P-ISSN: 2715-2448 | E-ISSN: 2715-7199
Vol.5 No.1 Januari 2024
Buana Information Technology and Computer Sciences (BIT and CS)

Detection of Malacca Woven Fabric Motifs Using the YOLOv4 Method

Adi Semri Neno[1], Aviv Yuniar Rahman[2], Fitri Marisa[3]
[1,2,3]Department of informatic Engineering, Universitas Widyagama Malang, Indonesia
[2]school Graduate, Doctor of Philosofhy in information & Communication Technology, Asia Universiti, Selangor, Malaysia
[1]nenoady@gmail.com, [2]aviv@widyagama.ac.id, [3]fitri@widyagama.ac.id

Abstract
Malacca is one of the districts that has a weaving culture and also produces woven cloth in East Nusa Tenggara. The large number of types of woven cloth from each Malacca tribe means that outsiders and even native Malacca people are not yet familiar with typical Malacca motifs, therefore a system is needed that can help make it easier for people to recognize the types of woven fabric motifs. Malacca woven fabric in this study was used to detect the types of woven fabric motifs in Malacca district using the YOLOv4 method. The results of detecting Malacca woven fabric motifs correspond to each type of woven fabric. Apart from that, the Malacca woven fabric motif detection system with YOLOv4 technology is an effective and efficient solution in recognizing Malacca woven fabric motifs. Malacca woven fabric is classified into four classes with an impressive mAP score of 100%.

Keywords: *Object Detection, Identifying, Malacca woven fabric motifs, woven fabric, YOLOv4.*

I. Introduction

Woven fabrics are one of Indonesia's valuable cultural heritages, exuding the rich traditions and folk arts of each region[1]. One area known for its beautiful and unique woven fabric is Malacca Regency, East Nusa Tenggara Province[2]. Malacca woven cloth is also an important symbol in local culture, reflecting the history, beliefs and values of its people[3].

One of the most famous cultural assets of Malacca Regency is the art of traditional woven cloth. Malacca woven cloth is famous for its beautiful and colorful designs[4]. The woven fabric motifs often reflect the surrounding culture and nature. In addition, the practice of weaving is a skill that is passed down from generation to generation[5]. It helps develop craftsmen's skills and keeps the tradition of arts and crafts alive, as it has beautiful and colorful designs, and woven fabric motifs that reflect the culture and natural surroundings[6]. Malacca woven cloth not only plays a role as traditional clothing, but also has a deeper role[7]. In everyday life. Motifs and patterns resulting from traditional weaving techniques become a means of telling ancient stories, local mythology, and passing knowledge between generations.

There are many types of woven cloth motifs from each Malacca tribe, so outsiders and even native Malacca people are not yet familiar with the typical Malacca woven cloth motifs[8]. Therefore, it is necessary to detect woven fabric motifs which can help make it easier for the public to recognize the type of woven fabric motif using the YOLOv4 method[9]. In previous research, Hue, Saturation, Value (HSV) and Gray Level Cooccurrence Matrix (GLCM) feature extraction was carried out to identify woven fabric motifs in South Central Timor Regency. Research was carried out to identify types of woven fabrics in TTS district using the HSV color feature extraction method, and GLCM texture characteristics, and to measure the similarity of woven fabrics using the Euclidean distance metho. The

results obtained in this research obtained a GLCM texture accuracy level for color features of 55%, HSV color features of 62.5% and combination of color and texture features of 91.67%[10].

The aim of this research is to detect Malacca woven cloth motifs using YOLOv4, so that it can help foreigners and native Malacca people to recognize the types of motifs on Malacca woven cloth[11]. This research will make a positive contribution to preserving culture, education and economic development in Malacca Regency, as well as introducing the beauty of Malacca woven cloth art to the wider world through a modern technological approach[12].

II. Methods

In this case, it is a method for detecting Malacca woven fabric motifs using YOLOv4. The methodology used in this research is shown in Figure 1. It begins with the first process of literature study which will be carried out by researchers to look for references for implementing Malacca woven fabric motif detection using YOLOv4. This process is carried out by running a script that has been designed by the researcher. Then testing was carried out using a dataset prepared in the form of woven fabric. The test results will then be evaluated using the Mean Average Precision parameter. The purpose of this evaluation is to compare the results of identifying YOLOv4 objects in Malacca woven fabric motifs.

