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Classification of Lombok Songket and Sasambo Batik Motifs Using the Convolution Neural Network (CNN) Algorithm

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***Abstract*— Sasambo batik is a traditional batik from the West Nusa Tenggara province. Sasambo itself is an abbreviation of three tribes, namely the Sasak (sa) in the Lombok Islands, the Samawa (sam), and the Mbojo (bo) tribes in Sumbawa Island. Classification of batik motifs can use image processing technology, one of which is the Convolution Neural Network (CNN) algorithm. Before entering the classification process, the batik image first undergoes image resizing. After that, proceed with the operation of the convolution, pooling, and fully connected layers. The sample image of Lombok songket motifs and Sasambo batik consists of 20 songket fabric data with the same motif and color and 14 songket data with the same motif but different colors. In addition, there are 10 data points on songket fabrics with other motifs and colors. In addition, there are 5 data points on Sasambo batik fabrics with the same motif and color and 5 data points on Sasambo batik fabrics with the same motif but different colors. The training data rotates the image by 15^0 as many as 20 photos. Testing with motifs with the same color shows that the system's success rate is 83.85%. The highest average recognition for Sasambo batik cloth is in testing motifs with the same color for data in the database at 93.66%. The CNN modeling classification results indicate that the Sasambo batik cloth can be a reference for developing songket categorization using a website platform or the Android system.**

***Keywords*— Songket; Batik; Convolution Neural Network (CNN); neural network; Sasambo.**

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I. INTRODUCTION

Songket and batik are human creations in Southeast Asia, especially Indonesia and Malaysia. Songket cloth is a traditionally woven product with a decorative and beautiful motif [1], [2]. It is made from mixed colorful cotton threads and uses a tool called Panta; a loom made of wood [3].

Sasambo batik is typical of the Sasambo tribe from the province of West Nusa Tenggara. Sasambo itself is an abbreviation of three powerful tribes in West Nusa Tenggara Province, namely the Sasak (Sa) in Lombok, the Samawa (Sam) in Sumbawa, and the Mbojo (Bo) in Bima [4]. The three ethnic groups expect Sasambo batik to strengthen their harmony and togetherness. The craftsmen still process Sasambo batik using traditional techniques [5]. Craftsmen need to use their hand skills to create patterns, motifs, and colors on sasambo batik.

Indonesia has many regions, each with unique traditional textiles. One of them is the island of Lombok. After Islam entered the island of Lombok, the songket motif slowly changed. Its shape is similar to that of other types of plants, such as tendrils, bamboo shoots, trees of life, and flowers, as shown in the picture [6]. The animal motifs on the Lombok songket cloth change with Arabic calligraphy motifs, except for the bird motif. The motifs on the Lombok songket cloth have the characteristic of embossed motifs. The motifs fill the entire surface of the songket and look luxurious and elegant [7]. Besides songket, batik also has a variety of exciting motifs and patterns[8]. So, to make it easier to recognize these motifs, we need an algorithm that can identify and classify them[9], [10], [11]. Several methods have been used for image feature extraction, among which the most widely used is the Gray Level Co-occurrence Matrix (GLCM)[9][13][14]. In addition, some use Support Vector Machines (SVM) and multi-texton histograms [15], [16], [17]. These methods can extract features well.

Furthermore, batik classification uses several methods. Classification of Yogyakarta batik image motifs using the Adaptive Neuro Fuzzy Inference System with an accuracy rate of up to 80%[18]. The CNN algorithm has also been

combined with KNN and Learning methods with accurate results [19], [20]. Furthermore, songket, or image classification, uses the backpropagation method [21].

The classification method using CNN can also detect diseases in humans and plants that have a high level of accuracy [22], [23], [24], [25] In addition, CNN or 3D CNN has a good result for the classification of cancer and Alzheimer's disease [26], [27]. Classification of facial expressions using CNN shows promising results [28], [29]. Furthermore, Modified Region-Based CNN can be applied to help blind people [30], [31]. CNN can combine with back-propagation to get high identification recognition [25], [32]. Several researchers developed songket feature extraction studies. However, the samples used were relatively small. Songket classification using CNN has been done, but the selection only uses songket motifs without batik. The category of traditional songket and batik was not analyzed.

Based on previous research, the CNN algorithm is a deep learning method with high accuracy in image recognition classification because it can recognize complex image shapes or motifs. The sort of motifs that combine Songket and sasambo batik motifs using the Convolutional Neural Network (CNN) algorithm have yet to be studied in depth by researchers. To classify the recognition of Songket and batik sasambo motifs using CNN modeling must be conducted, as the existing research is still separate from the classification of Songket without batik or batik alone. This classification can add public insight into local cultural heritage, namely the introduction of Songket and batik Sasambo motifs originating from the islands of Lombok and Sumbawa. In addition, this research can be a reference for development in the field of CNN or combined with a website-based system or Android application.

