COMPARATIVE ANALYSIS OF SOBEL AND CANNY METHOD IN BATIK KAWUNG IMAGE

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Abstract: Abstract: this study evaluates and compares the performance of two edge detection methods Sobel method and Canny method on batik image. Batik images have unique characteristics and complex patterns, making it difficult to analyze the edges. This study presents a comparison of the results using sobel and canny edge detection methods on batik kawung images both from peak signal-to-noise reatio and from mean squared error. The results showed that canny edge detection was better than sobel method. This can be seen from the results of PSNR and MSE that is 100%. This analysis is determined by considering factors such as the accuracy of edge detection, sensitivity to noise, and the ability to handle the complexity of batik drawing patterns. The results of this study provide a detailed description of the advantages and disadvantages of each method in the image of batik kawung. The conclusions that can be drawn from this study can provide valuable guidance for choosing the optimal edge detection method in image analysis of batik kawung and others.

Keywords: batik kawung; canny; MSE; PSNR; sobel

Abstrak: Penelitian ini mengevaluasi dan membandingkan kinerja dua metode deteksi tepi metode Sobel dan metode Canny pada citra batik. Gambar batik mempunyai ciri-ciri yang unik dan pola yang kompleks, sehingga menyulitkan analisis tepian. Penelitian ini menyajikan perbandingan hasil menggunakan metode deteksi tepi sobel dan canny pada citra batik kawung baik dari peak signal-to-noise reatio maupun dari mean squared error. Hasil penelitian ini menunjukkan bahwa deteksi tepi canny lebih baik dibandingkan dari metode sobel. Hal ini dapat dilihat dari hasil PSNR dan MSE yang dihasilkan yaitu 100%. Analisis ini ditentukan dengan mempertimbangkan faktor-faktor seperti keakuratan deteksi tepi, kepekaan terhadap noise, dan kemampuan menangani kompleksitas pola gambar batik. Hasil penelitian ini memberikan gambaran secara detail mengenai kelebihan dan kekurangan masing-masing metode pada citra batik kawung. Kesimpulan yang dapat diambil dari penelitian ini dapat memberikan panduan berharga untuk memilih metode deteksi tepi yang optimal dalam analisis citra batik kawung dan yang lainnya.

Kata kunci: batik kawung; canny; MSE; PSNR; sobel

INTRODUCTION

Indonesia is full of different cultures, one of which is batik which is still a culture that still exists today. Culture is a habit that contains elements of important values and principals that are inherited from generation to generation one of which is batik kawung [1], [2]. The uniqueness of the pattern and visual

complexity make batik drawing an interesting subject. Since the art of batik was adopted by many cultures in Indonesia, batik has developed into a variety of motifs, one of which is batik kawung [3], [4]. Kawung Batik is only used by the royal family, this motif represents the character of a leader who is able to control passions, maintain conscience and create balance in human life behavior. This Batik comes from Yogya-karta [5]. This study was conducted because until now, there is no accurate and fast information system in detecting and interpreting batik motifs [6]. This study analyzes the pattern of kawung batik by edge detection using sobel and canny methods to be tested on batik images in evaluating the performance and adapta-bilitasnya against complex patterns and variations in intensity in the image.

Previous research conducted by David Wijaya et al in February 2023 used KNN as training, classification, KNN examined all exercise patterns to determine the nearest pattern K using certain parameters such as Euclidean distance and Manhattan distance and Gray-Level Co-Occurrence Matrix (GLCM) this study conducted an experiment with K Values at KNN = 1, 3, 5, and 7 with distance calculations using Euclidean and Manhattan. GLCM characteristics used are Entropy, Energy, contrast, Homogenitas, inequality, correlation, ASM, and the average of each characteristic. The results that have been Dil-akukan, the system created to obtain the highest accuracy of 75% with a combination of parameters; pixel distance = 7, K value = 1, the 1st fold as test data and the 2nd and 3rd fold as training data, and by using a StandardScaler. However, further research is still needed to improve the accuracy of batik classification [7].

Research conducted by Putri Luthfiah Harmaya et al in 2023 applied the canny and Sobel method of edge detection to an image in order to process the results of segmentation and object identification in dental caries images. Edge detection operators include Roberts Operator, Prewitt Operator, op-erator Laplacian and Laplacian of Gauss-ian (LOG). The results of this study can be inferred from both operators about the advantages and disadvantages of both operators [8]. Research using the canny edge detection method was also conducted by Maria Fontaine Yuanita Pale et al in 2023. From the analysis of the output of the program it can be determined program improve and detect the edge of the image will be better if the input image has a lot of texture, the results of the output image is determined by the kernel multiplication factor (Marks). From the analysis of the Program Output canny operators detect patterns of motives well. This study found that from the results of the classification process of pattern recognition motif sarong obtained accuracy of 91.67% [9].

