SMART RECOMMENDATION SYSTEM MODELING FOR BATIK USING THE CONTENT BASED RECOMMENDATION METHOD

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ABSTRACT

Batik was an intangible cultural heritage recognized by UNESCO, with unique variations of motifs, colors, and philosophies in each region, both in Indonesia and Malaysia. The development of the fashion industry and e-commerce brought both opportunities and challenges, since users often had difficulties finding batik that matched their preferences, occasions, or symbolic needs. This research aimed to develop a smart recommendation system model for batik using the content-based recommendation method. The dataset consisted of batik data from Indonesia and Malaysia with attributes such as region of origin, dominant color, main motif, category, and usage. The system development method applied was Prototyping, which included the stages of requirement identification, quick design, and prototype construction. The results showed that the system was able to provide relevant recommendations according to user preferences. For example, when the user selected batik preferences with green color, leaf motif, and casual usage, the system recommended Batik Priangan from Indonesia with the highest similarity value of 0.75. These findings proved that the content-based approach successfully connected batik attributes with user needs. This research was expected not only to simplify the search for batik products in the digital era but also to contribute to the preservation of batik culture through the utilization of information technology.

KEYWORDS

batik, content based recommendation, modeling, prototyping, smart recommendation system

INTRODUCTION

Batik was one of the world's cultural heritages recognized by UNESCO in 2009. Both Indonesia and Malaysia had a long tradition in batik production, with each region presenting distinctive motifs, colors, and symbolic meanings (Wahed et al., 2022). The development of the fashion industry and electronic commerce (e-commerce) had a significant impact on batik marketing. Although market access became broader, users often experienced difficulties in finding batik products that matched their preferences, event needs, or desired symbolic values (Aqthar & Prapanca, 2025). Traditional search systems that only relied on keywords were unable to present relevant personalized recommendations (Sulami et al., 2024).

Content-based recommendation systems were an appropriate solution because they utilized product attributes such as color, motif, region of origin, and usage to generate more relevant recommendations (De Campos et al., 2024). One effective technique for measuring content similarity was the Dice Coefficient (Sonali et al., 2023). This algorithm was simple, efficient, and proven to calculate the similarity level between items based on keywords effectively, including in cultural contexts such as batik.

Recent studies also showed that the Dice Coefficient method could be adapted for content-based recommendation systems with promising results. The application of Dice Coefficient for content-based product recommendations demonstrated good performance in measuring item similarity and generating relevant recommendations (Senyurek & Kevric, 2024). In addition, other studies emphasized that Dice Coefficient was one of the effective and widely used similarity measures in modern recommendation systems because it could evaluate the similarity of descriptions or keywords between items (Levy et al., 2025) . This confirmed the relevance of the method in linking user preferences with product attributes in content-based systems.

Based on this background, this research aimed to develop a smart recommendation system model for batik using the content-based recommendation method. The dataset consisted of batik data from Indonesia and Malaysia, which included attributes such as region of origin, dominant color, main motif, category, and usage. With this approach, the system was expected to provide recommendations according to user preferences while supporting the preservation of batik cultural heritage.

RESEARCH METHOD

This research used the Prototyping system development method. This method was chosen because it allowed system development to be carried out quickly and interactively. The Prototyping method had been widely applied in information system development studies due to its flexibility in adjusting to user needs (Sari et al., 2025).

The stages of the Prototyping method in this study were as follows::

1. **Requirement Identification**

At this stage, a needs analysis was conducted from both the user and system perspectives (Susanto, 2019). The analysis focused on the attributes used in the recommendation, such as dominant color, motif, region of origin, and usage of batik. The results of the analysis were used as the basis for designing the recommendation system.

2. Quick Design

At this stage, a general design of the recommendation system was created in the form of the system flow process. The design was still rough but became the foundation for further development(Susanto, 2019). The quick design of the system process was illustrated using a system flowchart.

3. Prototype Construction

At this stage, a prototype of the recommendation system was developed using the content-based recommendation method with the Dice Coefficient technique. Data went through a preprocessing stage, then similarity was calculated to generate content-based recommendations(Biasio et al., 2024). The Dice Coefficient formula used was as follows (Ali et al., 2020) :

$$DSC(X,Y) = \frac{2 \times |X \cap Y|}{|X| + |Y|}$$

a. X = the set of keywords from the query
b. Y = the set of keywords from the item
c. $|X \cap Y|$ = number of matching keywords

RESULT AND DISCUSSION

1. Requirement Identification

The needs analysis was carried out by reviewing user preferences in selecting batik. From the results of the analysis, the attributes that became the focus were:

a. The region of origin enriched the cultural context because batik had distinctive characteristics.
b. The dominant color was an important factor in matching user preferences.
c. The main motif distinguished the symbolic meanings among batik.
d. The category classified batik into groups that influenced its placement in the recommendation system.
e. The usage (event) determined the suitability of batik for weddings, formal, casual, or cultural occasions.