II. Materials and Method

There are six stages of the research approach used in this study. Fig 1 shows the process of research.

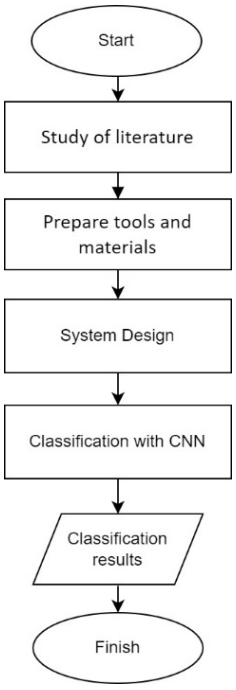

Fig. 1 Research stages

First, review the songket literature and current studies; prepare each tool and material. The next step is system design and classification with the CNN algorithm, and the final step is to present the results.

A. Lombok Songket Weaving

Lombok Songket handcraft locations can be in villages that are Lombok Songket weaving centers, such as Getap Village and Sukadana Village in West Lombok Regency. In addition, the place is in Ungga Village, Sade Village, and Sukarara Village in Central Lombok Regency[33]. Figure 2 illustrates how the first theme of Lombok Songket fabric is the wayang, or people, the motif from the Sasak tribe's theatrical narrative.

Fig. 2 Lombok songket motifs

B. Batik Sasambo

Sasambo batik is spreading in several areas on the island of Lombok and the island of Sumbawa. Sasambo batik has motifs and patterns that describe the typical house style of the Sasak, Samawa, and Mbojo (Sasambo) tribes. In addition, sasambo batik also usually depicts Lombok or chili and lizards as typical animals there. Other motifs are sahe (cow's eye), kakando motif, and uma lengge (a traditional house with a dome resembling a cone), as shown in Fig. 3. Each region that produces sasambo batik chooses different styles and colors.

Fig. 3 Sasambo batik motifs.

C. CNN (Convolutional Neural Network)

Convolutional Neural Network (CNN) is a multilayer perceptron (MLP) development with two-dimensional data[34]–[36]. CNN is included in this type of deep neural network because of its high network depth and application to image data. Feature learning is featuring extraction using two-dimensional size. In the case of image classification, MLP is unsuitable for use because it does not store spatial information from image data and considers each pixel as an independent feature, resulting in poor results. The way CNN works is similar to that of MLP, but each neuron has been represented in two dimensions in the CNN system. However, in MLP, each neuron has only one dimension.

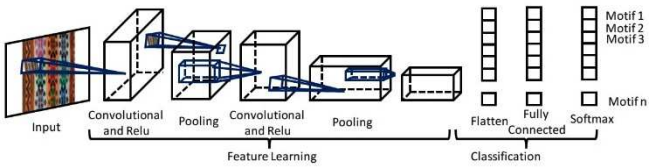

Fig. 4 Convolutional Neural Network

CNN consists of 3 parts: the first is the input of the image to be detected, and the second is feature learning, which functions to extract characteristics from the input in the form of 2 dimensions. The third way is to use the MLP model for classification. This model takes a two-dimensional input image and turns its features into a one-dimensional column matrix, as seen in Figure 4.

An MLP has n-layers (red and blue squares), with each layer containing neurons (white circles), as shown in Figure 5. The MLP accepts one-dimensional input data and propagates the data on the network to produce outputs.

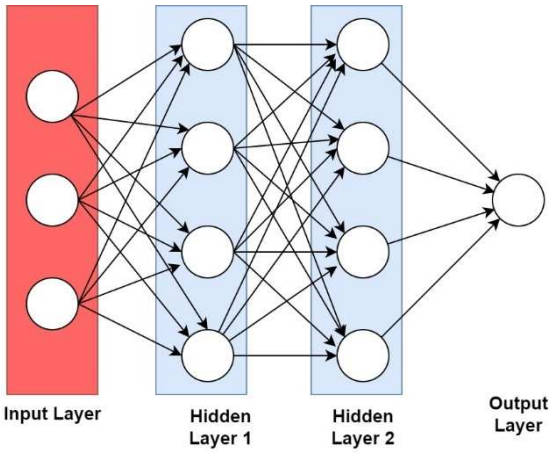

Fig. 5 MLP architecture

In CNN, the network's data is two-dimensional, so the linear operations and weight parameters on CNN are different. In CNN, linear functions use convolution operations. At the same time, the weights are no longer one-dimensional but four-dimensional, which is a collection of convolution kernels of Songket motif images, as shown in Figure 6.