Syafrika Deni Rizki et al in February 2021 presented four edge detection benchmarks, namely GRA-dient Citra, Roberts Operator, Sobel Operator and Prewitt Operator. The results of this study is to determine the edge detection is more appropriate to analyze the ultra-sound image, where from the results of this research in the testing process shows Prewit operators successfully detect existing ob-jek, even objects that function as a background successfully detected. The resulting edge detection is smoother compared to other opera-tor [10]. Analysis and comparison of sobel and prewitt edge de-taxiing methods that Dil Akukan Beriman et al in 2020 conducted a study in which sobel and prewitt edge detection can detect the actual edge with a mini-

mum error rate. Sobel and Prewitt were able to identify the edges with the axes used, having the intensity of random numbers whose results were the numbers 0 and 255 .in bars. The built system displays RGB, Grayscale, Sobel and Prewitt image conversion and Histogram of the image process performed [11].

Research to determine 7 types of fish meat using edge detection was also carried out by Maylina Syafira Putri in 2023 to limit two lines of homogeneous image regions with different brightness levels. The results obtained by comparison of two methods in which the Robert method produces a clearer edge detection compared with the kon-Volusion method [12]. Sadion Tumpal Damanik et al discuss pattern recognition using Sobel and Canny edge detection methods. Sobel and Canny edge detection methods proved to be effective in previous pattern recognition by involving data collection using Sobel method, training and testing of pattern recognition models, and experiments to determine the optimal ratio of training data and test data. The experimental results show that the Sobel edge detection method with Euclidean distance and optimal K value provides high accuracy in pattern recognition. However, it is also important to consider the use of Canny edge detection methods as an alternative [13]. Comparison of sobel and prewitt method on leaf image examined by Lufiatul Farida by distinguishing between object and background based on sobel execution time looks better than prewitt, because sobel method requires relatively lower execution time, histogram value is higher enough so that the results of sobel image looks clearer than prewitt [14]. The detection of sobel and canny edges was also shown in the image of aloe vera leaves by Louis Maximillian in 2023. aims to obtain the best detection

algorithm based on the value of aloe leaf edge Mean Squared Error (MSE) and Peak Signal-to-Noise Ratio (PSNR). The test results show that Sobel's algorithm gives better results with an average measurement of MSE of 2781.88 and an average PSNR of 14.04, while Canny's algorithm has an average MSE of 3542.02 and an average PSNR of 12.92 [15].

Saluky et al in 2023 implemented canny algorithm using python and opencv for edge detection with the results of can-ny algorithm for edge detection has better performance compared to other algorithms such as LoG (Laplaci-an of Gaussian), Robert Cross Operator, Prewitt and Sobel [16]. Research on can-ny Ju-ga edge detection was studied by Sriani et al in 2023 to test the pattern of Arabic writing on ancient gravestones where the images tested went through six stages of the Canny method, namely filtering noise (filtering), getting edge strength (edge strength), calculating edge direction, connecting edge direction, non-maximum suppression, and hysteresis to get the resulting image. The results obtained against some of the ancient gravestone image data, resulting in a visible digital image of the boundary between the object and the background in the form of the edge of the object clearly [17].

METHODS

The method used in this study starts from the input image of batik kawung, batik kawung image preprocessing, implementation of sobel method and canny method followed by Edge analysis of the results of edge detection sobel and canny and ends with the presentation of results and conclusions.

Image Input

Image Input is a step or initial stage in a variety of image processing processes, including ob-jek detection, segmentation, pattern recognition, and more. The image becomes the basis for further analysis and extraction of information needed in various applications, while the image input that will be discussed in the study is input citra batik kawung. This stage is done input batik kawung Image by taking 5 samples of batik kawung image to be done which will be Dil-akukan preprocessing. This section is done before preprocessing the image

Image Preprocessing

Image preprocessing refers to a series of steps or techniques that are applied to an image before it begins an advanced stage of analysis or processing. The main purpose of image preprocessing is to improve image quality to produce better results. This preprocessing is done to convert batik kawung image into grayscale image before implementation into sobel method and canny method. RGB images can be converted into Grayscale images by calculating the average of red, Green, Blue color elements. Systematically, the calculation can be seen in the following Formula (1) [15], [17], [18], [19] :

$$G = 0{,}2989 * R + 0{,}5870 * G + 0{,}1140 * B \qquad (1)$$

Implementation of Sobel method and Canny method

Sobel method is an evolution of Robert method that uses HPF (high pass filter) that can Mer-educsi noise before performing perhi-tungan edge detection, for sobel method can be seen in the following Formula (2) [18] :

$$Sobel = \sqrt{Sx^2 + Sy^2} \qquad (2)$$

Canny method is a method known as the optimal edge detection operator because of its low error rate. The pixel spacing found on Canny edge detection is so short that it results in one answer and one edge. The calculation of canny method can be seen in the following Formula (3) :

$$|G| = |Gx| + |Gy| = 0 \qquad (3)$$

In addition, canny can also produce different image views from all methods because it shows the relief effect in it [19].