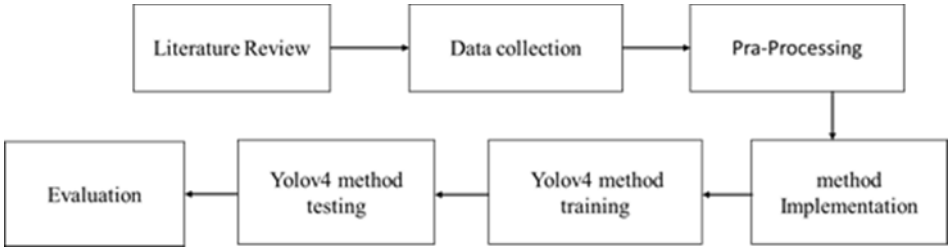

Fig 1. motifs detection flow Malacca woven fabric using YOLOv4

1. Literature Review

In this case the researcher looked for references from several sources related to Yolo. In this process, researchers also use references within the limits of only using the Yolo Method. On the other hand, researchers also used source journals to look for references in detecting Malacca woven fabric motifs.

2. Data Collection

The source that has been obtained is the data used in the reference for Yolo object detection of various types. The results of the collection will later be implemented into Malacca woven fabric motifs YOLOv4.

3. Pre-Processing

In this case, pre-processing is a process of classifying woven fabric motifs according to type and class. The way to classify woven fabric motifs is to create a bounding box. Where these limits, the box will later become a parameter in producing output, namely according to the class of woven fabric motif.

4. Mhetod Implementation

The application method used in this process is YOLOv4. The researchers designed code to implement YOLOv4 for woven fabric motifs. This will later be executed according to each code that has been designed by the researcher.

5. Yolo Method Training

The training process in the YOLOv4 method is the process of running the code designed by the researcher. The training process involves five categories of Malacca woven fabric motifs Motig_garuda,

Motif_marobo futus, Motif_human and deer, Motif_futus men dataset will be used to test the results of this training.

6. Yolo Method Testing

The implementation method used in this process is using YOLOv4. Researchers designed code to implement YOLOv4 for detection. This will later be executed according to each code that has been designed by the researcher.

7. Evaluation

The final step is the evaluation stage, which involves assessing the results obtained from the YOLOv4 small test. In testing, the parameters used for evaluation include Mean Average Precision (mAP), which is calculated based on the equation.

$$\text{mAP} = \frac{1}{n} \sum_{n}^{i} =_1 AP_\text{i} \text{ [13]}$$

In the equation, “n” represents the actual value, while “i” corresponds to the curve value on the precision x and y axes. The resulting plot will involve point interpolation to separate the resulting curve from the x and y axes.

III. Result and Discussion

Table I is the results of the tests carried out. This could explain that starting from 1000 iterations, the Garuda motif mAP value is 82.10% of the total between the training data and testing data. Then for the Marobo Futus motif, mPA results were obtained at 100% in the detection of Malacca woven fabric motif objects. The male futus motif produces an mAP level of 97.65% for object detection in Malacca woven fabric motifs. Furthermore, testing on human and deer motives, the final test resulted in an mAP score of 65.58%, a fairly large difference between the data used for training. To find out to what extent YOLOv4's detection accuracy is accurate, the testing process continues until the 6000th iteration. There are differences or discrepancies between the data used for training and testing at the end of the evaluation.

Table 1. Resulut From Woven Fabric Motifs

Type	Iteration					
	1000	**2000**	**3000**	**4000**	**5000**	**6000**
Eagle motif	82.10%	100%	100%	100%	100%	100%
marobo futus motifs	100%	100%	100%	100%	100%	100%
Humen and deer motifs	65.58%	100%	100%	100%	100%	100%
Men’s futus motifs	97.65%	100%	100%	100%	100%	100%

Furthermore, in the 2000 iteration, the Garuda motif already had a mAP value of 100% of the total difference or distinction between the data used for training and testing purposes. Then, the Marobo Futus motif also has an mAP result of 100% in detecting Malacca woven fabric motifs. The male futus motif produces a mAP level of 100% detection of the Malacca woven fabric motif object. Furthermore, testing on human and deer motifs had an mAP level of 100% of the total detection. The next test used 3000 iterations, the results of the Garuda motif had a mAP value of 100% of the total sum of the differences between the data used for training and testing purposes. Then the marobo futus motif has a result of 100% in the detection of Malacca woven fabric motif objects. The male futu motif produces a mAP detection rate of 100%. Woven fabric motif objects. Furthermore, testing on human and deer motifs alone had the same mAP level. In detecting other motifs, the mAP level obtained was 100% of the total detected. In the 2000th to the 6000th iteration, the mAP level obtained was more stable and did not experience a decrease. Various iterations have maximum yields of mAP levels up to 100%

