Classification of batik in southern coast area of java using convolutional neural network method

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Received 1 May 2021; accepted 9 August 2021; published 14 September 2021

ABSTRACT

Batik is a craft inherited from our ancestors from the archipelago which has a high aesthetic value. Batik has several kinds of motives. Perhaps only a few of the information related to batik can find out. Therefore, not everyone can know or recognize batik in the southern coastal areas of Java correctly. Convolutional Neural Network is a part of deep learning that can be used to recognize and detect objects in digital images. Convolutional Neural Network is a type of Artificial Neural Network that was created specifically so that it can work on data in the form of an array. Based on the results of the study, the results obtained were 100% accuracy for the training process and 99% for the testing process with 630 training data and 180 validation data. The accuracy results obtained by testing the model are 93,3 % with 90 test data. So it can be concluded that the CNN model that has been created can classify batik motifs well.

KEYWORDS
Batik
Deep Learning
Convolutional Neural Network

1. Introduction

Indonesia is one of the countries that is very large and abundant, thus making Indonesia a country that holds various natural and cultural wealth. Culture is a lifestyle that exists within a class of humans, which develops and is inherited continuously from the early generations to the generations to come. One of the rich cultural heritages in Indonesia, namely Batik. The batik culture, which comes from two sentences amba and tik which can be translated by drawing this point, has even made Indonesia increasingly popular to the highest ranking of cultural arts in the world [1]. Batik is one of the handicrafts inherited by our ancestors of the archipelago which has high "aesthetic value". Batik has several kinds of motives. In the past, batik motifs were generally still shaped like plants and animals. Over time, batik motifs can spread to abstract motifs such as puppets, clouds and others. Batik motifs that exist in Indonesia, almost all regions have different types of batik patterns or patterns and also have various meanings and their own history.

Batik Pesisir South coast of Java is batik originating from the seaside area of the South coast of Java. In areas adjacent to the seashore of the southern coast of Java, various Batik is produced according to the characteristics of the region itself. The name of the coast of the South Coast of Java is used because Batik which will be carried out in particular research is on batik originating from areas adjacent to the southern coast of Java. Regarding the information related to the introduction of the types of batik motifs, perhaps it is from people who have expertise in batik and batik craftsmen who understand the most about batik as a whole, while the general public does not really know the batik motifs. Because batik has different motives and batik motifs in some areas have almost uniform but not the same motifs. Based on the results of the study, among the various rules that can be used to identify is one of them using the pattern recognition method. This method can be used to identify a batik motif [2].

Computer Vision is a technique that can identify objects. The computer gets an image input to be studied and implements a certain recognition algorithm, the hope is to know the object in the image. In computer vision, there is a Macine Learning, including the neural network method which has the power to classify patterns in the field of pattern recognition (pattern recognition) which can be used to read images (identify images and non-image patterns) and even be able to recognize different images. Of the

various methods that can be used to recognize a pattern is to use the Deep Learning method, namely the Counvolutional Neural Network (CNN) [3]. Deep Learning is one of the elements in Machine Learning (ML) based on artificial neural networks that will educate a computer so that it can carry out an activity that is similar to human characteristics. Deep learning is one of the elements in ML where the algorithm is used, including the idea of how the human brain can think [4]. Deep Learning is learning related to several levels of representation and abstraction that supports being able to digest data such as images, sounds, and text [5].

There are various methods in the machine learning classifier that are often used, including Naive Bayes [6] Support Vector Machine [7], K-Nearest Neighbors [8]. Among the various methods available in the machine learning classifier, namely the Convolutional Neural Network (CNN) method, it is able to provide relevant results in identifying images. This is due to the Convolutional Neural Network trying to imitate the image recognition system in the human visual cortex, so that it has the expertise to process image information [9]. Some of the reviewers are related to image processing using the CNN method resulting in a good level of accuracy. The study conducted by Yaganisawa et al (2018) in [10] using the Convolutional Neural Network method on object detection object in manga images. These methods are effective. Homewver, it is unclear whether such methods meet image features are different form natural images. CNN also used by Alipourfard et al for hyperspectral image classification. This image classification by combination of subspace-based feature extraction and CNN. The performace improve and the classification overall accuracy is 98.1% in India Pine image dataset [11]. Based on the results of several researchers who use the Deep Learning method, namely the Convolutional Neural Network in CNN image processing, it can provide very good classification results [12].