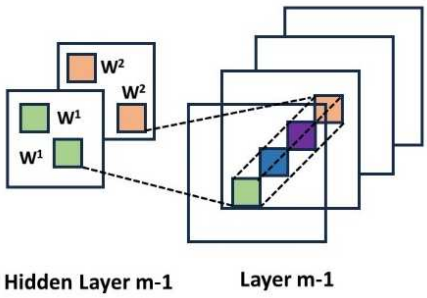

Fig. 6 Convolution process on CNN

Image retrieval is done by taking the original photo of the songket and then converting it into a visual image to be used as an image trained and tested using a cellphone camera. Image data of songket weaving motifs used in this study were 15 songket motifs with the same color motif and nine songket motifs with different color motifs used as training.

1) System Design: The system design process begins with research and analysis of the system built to determine the classification of Lombok songket motifs and sasambo batik. There are several processes carried out in system design.

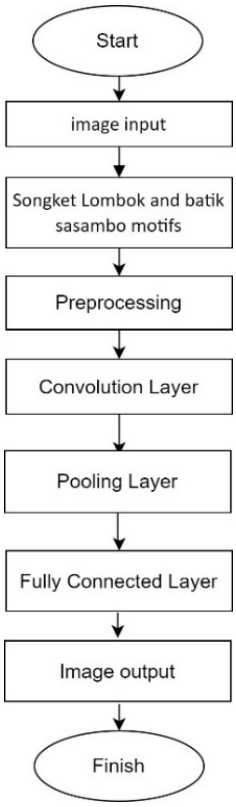

Fig. 7 System Design

2) Image of Lombok Songket Motif and Sasambo Batik: A camera took sample photos. Furthermore, the collected data was converted into a visual image as training and test data. Data samples for training and testing are shown in Fig. 8 -11.

Fig. 8 Lombok songket motifs as training data

Fig. 9 Lombok songket motifs as test data with different colors

Fig. 10 Lombok songket motifs as test data with different motifs and colors

Fig. 11 Batik Sasambo Motifs

3) Preprocessing: The preprocessing stage aims to produce a better image to be processed later[37], [38]. That is by resizing the input image with a size of 4032 × 3024 pixels to a length of 224 × 224 pixels so that the classification process does not take a long time.

4) Convolution Layer: All data touching the convolutional layer undergoes a convolutional process. The filters in the convolutional layer have length, height, and thickness according to the input data channel[39], [40]. Each filter undergoes a shift and "dot" operation between the input data and the value of the filter, as shown in fig. 12. The convolutional layer significantly experiences the complexity of the model by optimizing its output.

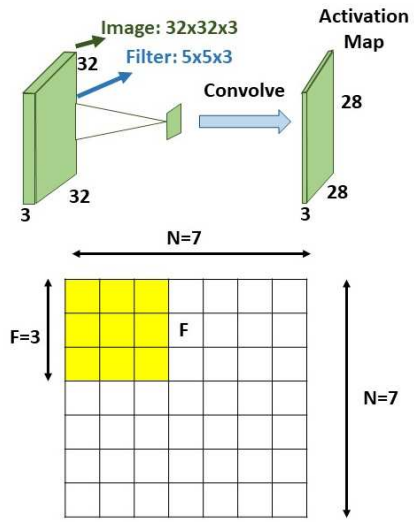

Fig. 12 Convolution Layer

5) Pooling Layer: A filter with a particular stride size makes up the pooling stage, a layer of the matrix measuring system [41]. The amount of strides determines each shift, as shown in Fig. 13. The feature map region or activation map showed a change in that. Two types are max pooling and average pooling [42]. Pooling works by dividing the input into small pieces and taking the most considerable value, or the average of all results. Max pooling only accepts an enormous weight from one part. On the other hand, average pooling only performs dimensional reduction, which is its noise-removal mechanism.

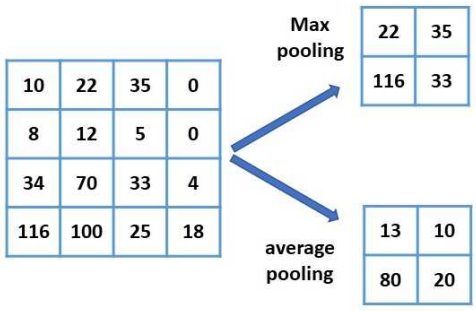

Fig. 13 Pooling Layer

6) Fully Connected Layer: As shown in Fig. 14, each neuron in the convolution layer needs to transform into one-dimensional data before entering a fully connected layer. Because this causes the data to lose spatial information and is irreversible, the fully connected layer can only be implemented in the classification process.

