IDENTIFICATION OF LEATHER TYPE USE METHOD 2DPCA AND LVQ TO DIGITAL IMAGE

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ABSTRACT

Leather is a material that is flexible and durable are made with animal skin tanning process, usually cowhide and sheepskin. Leather materials are widely used as raw material for the manufacture of clothing, vehicle interiors, furniture, shoes, and other accecoris. Leather is the right choice because it offers convenience and durability. In the skin material are kind of baffled to choose and need the knowledge to know the type, in order to avoid any loss in buying a leather type material is desired because some materials have similar skin types by visible. Implementi the method 2DPCA and LVQ as ekstaksi characteristics and classification.

2DPCA an extraction method development of the PCA method. 2DPCA serves as feature extraction for data compression. By using the image extraction method 2DPCA leather type material will be classified using LVQ which is one method of artificial neural network training to layers kompetetif superfised. LVQ classify the input vector is given by finding the shortest distance to the input vector is then grouped in the same class.

Keyword *: 2DPCA, feature extraction, LVQ, classification*

1. INTRODUCTION

Leather is a material that is flexible and durable made with animal skin tanning process, generally cow's skin. Leather is widely used as a raw material for the manufacture of clothing, vehicle interior, furniture, shoes, accecoris and more. Leather be the right choice because it offers comfort and durability. Leather high shaft so that it has the right to use the rainy season or summer. Skin that has been processed and will be used for the manufacturing process of the goods has several types. Types that have different textures – different according to your needs. So that consumers or users of the skin it is difficult to distinguish the material quality and the quality of skin types, because some of the material has similarities in skin types visible. Based on observations conducted disentra skin cibaduyut, Bandung there are some sellers who don't know the ingredients of skin skin type they are selling. This is certainly detrimental to the consumer when the consumer wants to buy a specific type of leather but because of the lack of knowledge about the material of the skin resulting in wrong in buying the desired skin. While the ingredients in skin want to have better quality of leather is purchased. Later yet the existence of a valid source that explains about skin type and quality. Some of these skin types such as full grain leather, nappa leather, leather milling, patched leather, patent leather, nubuck leather/THUMP, suede leather, and pull-up leather. Based on the foregoing, the identification of the materials needed for the skin type that have the necessity to know the ingredients of a particular skin type allowing consumers can use skin appropriately.

Research on identification of leather ever done on previous research. Research on identification of authenticity cowhide tersamak based skin image characteristics extraction method using Gray Level Co-Occurrence Matrix (GLCM) [1].

Based on the above issue on this research will do a leather type material identification based on texture. However, the element of color also participate in the process of this research only on the praproses values in the image are made into one value becomes the value of the keabuan, in order to facilitate in the calculation. As for identifying based on other parameters in this case is quite difficult, because there will be many parameter values that will be used as the input. Then in terms of color material type of skin do not have absolute color for each particular type, but the color is done randomly from any type of material just to make the skin look attractive. Thus for this research just do identification based on texture leather type material only.

In this study did identify the material type of the skin using method 2 Dimensional Principal Component Analysis (2DPCA) feature extraction for image Vector Quantization method and Learning (LVQ) for the classification of image features. Based on the previous peneltitian about 2DPCA characteristics extraction methods in face image recognition with Matlab [2], the level of accuracy that is produced by a method of 2DPCA very good more than 60.0%. As for research using LVQ method has also been done as an introduction to the types of diseases THT Learning vector quantization using the network [3], the resulting accuracy is also very good reach 94% in the process of testing and training.

Based on the above issue on this research will identify the type of leather using the method of Principal Component Analysis 2 dimensions (2DPCA) for extracting characteristic of image and Vector Quantization method of Learning (LVQ) for classification.

1.1 Outline of the Problem

Based on the background of the problems that have been described, then that is a staple of the problem is how to apply the method of extraction of characteristics and classification of methods for identifying the material type of the skin. This research just testing based on texture image. The level of accuracy obtained after using both of these methods.