Based on studies from various researchers related to the use of the CNN method which can provide excellent accuracy results, therefore in this study the Convolutional Neural Network will be used as one that can be used to identify a batik pattern by looking at the texture of batik which has its own specificity. type of batik. This paper is divided into 4 sections. Section 1 is an introduction. Section 2 is the research method used. Section 3 is the result and discussion. While section 4 is the conclusion of the research conducted.

2. Method

This research discusses the classification of batik motifs in the southern coast of Java using the Convolutional Neural Network method. The dataset in this study is the image of the Batik Motif for the Coastal Areas of South Java, which is obtained from the google image search site. The number of image is 630 sample image dataset. The dataset consists of 9 classes of batik motifs on the southern coast of Java as shown in Table. 1. While the software that will be used in this research is Python software version 3.8 and uses Tensorflow – GPU. Image dataset in this research consist of 9 class i.e : Srandil, Adi purwo, Merakan, Pace Ukel Bungan, Beras Wutah, Cebong kumpul, Lorok, Pace Gelaran and Wijaya kusuma. Fig. 1 are shown 9 class of Batik Motif.

Fig 1. Coastal Regional Batik Motifs of the South Coast of Java

Table 1. Source of Image Dataset

No.	Motif	Space Colour	Image Format	Sample Dataset	Source
1	Srandil	RGB	.jpg	70	https://www.batikcilacap.com/produk/batik-srandil/
2	Adi Purwo	RGB	.jpg	70	https://infobatik.id/motif-batik-purworejo/
3	Merakan	RGB	.jpg	70	https://fitinline.com/article/read/batik-kebumen/
4	Pace Ukel Bunga	RGB	.jpg	70	https://fitinline.com/article/read/batik-pacitan/
5	Beras Wutah	RGB	.jpg	70	https://batikfashionista.wordpress.com/2016/02/12/kesenian-batik-kebuman
6	Cebong Kumpul	RGB	.jpg	70	https://www.kaskus.co.id/thread/5a04166954c07acb338b456e/mengenal-batik-cilacap-yang-bersejarah
7	Lorok	RGB	.jpg	70	http://gemaharjo.sideka.id/2018/01/25/mengenal-ragam-pace-motif-batik-khas-pacitan
8	Pace Galaran	RGB	.jpg	70	http://jejakbatik.blogspot.com/2014/10/batik-pacitan.html
9	Wijaya Kusuma	RGB	.jpg	70	https://www.kaskus.co.id/thread/5a04166954c07acb338b456e/mengenal-batik-cilacap-yang-bersejarah

The research process flow or stages in research depicted in Fig. 2 are the stages of the research that will be passed sequentially, after completing the first stage then the second stage and proceed to the next stage until the last stage.

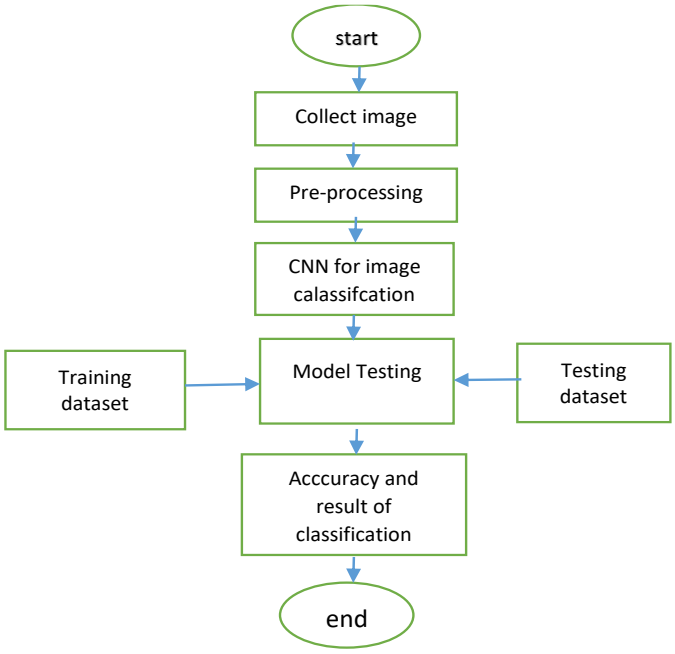

Fig. 2 The stages of the research

The building a model that will be used in data processing. Establishing a model is divided into determining the number of layers to be used, ensuring the kernel size, ensuring the filter, ensuring the activation function and also determining the pool size. Fig. 3 shows the CNN architecture that the research done.