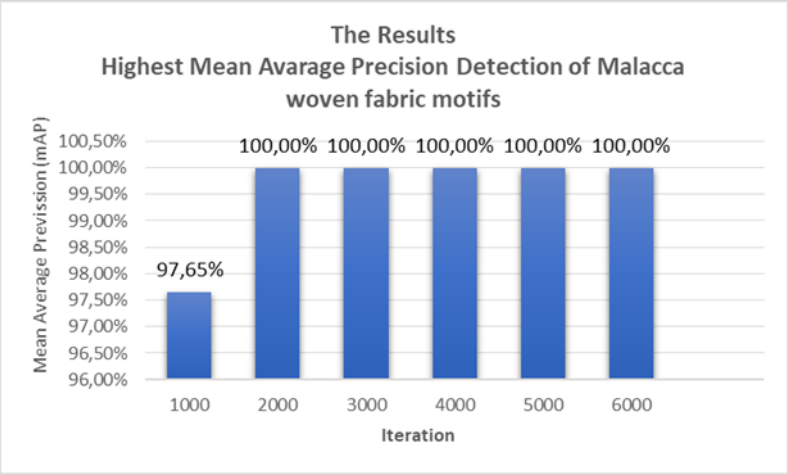

Fig 2. mAP Highest Detection of Malacca woven fabric motifs

Fig 3. Detection results of Malacca woven fabric motifs

Table 2. comparison of research methods with the proposed method

Researcher	Object Detection	Method	mAP
FS Lesiangi AY Mauko And, BS Djahi	1). TTS woven fabric 2).3 fabric images TTS tribal weaving Datasets	1). Hue, Saturation, Value HSV), dan	55%,-62,5%
		2). Gray Level Cooccurrence Matrix (GLCM)	91,67%.
Our Proposal	Woven fabric 1500 datasets	YOLOv4	100.0%

In Figure 2 it can be explained that the values produced in the Tenu Malaka fabric motif detection test with various iterations had maximum results with mAP levels reaching 100.0%. for the time used in detection is only a few minutes. However, if detection with more iterations, it will take around 8 hours to produce Mean Accuracy Precision. Additionally, at the maximum batch used in testing, 14,000 sampling tests and training data were used. The error rate in the entire test was only 0.522 in the woven fabric motif detection test. The tests that have been carried out have the maximum and highest mAP values from 1000 iterations to 6000 iterations shown in Figure 3. It can be explained that the mAP at 1000 iterations is the test results has a maximum value of 97.65%. for the highest mAP, namely 2000 iterations up to 6000 iterations, the maximum result is 100%.

In Figure 3, it can be explained that the detection of Malacca woven fabric motifs using YOLOv4 has been successful and can detect the types of Malacca woven fabric motifs according to each class. The tests carried out to detect YOLOv4 objects are also very short and efficient in terms of time and accuracy. Therefore, the YOLOv4 method is very effective in detecting various motifs of Malacca

woven fabric. The results obtained by the YOLOv4 method can help the outside community to recognize Malacca woven fabric motifs.

In table II there is a comparison between the methods that have been used to detect Malacca woven fabric motifs with the proposed method. Previous research identified woven fabric motifs using the Hue, Saturation, Value (HSV) and Gray Level Cooccurrence Matrix (GLCM) methods. This research used 3 images of TTS tribal woven fabric with 2 methods studied. The results of this research were the highest, namely 91.67% in identifying TTS woven fabric using the Gray Level Coocrrence Matrix method. This result is relatively high, but in this case the research only used data on 3 images of TTS tribal woven fabric. The data is said to be very small because of the large number of woven fabrics. From the proposed goal, the researchers used Malacca woven fabric motifs using 1500 data with 4 types of classes for the process of detecting Malacca woven fabric motifs. The testing process uses 1500 Motig image data of Malacca woven fabric. The results obtained from this test were higher than the previous method, namely 100% detected using the YOLOv4 method on Malacca woven fabric motifs.