Analysis of Sobel and Canny edge detection results

The results of the analysis of sobel and canny method is to calculate the image quality evaluation metrics dilakukan by using PSNR (Peak Signal-to-Noise Ratio) and MSE (Mean Squared Error).

PSNR (Peak Signal-to-Noise Ratio)

Hasil analisis metode sobel dan canny adalah untuk menghitung metrik evaluasi kualitas citra yang diperoleh dengan menggunakan PSNR (Peak Signal-to-Noise Ratio) dan MSE (Mean Squared Error) [18]:

$$PSNR\,(x,y) = 10 \log_{10} \left[\frac{M^2}{MSE} \right] \qquad (4)$$

MSE (Mean Squared Error)

MSE is used to measure the average of the square of the difference between the pixels of the original image and the edge detection results, can be seen from the following formula (5):

$$MSE = (\sum_{i=2}^{M} ||x(i) - y(j)||2)M$$

(5)

RESULTS AND DISCUSSION

This study was conducted by analyzing and comparing the results of the detection of sobel and canny. The results of sobel method can be seen in Table 1 while the results of canny method will be displayed and can be seen in Table 2.

Table 1. Sobel Edge Detection Results
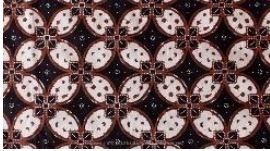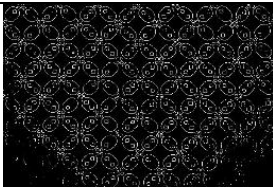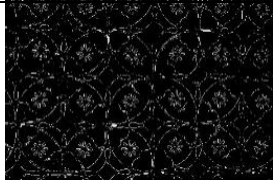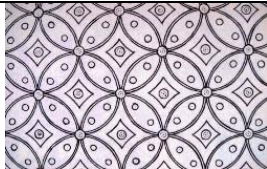
Image Input	Sobel Result Image

Table 2. Canny Edge Detection Results
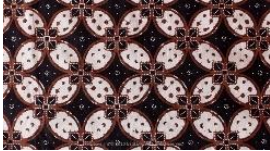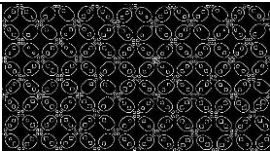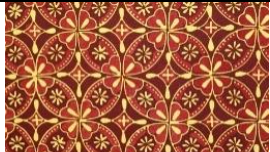
Image Input	Canny Result Image

Table 1 and Table 2 have been compared the results of the sobel method and canny method in the form of images. In addition to the form of images will also be a comparative analysis by calculating the value of the peak signal-to- noise ratio and m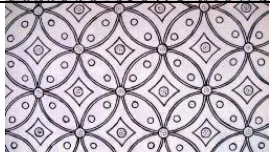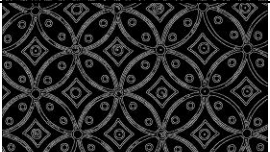ean squared error of both methods, so that from the results of this ana-lisa we can see and compare the results statistically for sobel method and canny method in table 3.

Table 3. PSNR and MSE of Sobel and Canny Edge Detection

Batik Image	Peak Signal-to-Noise Ration		Mean Squared Error	
	Sobel	Canny	Sobel	Canny
Batik1	10.48	11.05	0.0894	0.079
Batik2	10.83	11.65	0.0825	0.0684
Batik3	9.64	9.98	0.1086	0.1005
Batik4	8.28	11.67	0.1486	0.068
Batik5	6.89	7.52	0.2047	0.1772

CONCLUSIONS

Canny method gives a clearer image results than the results of the sobel method. The result can be seen from PSNR (Peak Signal-to-Noise Ration) which is 100% canny value is better than sobel method. The higher the PSNR value, the better the image quality. The value of MSE Mean Squared Error) calculated from both methods also shows that the value of canny 100% is also better than sobel, where the lower the value of MSE, the better the image.

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