

# Semantic Search with Combination Impression and Image Feature Query

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**Keywords:** Semantic, Image Search, Combination Query.

**Abstract:** In this study we propose a new approach in the semantic image search system, namely the combination of images and impressions query that display results in the form of images that contain impressions. In previous studies, focusing on semantic image search using combining color and shape features into a single query which displays the results of images and impressions, and semantic search impression with mechanism weighting combination color feature and image feature as query. In this study, the dataset images that we used were 142 Malay songket motifs, and each songket motif contained impressions. In this study, the dataset and image query were extracted into metadata using the Hu Moments Invariant method. Based on the results obtained, we can conclude a success rate of 53% by testing of 10 query combinations.

## 1 INTRODUCTION

Songket Malay or always known as Songket Siak, and Songket Bukit Batu, is one of the handicrafts that has existed for generations in Riau. To maintain the value of traditional customs that are expected to songket craftsmen to be able to understand the meaning contained in every variation of motifs so that the songket fabric that is made still has a high philosophical value. At this time information about the meaning of each songket motif is very limited, causing the next generation songket craftsmen do not know the information and cultural values contained in every songket motif used (Amirullah, Barakbah, & Basuki, 2015; Amirullah, 2018). Songket craftsmen should be able to understand well the meaning contained in every color and shape that is included in every songket motif they create, so as not to cause mistakes in the rules of combining motifs on songket fabric which can result in the resulting songket fabric being meaningless (Amirullah, 2018).

The development of science in the field of image processing and artificial intelligence is the main basis in this research. In previous research, it can be seen that there are 142 Riau Malay songket motifs, consisting of several basic colors that also contain impressions (Amirullah, Barakbah, & Basuki, 2015; Amirullah, 2018). Impression is a term of the meaning contained in every image of the Songket

motif. In this system that we propose, focus on searching songket motif images by querying the combination (Dinakaran, Annapurna, & Kumar, 2010) of image shape features and impression features, where the image dataset and image query are extracted into metadata using the Hu Moments Invariant method. In this search system presented images which contained impression.

## 2 RESEARCH METHODS

In the first stage, the research method carried out as in the previous research is creating the Impression Metadata, based on our previous research, which is conducting research to get impressions on each Motif Songket Image, from 142 Motif Songket Images, we found 27 Impressions, and in each image there are 2 to 3 impressions, so that the 142 x 27 metric is created (Amirullah, Barakbah, & Basuki, 2015; Amirullah, 2018). From this impression data, we do the metric multiplication with the metadata results from the shape extraction in each Motif Songket Image, thus creating a new metric that is 142 x 7.

Search system that uses a combination of image shape feature and impression feature as queries, which starting from extracting the Query Image feature, then extracting the we count similarity with the impression feature on the database to get the

impression query options that are the most similar/ closest with the query image entered first, then the user selects the impression query that is displayed, then the system takes the metadata from the impression query and retrieves the extracted metadata from the query image, then multiplies the metric to create a new query that is a combination of Image form features and features Impression, the last measurement of similarity between the query results in combination with the image dataset in the database and displays the results in the form of images. For more details, can be seen in the following system design drawings.

Semantic search system stages with a query combination of image shape features and impression features:

1. The user input a query image and impression.
2. Based on the query image shape feature, the system measures the similarity to the shape-impression metric and displays the 10 closest impressions.
3. Based on the closest impression, the user then takes one of 10 impressions for the impression query.
4. From the query image shape feature and the impression- shape feature a metric multiplication process is performed to combine the two queries into a single/ combination query.
5. Furthermore, using the cosine similarity measurement method, the system will measure the similarity between the query combination with the dataset's image shape feature, and display the 10 closest / most similar songket motif images.
6. Finally, we analyze the accuracy of search results with combination queries.

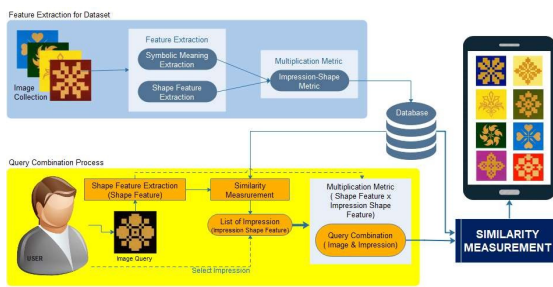


Figure 1: Semantic Image Search System Design with queries combination of shape features image and feature impression.