The dataset consisted of batik data from Indonesia and Malaysia, which included attributes of region of origin, dominant color, main motif, category, description, and usage. The batik dataset samples used in the modeling of the smart recommendation system amounted to 20 data items, which were presented in Table 1.

Table 1. Batik Data

Code	Batik Name	Region of Origin	Dominant Color	Main Motif	Category	Usage
B01	Batik Parang Kusumo	Yogyakarta	Brown	Parang	Classic	Formal events, traditional ceremonies
B02	Batik Kawung	Yogyakarta	Black, White	Circle	Classic	Uniform
B03	Batik Mega Mendung	Cirebon	Blue	Cloud	Iconic	Wedding events, casual wear
B04	Batik Truntum	Solo	Brown, Cream	Star, flower	Philosophical	Wedding events, family events
B05	Batik Sido Mukti	Solo	Maroon	Geometric	Bridal	Wedding attire

B06	Batik Lasem	Lasem	Red	Dragon, phoenix	Chinese-Javanese	Traditional ceremonies, wedding events
B07	Batik Priangan	Tasikmalaya	Green	Leaf, flower	Floral	Cultural events, casual wear
B08	Batik Lereng	Pekalongan	Black	Diagonal lines	Geometric	Formal events, uniform
B09	Batik Sekar Jagad	Yogyakarta	Brown, Black	Map, flower	Philosophical	Formal events, wedding events
B10	Batik Papua	Papua	Black, Yellow	Bird-of-paradise	Modern-Ethnic	Cultural events
B11	Batik Kelantan Songket	Kelantan	Gold, Black	Weaving	Traditional	Formal events, wedding events
B12	Batik Terengganu Laut	Terengganu	Blue	Wave, sea flora	Modern-Nature	Casual wear
B13	Batik Pahang Bunga Raya	Pahang	Red, White	Hibiscus flower	National	State events
B14	Batik Negeri Sembilan Daun	Negeri Sembilan	Green	Leaf, rice plant	Nature	Cultural events, formal events
B15	Batik Selangor Songket	Selangor	Gold, Maroon	Geometric	Traditional	Formal events, wedding events
B16	Batik Sabah Fauna Laut	Sabah	Blue, Yellow	Turtle, fish	Maritime-Ethnic	Cultural events
B17	Batik Sarawak Hornbill	Sarawak	Black, Red	Hornbill bird	Ethnic-Cultural	Cultural events
B18	Batik Perlis Anggur	Perlis	Purple, Green	Grapes, leaves	Floral	Cultural events, casual wear
B19	Batik Melaka Sulur Kembang	Melaka	Brown, Green	Vine flora	Floral	Formal events, cultural events
B20	Batik Johor Ombak Rindu	Johor	Blue, White	Waves, clouds	Marine-Nature	Cultural events, casual wear

2. Quick Design

In the quick design stage, a recommendation system flowchart was created to illustrate the workflow of the system (Roy & Dutta, 2022). The process design functioned to show how batik data were processed starting from user input to the output in the form of recommendations. The flowchart of the smart batik recommendation system could be seen in Figure 1.