1.2 Purpose and Objectives

The purpose of this research is to make a desktop based application that can display the results of the extraction of characteristics and classification of material testing based on the type of skin texture.
Goals achieved in this research are:

1. *Identification of the material type of the skin on the digital image.*
2. *Referable and benchmark for the identification of the ingredients of skin types,*
3. *Find out the level of accuracy of the method using 2DPCA and LVQ in conducting identification based on texture.*

2. CONTENT OF THE STUDY

2.1 Leather

Leather is a material that is flexible and durable made with animal skin tanning process, generally cow, sheep or goat. Leather is widely used as a raw material for the manufacture of clothing, vehicle interior, furniture, shoes, accecoris and more. The leather becomes the right choice because it offers comfort and durability. Genuine leather high shaft so that it has the right to use the rainy season or the summer and even winter. Material type of leather that's been disiap used to process goods have types – types. Types that have different textures different from corresponding types and needs. So that the customer or the user of leather is hard to distinguish.

Its kind of distinguishing the use of its kind according to needs was required. Every type of leather that will be used to create an item using a different skin types different according to needs the item. like for example when want to make formal shoes or loafers, but because it does not know the type of material the peel and buy leathers suede or milled. Certainly wrong and harmful, because it does not fit the needs of regular formal wear shoes because the material type of brush-off. Hence the need for knowledge about the type of material of the skin so as not to wrong or did not happen which is not on its use because there's still the sellers who do not understand. So make the user or consumer of leather is quite difficult in choosing and buying leather.

The type of leather used in this study are :

1. *Full grain*

   Type of material of the leather in the process as a whole without changing or modifying the structure of the surface of the leather.



Pictures 1 Full grain

2. *Milling*

   Leather has an extra surface of artificial/diemboss into it once more the outside skin mashed the less good.



Pictures 2 Milling

3. *Pull up*

   Leather that is showing the effects of color meretak when the skin is pulled tight.



Pictures 3 Pull up

4. *Suede*

   Leather type is a type of leather that are processed in reverse order, i.e., tanned from the inside of the skin.



Pictures 4 Suede

2.2 Textures

Textures in General refers to the repetition of the basic texture elements which are often called primitive or texel (texture element). To form a texture at least there are two requirements that must be met are:

1. *Consists of one or more pixels that form the primitive patterns (the smallest parts). Primitive pattern forms it can be points, straight lines, curved lines, polygons and others that are the basic elements of a form.*
2. *The emergence of primitive patterns over and over again with the interval distance and a certain direction so that it can be predicted or found a characteristic perulangannya.*



Pictures 5 examples of texture leather types

An image of providing interpretation of different textures when viewed with a different angle and distance, man looking texture based on descriptions that are random, such as smooth, rough, regular, irregular, and other. This is an inappropriate description and non-quantitative, so it required the presence of a quantitative description (mathematically) to facilitate analysis.

2.3 Analysis Textures

Analysis of texture is the basis of a wide range of applications, the application of the analysis of textures such as remote sensing, medical imaging, identification of the quality of a material (wood, leather, textiles and others). On the analysis of the imagery, categorized into five main categories, namely statistical, structural, geometry, basic models and signal processing. Statistical approach to considering that the internsitas generated by a two-dimensional random field, this method based on the frequency-frequency space. Examples of statistical methods is the autocorrelation function, run-length, matrix, kookurensi, tranformasi, fourier frequency edge. Structural engineering related to Intrusion the smallest parts of an image. examples of structural method is the model of fractal. Geometry methods based upon the device geometry on the elements of texture. An example of a basic model is a random field. Whereas the method of signal processing is a method based on frequency analysis such as the transformation of gabor and wavelet transform.

2.3.1 PCA

PCA is a method of extraction of features for pattern recognition. PCA conducts second order based on information compression of the Mean Square Error (MSE) [19].

Mathematically PCA was defined as follows [19]. Suppose there are column vectors Xi image = [X 1, x 2 ... XM] where M is the number of the image and is the number of columns in the matrix of Xi. Then μ, i.e. the mean of the Matric Xi can be calculated as follows:

$$\mu = \frac{1}{M}\sum_{i}^{M} Xi \qquad (1)$$

Reduction in data matrices Xi with a mean μ imagery will produce data with average value zero. This process is also called with the normalization of data.

$$\varphi = Xi - \mu ; i = 1,2 \ldots \ldots M \qquad (2)$$

The result of this matrix is then used to construct the matrix kovarian matrix as follows.