### 3 FEATURE EXTRACTION

#### 3.1 Impression Feature Extraction

Most of the general public does not understand the impression contained in the philosophy in the shape of rhymes and the meaning of the background color of each motif, therefore in previous studies we carried out the impression extraction to be easily understood (Amirullah, Barakbah, & Basuki, 2015). The results of the impression extraction create a metric 142 x 27. 142 is the number of images, and 27 is the number of impression dataset (Amirullah, Barakbah, & Basuki, 2015).

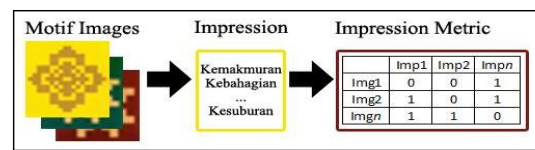


Figure 2: The extraction Impression of Songket Motif.

#### 3.2 Shape Feature Extraction

Extraction of shape features in the image of each songket motif in the dataset and image query using the Hu Moment invariant method. This method is used because it has no effect on rotation, scale and translation, and produces seven equations (Amirullah, Barakbah, & Basuki, 2015; Amirullah, 2018). In the feature extraction process of the image shape using the Hu Moments invariant method produces metadata metrics based on the number of images (142 images) and the number of equations (7 equations). Definition The basic equation of object moments with the Hu Moment Invariant (Amirullah, Barakbah, & Basuki, 2015; Amirullah, 2018, Ming-Kuei, 1962). Method is as follows.

$$m_{ij} = \sum_x \sum_y x^i y^j a_{xy} \quad (1)$$

$$m_{00} = \sum_x \sum_y a_{xy} \quad (2)$$

$$m_{10} = \sum_x \sum_y x.a_{xy} \quad (3)$$

$$m_{01} = \sum_x \sum_y y.a_{xy} \quad (4)$$

$$x' = \frac{m_{10}}{m_{00}} \quad \text{and} \quad y' = \frac{m_{01}}{m_{00}} \quad (5)$$

Then the determine central moment and process of normalizing the central moment by using the following equation.

$$\mu_{ij} = \sum_x \sum_y (x-x')^i (y-y')^j a_{xy} \quad (6)$$

$$\eta_{ij} = \frac{\mu_{ij}}{(\mu_{00})^2} \quad (7)$$

Furthermore, building features of momentary forms are invariant in object recognition and do not affect the translation, scale, and rotation of images. The invariant moment equation is as follows (Ming-Kuei, 1962).

$$\phi_1 = \eta_{20} + \eta_{02} \quad (8)$$

$$\phi_2 = (\eta_{20} + \eta_{02})^2 + 4\eta_{11}^2 \quad (9)$$

$$\phi_3 = (\eta_{30} - 3\eta_{12})^2 + (3\eta_{21} - \eta_{03})^2 \quad (10)$$

$$\phi_4 = (\eta_{30} + \eta_{12})^2 + (\eta_{21} + \eta_{03})^2 \quad (11)$$

$$\phi_5 = (\eta_{30} - 3\eta_{12})(\eta_{30} + \eta_{12}) \{ (\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2 \} + (3\eta_{21} - \eta_{03})(\eta_{21} + \eta_{03}) \{ 3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2 \} \quad (12)$$

$$\phi_6 = (\eta_{20} - \eta_{02}) \{ (\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2 \} + 4\eta_{11}(\eta_{30} + \eta_{12})(\eta_{21} + \eta_{03}) \quad (13)$$

$$\phi_7 = (3\eta_{21} - \eta_{03})(\eta_{30} + \eta_{12}) \{ (\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2 \} + (3\eta_{21} - \eta_{03})(\eta_{21} + \eta_{03}) \{ 3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2 \} \quad (14)$$

### 3.3 Query Combination Image and Impression

Query combination of shape features with impression features are the main topic of the system proposed in this study. To combine these two different features, we use the concept of metric multiplication between image shape features with the impression shape feature. The results of this metric multiplication creates the new metric is 1 x 7, and this is a combination query image query with an impression. More details as visualized in the Figure 3.

