5	Result
Sketch	0.48	0.51	0.52	0.79	0.57	**0.57**
Keyword	0.33	0.33	0.33	0.33	0.33	**0.33**

Comparison 2	Test 1	Test 2	Test 3	Test 4	Test 5	Result
Sketch	0.84	0.96	0.77	0.96	0.96	**0.90**
Keyword	0.75	0.75	0.75	0.75	0.75	**0.75**

Comparison 3	Test 1	Test 2	Test 3	Test 4	Test 5	Result
Sketch	0.53	0.76	0.34	0.62	0.64	**0.58**
Keyword	0.47	0.74	0.47	0.47	0.47	**0.52**

Comparison 4	Test 1	Test 2	Test 3	Test 4	Test 5	Result
Sketch	1.0	1.0	1.0	0.87	0.95	**0.96**
Keyword	0.33	1.0	0.33	0.33	0.33	**0.46**

Comparison 5	Test 1	Test 2	Test 3	Test 4	Test 5	Result
Sketch	0.71	0.83	0.8	0.84	0.68	**0.77**
Keyword	0.7	0.7	0.7	0.7	0.7	**0.7**

Comparison 6	Test 1	Test 2	Test 3	Test 4	Test 5	Result
Sketch	0.90	0.87	0.78	0.95	0.91	**0.88**
Keyword	0.33	0.33	0.32	0.32	0.32	**0.32**

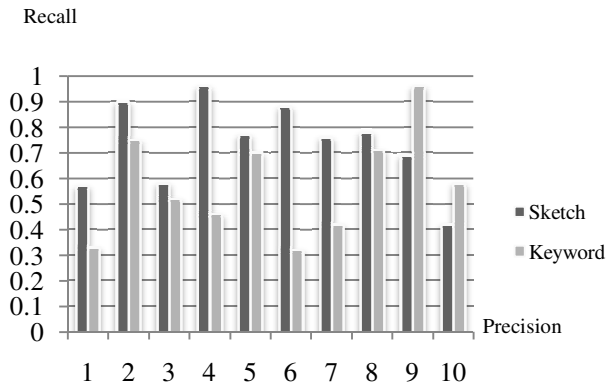
Comparison 7	Test 1	Test 2	Test 3	Test 4	Test 5	Result
Sketch	0.7	0.64	0.99	0.93	0.53	**0.76**
Keyword	0.28	0.28	1.0	0.28	0.28	**0.42**

Comparison 8	Test 1	Test 2	Test 3	Test 4	Test 5	Result
Sketch	0.77	0.80	0.93	0.93	0.48	**0.78**
Keyword	0.83	0.67	0.68	0.68	0.68	**0.71**

Comparison 9	Test 1	Test 2	Test 3	Test 4	Test 5	Result
Sketch	0.59	0.58	0.80	0.77	0.70	**0.69**
Keyword	0.82	1.0	1.0	1.0	1.0	**0.96**

Comparison 10	Test 1	Test 2	Test 3	Test 4	Test 5	Result
Sketch	0.33	0.61	0.41	0.33	0.43	**0.42**
Keyword	0.58	0.58	0.58	0.58	0.58	**0.58**

Table 4 shows the results of a comparison between the sketching and keywords technique which found that eight out of 10 of the retrieval results that used the sketching techniques were more effective than the keyword techniques. For an easier comparison, the results are included in the graph in Fig 9.



Based on the results, the systems of retrieving songket motif imagesare weak at analysing the images of petakcatur andkupu-kupu sketches. This is because the sketches of petakcatur and kupu-kupu drawn by the user are simple curves, but the images of petakcatur and kupu-kupu stored in the repository are complex images, which are harder for the system to extract. After that,a survey of consumers found that the relevant documents can be found by the user using the sketch technique when the sketch image entered by the user is equated with the results achieved by the songket motif images. Thus, an image that closely resembles the sketch image is considered relevant by the user. The keyword matching is based on similarities with the keywords entered by the name of songket motif images obtained while the results reach the same name prefix or are content with the same name when the keywords entered are considered irrelevant as they do not coincide with the keyword included. This resulted in precision results for keywords being lower than sketching techniques. Thus, based on the analysis, it was found that sketching techniques can help users easily access images using keyword techniques meaning that to access sketching techniques the user does not need to think of keywords that coincide with songket motif images.

4.Conclusions

Testing plays an important part in evaluating the functioning of the system presented in this study. This study uses the method outlined by Cranfield [14] for recall and precision results. Comparing the results of the recall and precision for the sketches technique and forkeywords shows the precision sketching technique to be more precise than the keyword technique. This study shows the sketch technique can help users access images without having to remember the name of the image.

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