Cov = (1/n)[Transpose(X-mx)*(X-mx)] (3)*

After the kovarian matrix is obtained, then look for the matrikkovarian of the eigenvalue equation as follows:

Determinant(Cov – λ I) = 0 (4)

After obtained eigenvalue, the largest eigenvalue in addition to find the value of the eigenvector. By the following formula:

(λI – Cov) = 0 (5)

2.3.2 2DPCA

The method 2DPCA is development of a PCA serves as a method of extracting features for data compression. 2DPCA method has advantages of PCA method in terms of the accuracy of data and the complexity of the timing but have a deficiency of IE requires a lot of coefficients in storing data [9].

The difference of 2DPCA and the PCA is on a initial step a matrix image retrieval. If on a method if the method on PCA a two dimensional image of a matrix (m x n) then the matrix transformed into a matrix of matrix rows or one dimension.

2DPCA method if an image matrix (m x n) then the image of the matrix need not be ditranformasi to the matrix of one dimension. A matrix A with the image size (m x n) and X a vector column stating the unity of an n-dimensional. To project the image of A, (m x n) matrices to linear transformations of X with the following equation.

$$Y = AX \qquad (6)$$

2.4 Classification

Classification is the process to find a model or menjelasakan or functions that differentiate the concepts or classes of data, in order to be able to estimate the class of an object label is not known. In achieving these goals, the process of classification form one model which is able to distinguish the data

into different classes – classes based on rules or specific function. The usual form of its own that model rule "if-then", in the form of decision tree, or mathematical formulas.

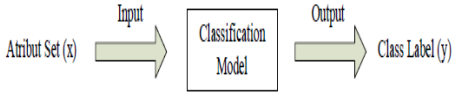


Figure 6 Block Diagram Model Classification

2.4.1 Classification LVQ

Method of Learning Vector Quantization (LVQ) i.e. is the method to do the training against supervised competitive layers. Competitive layer will automatically learn to perform the classification against the input vectors are given. If the input vector has some very close together, then the vector – the input vector will be grouped in the same class.

From this data classification method is LVQ Adaptive based on training data with the desired class of information which can also be taken from an ANN of levenberg Marquardt taken i.e. the value of the amount of training his epoh and value error (MSE). Although there is a supervised training method but using LVQ clustering data unsupervised to pre set process data and the determination of the cluster center. LVQ network architecture almost resembles a network training competitive except at each of his output is associated with a particular class. The training process on the network made to set the value of the network weights (wi) which will undergo changes at any training conducted.

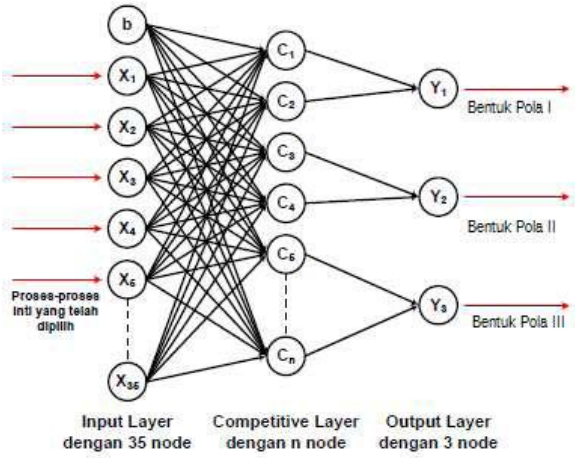


Figure 7 Architecture of Learning Vector Quantization (LVQ)

2.5 Accuracy testing method

In testing, either using a secenario testing accuracy can be done with 3 types of testing, i.e.

1. *Training set test*
2. *Supplied set test*

1. *Training set test*

   Testing method using data already in training, in other words, the training data and test data is the same data
2. *Supplied set test*

   Testing methods using different data, in other words, different training data with the data that will be tested.