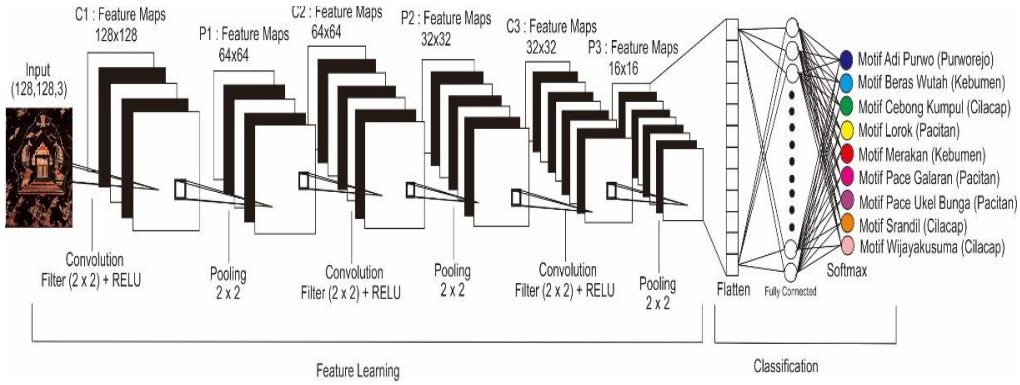

Fig. 3 Convolutional Neural Network Architecture

The CNN architecture shown in Fig. 3 uses an image input measuring 128x128 pixels and measuring 3 arrays, because the image to be inputted is in color or RGB. The first layer uses convolutional layers with a total of 16 filters, meaning that the researcher will use 16 feature detectors, the kernel used in the first convolutional layer is 2x2 in size and then proceed with activation using RELUn [13] . In the first Maxpooling process using a 2x2 pooling size by using one step shift filter. In the second layer, the convolutional layer uses a number of filters of 32, which means that the researcher will use 32 feature detectors and the kernel used in the second 2x2 convolutional layer, then proceed with activation using RELU. In the second pooling process using Maxpooling 2x2 size by using one step shift filter. The next layer uses the third convolutional layer by using a number of filters of 64, which means that researchers will use 64 feature detectors and the kernel used in the third convolutional layer measuring 2x2, then proceed with activation using RELU. In the third pooling process using Maxpooling 2x2 size by using one step shift filter. The next step goes to Flatten, flatten serves to change the previously two-dimensional matrix into one-dimensional. After going through Flatten, it will continue to the classification process using the Multi Layer Perceptron with the number of neurons in the predefined hid layers. The classes of images are then grouped based on the value of neurons in hidden layers using the Softmax activation function. The output layers contain the probability of each class being predicted by the classiflayer. Fig. 4 shows the CNN model in this study.

```
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_63 (Conv2D)           (None, 128, 128, 16)      208
_________________________________________________________________
max_pooling2d_63 (MaxPooling (None, 64, 64, 16)        0
_________________________________________________________________
conv2d_64 (Conv2D)           (None, 64, 64, 32)        2080
_________________________________________________________________
max_pooling2d_64 (MaxPooling (None, 32, 32, 32)        0
_________________________________________________________________
conv2d_65 (Conv2D)           (None, 32, 32, 64)        8256
_________________________________________________________________
max_pooling2d_65 (MaxPooling (None, 16, 16, 64)        0
_________________________________________________________________
flatten_25 (Flatten)         (None, 16384)             0
_________________________________________________________________
dense_50 (Dense)             (None, 512)               8389120
_________________________________________________________________
dropout_25 (Dropout)         (None, 512)               0
_________________________________________________________________
dense_51 (Dense)             (None, 9)                 4617
=================================================================
Total params: 8,404,281
Trainable params: 8,404,281
Non-trainable params: 0
```