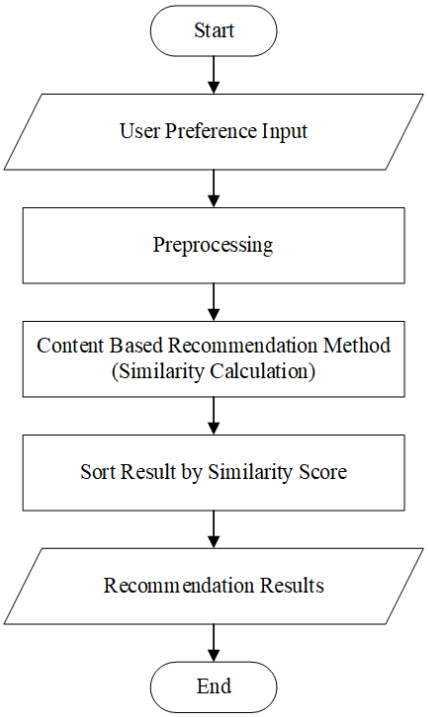

Figure 1. Smart Recommendation System Flowchart

The flowchart illustrated the main process of the smart batik recommendation system. The process began with the input of user preferences, where users could enter attributes such as dominant color, motif, region of origin, or type of usage (event). Next, the system performed preprocessing of the batik dataset to ensure that the data were clean and ready to be processed. After that, the system calculated the similarity level between batik data using the content-based recommendation method with the Dice Coefficient technique, which assessed similarity based on the attributes entered by the user. The similarity values obtained were then sorted to produce a ranked list of batik recommendations. At the final stage, the system displayed batik recommendations with the highest level of suitability according to the user's preferences.

3. Prototype Construction

a. Content-Based Recommendation Method Design

1) Preprocessing

This stage aimed to transform user input into a structured, consistent, and computationally processable representation. Preprocessing included the processes of case folding, tokenization, and filtering. If a user searched for batik with the preference "Green batik with leaf motif for casual use", then the preprocessing process could be seen in Table 2.

Table 2. Preprocessing

Stage	Description	Result
Preference Input	The user entered batik preferences according to their needs	Green batik with leaf motif for casual use
Case Folding	The process converted the preference input into lowercase letters for consistency	green batik with leaf motif for casual use
Tokenization	The process broke down the case-folded result into individual words	| green | batik | with | leaf | motif | for | casual |
Filtering	The process filtered tokenized data relevant to user preferences for further similarity calculation	| green | leaf | motif | casual |
Preprocessing Result	The process analyzed the filtering result to match with the attributes of the items	Color: green Motif: leaf Usage: casual

2) Similarity Calculation

The results from the preprocessing stage were compared with user preferences using a similarity measure, so that the level of similarity between batik attributes and user needs could be identified. If the user's needs were the same as the attributes owned by the batik, then the intersection value was 1 for each attribute. The preprocessing result of user preferences showed requirements in three batik attributes, namely color, motif, and usage.

An example of similarity calculation using the content-based recommendation method with the Dice Coefficient technique was as follows:

Batik Code: B07
Intersection = 3 (green, leaf, casual)
$|X| = 3$, $|Y| = 5$
Similarity (DSC) = $2 \times 3 / (3+5) = 6/8 = 0.75$

The results of similarity calculation for all batik products could be seen in Table 3.

Table 3. Similarity Calculation Results

Code	Batik Name	Dominant Color	Main Motif	Usage	Intersection	Similarity
B01	Batik Parang Kusumo	0	0	0	0	0
B02	Batik Kawung	0	0	0	0	0
B03	Batik Mega Mendung	0	0	1	1	0,29
B04	Batik Truntum	0	0	0	0	0
B05	Batik Sido Mukti	0	0	0	0	0
B06	Batik Lasem	0	0	0	0	0
B07	Batik Priangan	1	1	1	3	0,75
B08	Batik Lereng	0	0	0	0	0
B09	Batik Sekar Jagad	0	0	0	0	0
B10	Batik Papua	0	0	0	0	0

B11	Batik Kelantan Songket	0	0	0	0	0
B12	Batik Terengganu Laut	0	0	1	1	0,29
B13	Batik Pahang Bunga Raya	0	0	0	0	0
B14	Batik Negeri Sembilan Daun	1	1	0	2	0,50
B15	Batik Selangor Songket	0	0	0	0	0
B16	Batik Sabah Fauna Laut	0	0	0	0	0
B17	Batik Sarawak Hornbill	0	0	0	0	0
B18	Batik Perlis Anggur	1	1	1	3	0,67
B19	Batik Melaka Sulur Kembang	1	0	0	1	0,25
B20	Batik Johor Ombak Rindu	0	0	1	1	0,22

From the results of the similarity calculation, it was shown that the highest value was 0.75. Therefore, the batik that was recommended to the user according to the inputted preferences was Batik Priangan.

b. Recommendation System Interface Design

1) Home Page

The home page was the initial display page of the smart batik recommendation system.