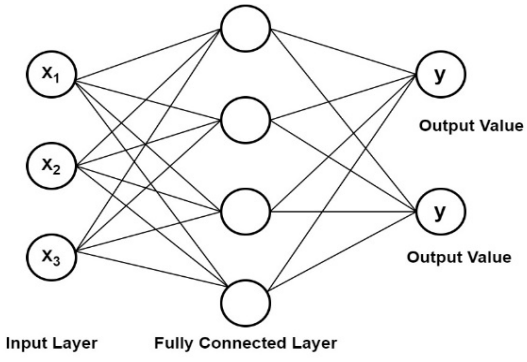

Fig. 14 Fully Connected Layer

III. Results and Discussion

Sample data Songket motifs and Sasambo batik as many as 20 motifs of Songket fabrics that have the same motif and color. In the training data, the image is rotated by 15^0, as many as 20 objects for each photo, and produces 400 images. Five data of Sasambo batik fabrics with motifs and colors, each 20 times, resulting in 100 training data. Fourteen data of Songket fabrics with the same motif but in different colors as validation data. Ten data of Songket fabrics with varying motifs of different colors. Five data of Sasambo batik cloth with the same motif and other colors (there are 29 data out of the database). In this study, the training and validation process was carried out with a comparison of 70% of the training data, 350 images in the database, and 30% of the test data, 150 images in the database. In this study, testing was carried out on data in the database with the same motif of different colors and data outside the database.

The amount of data is 500 images, which consists of 20 Lombok Songket rotated 20 times, resulting in 400 images. 5 batik Sasambo rotated 20 times, resulting in 100 images. All of these images are used for training and validation. It consists of 70% for training data (350 images) and 30% for validation (150 images). In addition, the test data is 29 images, with details of 14 images of Songket motifs with the same motif but different colors. Ten images have different motifs and colors, including Sasambo batik, which has the same motif but different colors.

A. Results of the Training Process

The results obtained from the accuracy of the training data are 210 data with 25 motifs of 99.43%, with the time required to carry out the training process for 51 min 35 sec, as shown in fig. 15. The number of epochs used is six and 35 data per epoch for training. For this level of accuracy, it said that the training process carried out was successful and got excellent results. Table 1 represents the training result.

TABLE I
TRAINING PROCESS RESULT DATA

No	Parameter	value
1	Level of accuracy	99.43%
2	Time to carry out the training process	51 min 35 sec
3	Epoch	6
4	Amount of data	210
5	Iterations per epoch	35

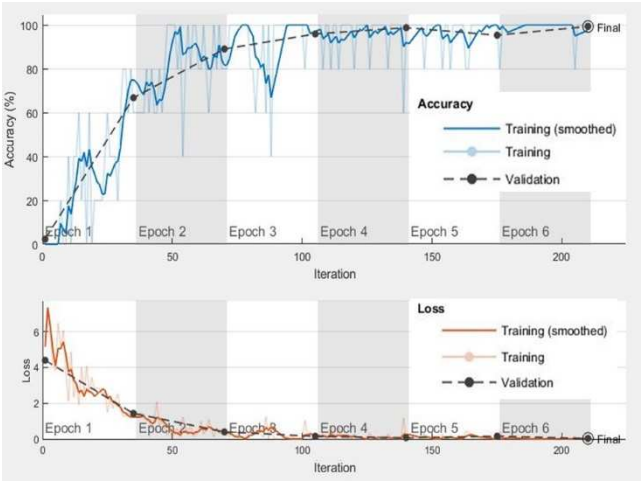

Fig. 15 Training Process Results

B. Testing the data in the database

The testing process used 20 Songket motifs with the same motif and color and 5 data on Sasambo batik cloth with the same motif and color, as illustrated in Table 2. The highest recognition rate in Songket is found in the Kerit motif, which is 99.42% in the form of a bird image with a clear pattern. Next, the average testing data of Songket images is 83.85 %.