Fig. 4 Convolutional Neural Network Model

The first layer is convolutional layers, in the first convolutional layer it produces an image with dimensions of 128x128x16 by producing 208 parameters.The results of the paramenter on the first convolutional layer, namely 280, come from ((2x2x3) +1) x16 = 208, the number from the first 2x2 is the

number that comes from from kernel_size, then number 3 comes from the number of categories in the initial dimension, then number 1 is the unit of bias that must be present in a calculation, and the number 16 is the number of the number of filters. The first Maxpooling layer with a dimension of 64x64 is obtained from the division between the dimensions in the first convolutional layer (128x128) with the Maxpooling size used (2x2) and produces a size dimension of 64x64

Furthermore, by using an equivalent calculation method, the results obtained on the second layer, namely the second convolutional layers with the image dimensions obtained, namely 64x64 by producing 2080 parameters, this value is obtained from ((2x2x16) +1) x32 = 2080 In the second Maxpooling layer with a dimension of x64, it is obtained from the division between the dimensions in the second convolutional layer (64x64) with the Maxpooling size used (2x2) and produces a dimension of 32x32 size. Furthermore, in the third convolutional layer with the dimensions of the image obtained 32x32 by producing 8256 parameters.In the third Maxpooling layer with dimensions of 16x16, it is obtained from the division between the dimensions in the third convolutional layer (32x32) with the Maxpooling size used (2x2) and the resulting dimensions are 16x16. .

Furthermore, the number 16384 in the flatten is the number obtained in the multiplication of the previous dimensions, namely 16x16x64 = 16384, while in the first dense, 512 is the number that shows the number of neurons to be used. While 8389120 parameters were obtained from 16384x512 = 33554432. On the second dense, 9 shows the number of image classes used, so that the parameters obtained are 9x512 + 9 = 4617. So that the number of parameters obtained from the model that has been made is 8,404,281.

3. Results and Discussion

The CNN model showed in Figure 3 will be implemented into Google Colab with the Python 3.8 programming language, there are two stages that will be carried out at this stage, i.e : training and testing model.

3.1. Training Model Results

After going through various processes in the Convolutional Neural Network training and validation results were obtained. This process uses a total of 10 epochs, using a learning rate of 0.001. Fig. 5 is a curve of the results of the training process:

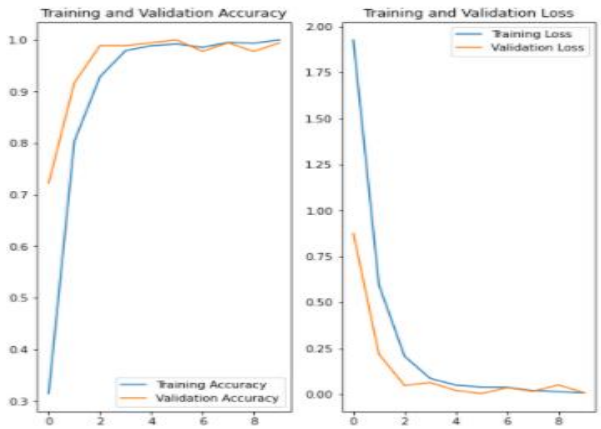

Fig. 5 Training CNN Model

Based on Fig. 5, the accuracy results on the training model get 100% by getting a loss value of 0.0084. The training process uses an input image measuring 128 x 128 pixels. The training time required for 10 epochs at the time of training the CNN model is 105 / s. If more epoch is used, the longer it will take for model training. While the accuracy from the validation data reaches 99% with a loss value of 0.0091.

3.2. Implementation of Model Prediction

To find out that the CNN model that has been trained gives the best results, a model prediction process is carried out using new data as input to determine the accuracy of the CNN model in classifying

a new batik motif image according to the type of motif. In Fig. 6 (a) and Fig. 6 (b) show the process classification motif Adi Purwo using CNN model

(a) Input Image Classification (b) Result of Image Classification

Fig. 6 Classification of Adi Purwo Motif Image Using CNN Model

The result of the predictive accuracy of the images that have been inputted by providing accuracy results and with the input of the new batik motif image the system predicts as an image of the Adi Purwo motif with an accuracy or confidence level of 100%.

3.3. New Data Testing Results

The testing process uses data as much as 90 test data, using 9 classes for each class of batik motif types, there are 10 test images in the Table 2.