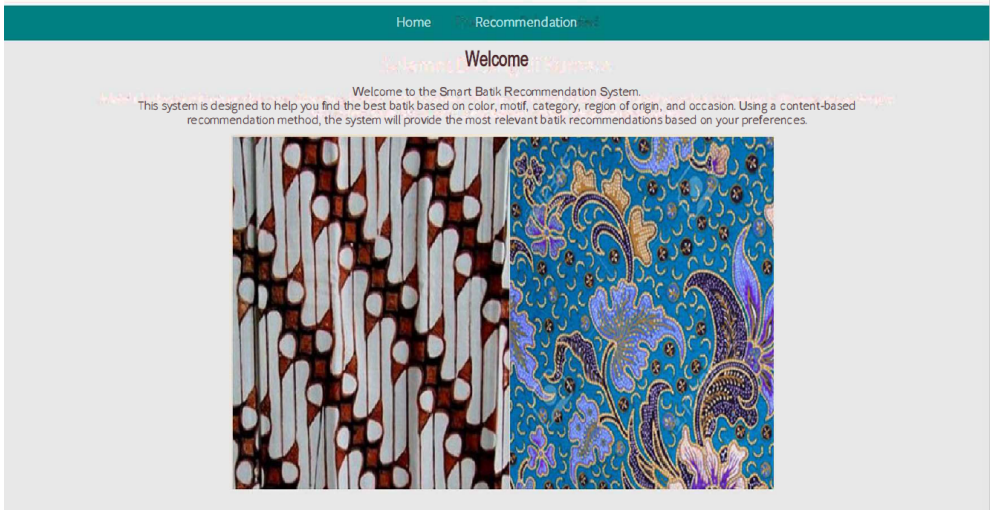

Figure 2. Home Page

2) Search Page

The search page was used to input user preferences according to the required batik.

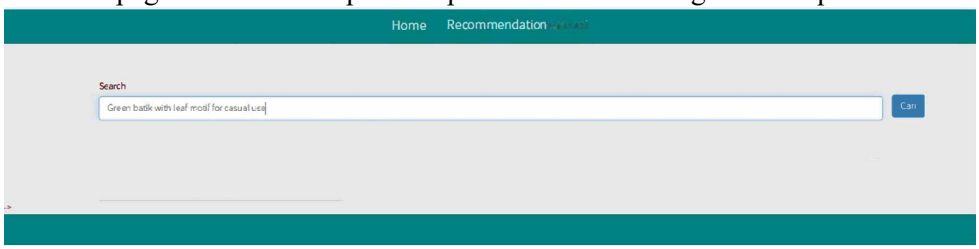

Figure 3. Search Page

3) Recommendation Result Page

The recommendation result page displayed batik recommendations according to user preferences with the highest similarity value.

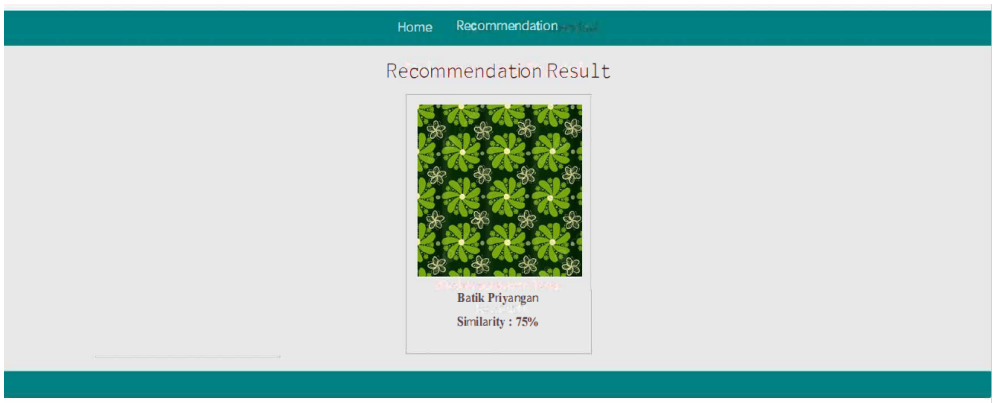

Figure 4. Recommendation Result Page

CONCLUSION

This research successfully developed a smart recommendation system model for batik using the content-based recommendation method with the Dice Coefficient technique. From testing 20 batik data samples from Indonesia and Malaysia, the system was able to provide relevant recommendations based on attributes such as color, motif, category, region of origin, and usage. The similarity calculation results indicated that batik with attributes closest to user preferences obtained the highest scores, such as Batik Priangan with a similarity value of 0.75 for the preference of green color, leaf motif, and casual usage. Therefore, it was concluded that this approach effectively assisted users in finding batik according to their needs, while also supporting the preservation of batik culture through the application of recommendation system technology.

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