IV. Conclusions

The results of detecting Malacca woven fabric motifs using the YOLOv4 method prove that detecting Malacca woven fabric motifs according to the maximum class of Malacca woven fabric motifs, namely men's futus motifs, and the 1000th iteration produces an mAP level of 97.65%. And produced high mAP in the 4 classes of Malacca woven fabric motifs from 2000 iterations to 6000 iterations with the highest mAP of 100%. This result is the very best result.

References

[1] L. D. E. Koten, R. Safitri, and M. P. Wulandari, "Hermeneutics of Ikat Weaving (Utan) Lian Lipa from Sikka Regency, East Nusa Tenggara (NTT)," *Int. J. Sci. Soc.*, vol. 3, no. 3, pp. 107–118, 2021, doi: 10.54783/ijsoc.v3i3.358.

[2] Y. Nataliani, "Frieze Group in Generating Traditional Cloth Motifs of the East Nusa Tenggara Province," *JTAM (Jurnal Teor. dan Apl. Mat.*, vol. 6, no. 3, p. 651, 2022, doi: 10.31764/jtam.v6i3.8568.

[3] S. Soetrisno, D. R. Sulistyaningrum, and I. Bifawa'idati, "Texture-Based Woven Image Classification using Fuzzy C-Means Algorithm," *Int. J. Comput. Sci. Appl. Math.*, vol. 8, no. 1, p. 1, 2022, doi: 10.12962/j24775401.v8i1.9588.

[4] Y. Suryati and B. N. Nggarang, "Analysis of Working Postures on the Low Back Pain Incidence in Traditional Songket Weaving Craftsmen in Ketang Manggarai Village, NTT," *J. Epidemiol. Public Heal.*, vol. 5, no. 4, pp. 469–476, 2020, doi: 10.26911/jepublichealth.2020.05.04.09.

[5] J. L. . Bessie, A. S. W. Langga, and D. N. S. Sunbanu, "Analysis of Marketing Strategies in Dealing with Business Competition (Study on Ruba Muri Ikat Weaving MSME in Kupang City)," *Webology*, vol. 19, no. 1, pp. 780–794, 2022, doi: 10.14704/web/v19i1/web19055.

[6] H. Hambali, M. Mahayadi, and ..., "Classification of Lombok Songket Cloth Image Using Convolution Neural Network Method (Cnn)," *Pilar Nusa Mandiri …*, no. 85, pp. 149–156, 2021, doi: 10.33480/pilar.v17i2.2705.

[7] T. R. S. Hidayat, Nurindah, and D. A. Sunarto, "Developing of Indonesian colored cotton varieties to support sustainable traditional woven fabric industry," *IOP Conf. Ser. Earth Environ. Sci.*, vol. 418, no. 1, 2020, doi: 10.1088/1755-1315/418/1/012073.

[8] J. S. Nalenan, F. Siki, M. R. Talan, and R. J. Wabang, "Cultural Ideology in Woven Fabric Motif of Insana Communities at The Indonesian– Timor Leste Border," *Int. J. Lang. Cult.*, vol. 3, no. 2, pp. 57–63, 2021.

[9] X. Long *et al.*, "PP-YOLO: An Effective and Efficient Implementation of Object Detector," 2020, [Online]. Available: http://arxiv.org/abs/2007.12099

[10] F. S. Lesiangi, A. Y. Mauko, and B. S. Djahi, "Feature extraction Hue, Saturation, Value (HSV)

and Gray Level Cooccurrence Matrix (GLCM) for identification of woven fabric motifs in South Central Timor Regency," *J. Phys. Conf. Ser.*, vol. 2017, no. 1, 2021, doi: 10.1088/1742-6596/2017/1/012010.
[11] E. Halim *et al.*, "The Application of Digital Module Design of East Sumba Woven Fabric on Interior Accessories," pp. 286–294, 2022, doi: 10.5220/0010752600003113.
[12] J. Terven and D. Cordova-Esparza, "A Comprehensive Review of YOLO: From YOLOv1 and Beyond," pp. 1–34, 2023, [Online]. Available: http://arxiv.org/abs/2304.00501
[13] S. Lestari, "ieeQuality Detection of Export Purple Sweet Potatoes Using YOLOv4-Tiny".