Table 2. Testing Results

Matriks		Predict Class									Total
		Adi Purwo	Beras Wutah	Cebong Kumpul	Lorok	Merakan	Pace Galaran	Pace Ukel Bunga	Srandil	WijayaKusuma	
Actual Class	Adi Purwo	10	0	0	0	0	0	0	0	0	10
	Beras Wutah	0	10	0	0	0	0	0	0	0	10
	Cebong Kumpul	0	0	10	0	0	0	0	0	0	10
	Lorok	0	0	0	10	0	0	0	0	0	10
	Merakan	0	0	0	0	6	0	0	0	4	10
	Pace Galaran	0	0	0	0	0	10	0	0	0	10
	Pace Ukel Bunga	0	0	0	0	0	0	10	0	0	10
	Srandil	0	0	0	0	0	0	0	10	0	10
	Wijayakusuma	0	0	0	0	2	0	0	0	8	10

Sourced from table 2, the prediction results from the CNN model that have been made using new data or images can give good results. The prediction of the Adi Purwo batik motif image is classified into the Adi Purwo class giving correctly, which means that the classification of the image of the motif is correct. The prediction of the second batik motif image, namely the Wutah Rice motif, is classified into the Wutah Rice class appropriately, which means that the classification of the motif image is correct. The prediction on the image of the third batik motif, namely the Cebong Kumpul motif, is classified into the Cebong Kumpul class appropriately, which means that the classification of the image of the motif is correct. The prediction of the fourth batik motif image, namely the Lorok motif, is classified into the Lorok class appropriately, which means that the classification of the image of the motif is correct. The prediction on the image of the fifth batik motif, namely the Merakan motif, is classified into the Merakan class as much as 6 and is missing in the input data. The Merakan motif is classified as a Wijayakusuma motif as much as 4. The prediction for the image of the sixth batik motif, the Pace Galaran motif, is classified correctly as the Pace Galaran motif. as Pace Galaran classified as Pace Galaran motif gives good results, which means the classification of the motif image is correct. The prediction on the image of the seventh batik motif, namely the Pace Ukel Bunga motif, which is classified into the Pace Ukel Bunga motif class gives good results, which means that the classification of the motif image is correct. The

prediction on the image of the eight batik motif, namely the Srandil motif, was correctly classified as the Srandil motif gave good results. The prediction of the ninth batik motif image is that the Wijayakusuma motif is classified into 8 Wijayakusuma motif classes, and is missing in the Wijayakusuma motif input data classified as Merakan motifs as much as 2 image data, which means the classification of the motif image is good. The calculation of the overall accuracy (OA) of the entire matrix above is as Equaiton (1).

$$OA = \frac{TTP\ all}{Total\ Number\ of\ Testing\ Entries} x\ 100\% = \frac{84}{90} x100\% = 93{,}3\% \quad (1)$$

The accuracy that has been obtained from the model with an image input measuring 128x128 pixels, and by using the number of new images as much as 90 new image data, in order to test the model obtains an accuracy value of 93,3 % this accuracy is obtained from the right sharing of image data in grouping the motive with the data. the total overall, by this means the CNN model that has been created by the researcher is already beginning of a sentence.

4. Conclusion

Based on the results of the analysis that has been carried out, several conclusions were obtained. The Convolutional Neural Network Model in this study uses 630 training data, 180 testing data with 9 classes of batik motifs in the coastal areas of South Java, utilizing input_shape with a size of 128x128 pixels, using 3 convolution layers, 3 pooling layers using a 2x2 kernel size, using an optimazer Adam with the default learning rate value of the Optimazer is 0.001 and uses the number of epochs of 10. The level of accuracy obtained on the CNN model is 100% in the training process while the testing process gets an accuracy of 99%. Therefore, it can be concluded that the application of deep learning using the Convolutional Neural Network method can classify batik motif images in the coastal areas of South Java well.This study uses 90 new test data that is used for testing the CNN model that has been made. The test results on the model give new accuracy results in classifying the image of the batik motif by 93,3%.

Declarations

Author contribution. All authors contributed equally to the main contributor to this paper. All authors read and approved the final paper.
Funding statement. None of the authors have received any funding or grants from any institution or funding body for the research.
Conflict of interest. The authors declare no conflict of interest.
Additional information. No additional information is available for this paper.

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