TABLE II
THE RESULTS OF TESTING THE SONGKET IMAGE DATA IN THE DATABASE

No	Motif Name	Level of recognition (%)
1.	Bale Lumbung	89.47
2.	Bintang Empet	68.59
3.	Bulan Begantung	96.43
4.	Bula Bekurung	90.87
5.	Bulan Getap	77.49
6.	Dobel Terudat	81.67
7.	Enggok Kupu-kupu	47.11
8.	Kabut	84.64
9.	Keker	67.93
10.	Kembang Komak	88.38
11.	Kerit	99.42
12.	Kotak	94.49
13.	Nanas	87.71
14.	Petak	89.63
15.	Rang-Rang	90.94
16.	Sabuk Anteng	92.28
17.	Subahnale	92.71
18.	Topat	59.7
19.	Ucik	95.43
20.	Wacik	93.44
	Average	83.85

TABLE III
THE RESULTS OF TESTING THE BATIK IMAGE DATA IN THE DATABASE

No	Motif Name	Level of recognition (%)
1.	Bambu	98.6
2.	Bunga Semanggi	94.6
3.	Gandrung	81.04
4.	Gendang Beleq	94.15
5.	Kangkung	99.91
	Average	93.66

Table 3 represents the results of batik image testing. It used five different batik motifs. The highest batik recognition rate is found in the kale motif, which is 99.91% in the form of uncomplicated images of vegetable plants. Meanwhile, the average testing data of batik images is 93.96 %.

C. Testing the songket Lombok motif data using the same motif data with different colors

The testing data used 14 data of the same color songket cloth and 5 data of Sasambo batik cloth with the same motif and different colors. Table 4 and Table 5 show the results of the testing data outside the database. The level of accuracy is about 86.15 %. Tests with the same motif with different colors show that not all songket motifs can be recognized by the CNN algorithm. Based on 14 test data motifs, six can be identified as the same motif, while the other eight images are recognized as different motifs. While in batik, the test data recognized as the same motif as the database was only 1. The level of unrecognized Songket and batik motifs is about

52.23%. The CNN algorithm is recognized as a motif contained in the database.

TABLE IV
TESTING DATA OUTSIDE THE DATABASE RECOGNIZED

No	Motif Name	Motif recognize name	Level of recognition (%)
1.	Bulan Begantung	Bulan Begantung	95.4
2.	Bulan Getap	Bulan Getap	96.41
3.	Dobel Terudat	Dobel Terudat	85.22
4.	Keker	Keker	31.03
5.	Kotak	Kotak	98.9
6.	Rang-Rang	Rang-Rang	96.12
7.	Gendang Beleq	Gendang Beleq	100
	Average		86.15

TABLE V
TESTING DATA OUTSIDE THE DATABASE UNRECOGNIZE

No	Motif Name	Motif recognize name	Level of unrecognition (%)
1.	Bale Lumbung	Dobel rudat	45.62
2.	Bintang Empet	Subahnale	44.9
3.	Enggok Kupu-kupu	Bulan Begantung	21.55
4.	Nanas	Kabut	88.9
5.	Petak	Subahnale	95.99
6.	Subahnale	Rang-rang	44.79
7.	Topat	Bintang Empet	45.27
8.	Wacik	Dobel Terudat	20.72
9.	Bambu	Bunga Semanggi	73.31
10.	Bunga Semanggi	Kerit	36.42
11.	Gandrung	Kabut	46.44
12.	Kangkung	Bambu	62.84
	Average		52.23

D. Testing the Songket Lombok Motif Data Using the Different Motif Data with Different Colors

Ten Songket fabric samples in various colors are used in the testing procedure. Table 6 displays the findings of the testing data. The accuracy rate is around 0 %. The system considers that the ten images tested are not all the same as the images in the database. However, the system still looks for photos with the highest similarity level as output with a certain probability.

TABLE VI
THE SONGKET LOMBOK MOTIF DATA USING THE DIFFERENT MOTIF DATA WITH DIFFERENT COLORS

No	Motif Name	Similarity level to the database (%)
1.	Enggok	0
2.	Jaran Monce	0
3.	Kembang Rang-Rang	0
4.	Kembang Topat	0
5.	Kerujuk	0
6.	Merak	0
7.	Panah	0
8.	Pinggiran	0
9.	Primitif	0
10.	Seriti	0
	Average	0

IV. CONCLUSION

The classification system of Lombok Songket and Sasambo batik motifs with the Convolution Neural Network (CNN) algorithm produces an accuracy rate of 99.43%. After testing with data in the database (trained data), the average percentage for recognized Lombok Songket motifs is 83.85%. The average ratio for Sasambo batik motifs is about 93.66%. Tests with Lombok Songket motifs and Sasambo batik fabrics with different colored motifs outside the database obtained the average % of recognized Lombok Songket and batik motifs of 86.15%. In addition, the average rate for unrecognized Songket and Sasambo batik motifs is 52.23%. Testing with several themes of various colors did not reveal any motifs outside the database findings.

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