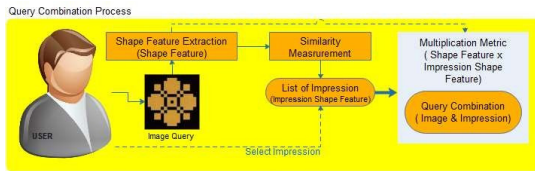


Figure 3: Query Combination Image and Impression Process

### 3.4 Similarity Measurement

The measurement of the similarity between the results of the multiplication of the query metric on the impression metadata and images with the images metadata in the dataset is carried out using the cosine method [1], [2] as follows.

$$\text{Cosine} = \frac{\sum_{i=1}^n A_i X B_i}{\sqrt{\sum_{i=1}^n (A_i)^2} \times \sqrt{\sum_{i=1}^n (B_i)^2}} \quad (15)$$

### 3.5 Precision Calculation





To calculate the precision for this experiment, we use a score calculation equation (Amirullah, 2018). The process begins by measuring the similarity of the query impressions to the impressions on the image search results, by giving the weight value to the first result with a value of 10 and the final value being 1, then calculating the average for each experimental process. The equation is as follows (Amirullah, Barakbah, & Basuki, 2015; Amirullah, 2018).

$$\text{Score} = \sum_{i=1}^{10} \text{scr}_i \quad (16)$$

The process of score weighting and calculating the average in the above equation, more details as shown in the following table.

Table 1: Weighing and calculating average score of system performance.


Query Combination		Result	Score	Score Result
Image	Impression Selected			
	Kewibawaan	1  Kewibawaan, Kerukunan, Tenggang Rasa	10	10
		2  Kewibawaan, Amanah, Bijaksana, Cerdik Pandai	9	9
		3  Kewibawaan, Ketulusan, Sopan Santun	8	8
		4  Kewibawaan, Kerukunan, Ketaqwaan	7	7
		5  Kewibawaan, Sopan Santun	6	6
		6  Kemakmuran, Tahu Diri, Sopan Santun	5	0





	7		Kewibawaan, Sopan Santun	4	4
	8		Persaudaraan, Tenggang Ra sa, Rendah Hati	3	0
	9		Kewibawaan, Saling Mengh ormati	2	2
	10		Kebahagiaa n, Sejahtera, Rendah Hati	1	1
<b>Total Score/ Total Score Result :</b>				<b>49</b>	<b>40</b>

#### 4 RESULTS AND DISCUSSION

On the experimentation process, user inputs image query and selects one a query impression by result process image query, and displays the results in the image of Motif Songket that contained impression. Based on 10 experiments that we carried out in the above manner and stages, the results can be known as in Table 2.

Table 2: Semantic search experiments with image and impression combination queries

No	Query Combination		Total Score Result
	Image Query	Impression Selected (1 of 10)	
1		Persaudaraan	36
2		Kemakmuran	24
3		Murah Rezeki	26
4		Kesuburan	39
5		Rendah Hati	39
6		Kerukunan	17

7		Ketulusan	19
8		Kerukunan	12
9		Sopan Santun	34
10		Kewibawaan	46
Average :			29,2
Percentage Acuration :			53%

In the above Experiments conducted 10 times, we can see that the results of the highest and lowest scores. And calculated the average results of this experiment is an average score is 29.2 of 49, and the percentage is 53% of 100.

#### 5 CONCLUSIONS

This semantic image search system with image and impression queries the development of previous research, namely semantic search with impressions based on the extraction of color and image features, the merging of color and shape features, with the weighting mechanism of colors and shapes. The new proposal in this study is to use a combination of shape and impression query features. In the process of getting the most suitable / close to the query semantic results we do the search process by measuring the similarity of image and impression queries to the shape-impression features contained in the dataset, thus displaying 10 image search results that contain the closest impressions. In the experiments we conducted, it was seen that the result of the average calculation of the experiment was an average score of 29.2 with a success percentage of 53%.

#### REFERENCES

Amirullah, D., 2018. Sistem Pencarian Semantik Impresi dengan Mekanisme Pembobotan Kombinasi Fitur Warna dan Fitur Bentuk, *INOVTEK Polbeng - Seri*

- Informatika*, vol. 3, no. 1, p. 41, 2018, doi: 10.35314/isi.v3i1.332.
- Amirullah, D., Barakbah, A. R., Basuki, A., 2015. Semantic Songket Image Search with Cultural Computing of Symbolic Meaning Extraction and Analytical Aggregation of Color and Shape Features. *EMOTTER International Journal of Engineering Technology*, vol. 3, no. 1, pp. 115–132, 2015, doi: 10.24003/emitter.v3i1.37.
- Dinakaran, B., Annapurna, J., Kumar, C. A., 2010. Interactive Image Retrieval Using Text and Image Content. *Cybernetics and Information Technologies*, vol. 10, no. 3, pp. 20–30.
- Malik A. T. A., Effendy, T., Yunus, H., 2004. *Corak Ragi dan Tenun Melayu Riau, Balai Kajian dan Pengembangan Budaya Melayu*. AdiCita. Yogyakarta.
- Ming-Kuei, H. 1962. Visual pattern recognition by moment invariants. *IRE Transactions on Information Theory*, pp. 66–70.