2.6 Analisis Proses

Analysis of the process that will be conducted in this research is the analysis of image classification based on granular texture. work process stages in conducting classification ranging from data input to output data. Here are the stages of the process analysis to be performed can be seen in Figure 4:

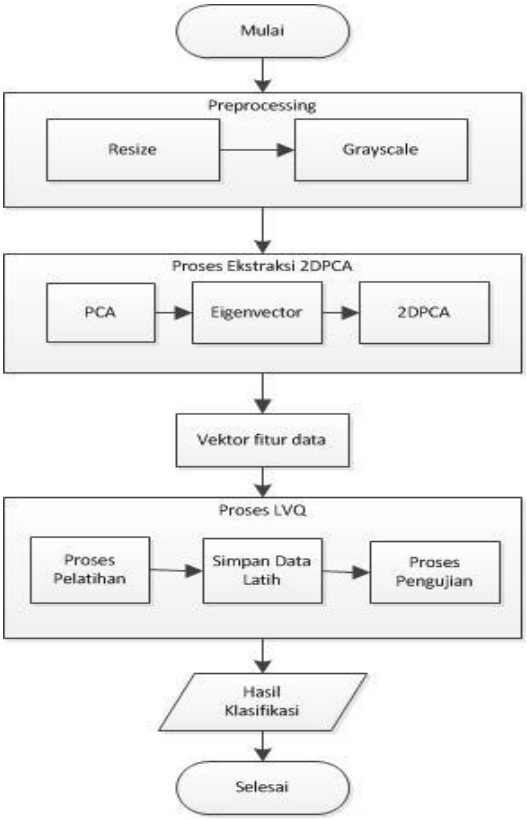


Figure 8 process flow

2.6.1 Input Data Analysis

Data input in the form of the material type of the skin. Then resize the size 32 x 32 into pixels with true color i.e., each pixel value that is there are 3 RGB, Then the image will be converted to

greyscale to simplify and facilitate the next process, with the aim to make each pixel one value, namely the value of keabuan. After the image is converted to grayscale in the matrix can be grayscale.

After getting the value of grayscale and then performed the extraction process characteristic of Two Dimensional Principal Component Analisys (2DPCA), in this process will generate a matrix of kovarian. Then search for eigenvector and eigenvalue of matrix Covariance. From the results of the process will be the optimal projection matrix is generated. From these data will be submitted to the training and testing phases to the process of classification method using Learning Vector Quantization (LVQ).

2.6.1.1 Preprocessing

On this peneltian, preprocessing is done to make it easier to get the value of the extraction of characteristics. Preprocessing is going to do is Resize and Grayscale. The following process flow from preprocessing :

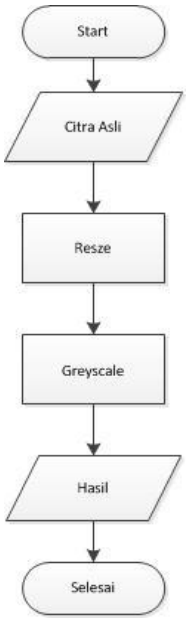


Figure 9 Alur Preprocessing process flow

2.6.1.1.1 Resize

Resizing is the process by which the input image size scaled down from its original size, it aims to get the input of all the input image or image data format to equate the input that will be used as the test image. Because the input image to be tested has a different size – it's different then the resizing was undertaken.

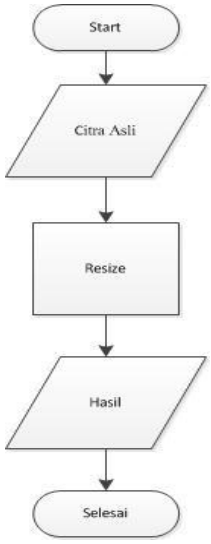


Figure10 Groove Resize

2.6.1.1.2 Greyscale

Greyscale is the process by which change color to grayish with how to change the color of the third element, namely the value of R, G, and B of each pixel into one value of the input. So With so obtained is the value of greyscale.

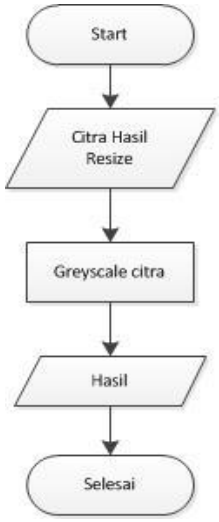


Figure 11 Process Flow Greyscale

2.6.1.1.3 Two Dimensional Principal Component Analysis (2DPCA)

Extraction of characteristic of the process is to get a major feature in the image. The extraction methods used in this study was 2DPCA (Two Dimensioanal Principal Component Analisys). Stages on the 2DPCA is looking for the value of the eigenvector of the largest eigenvalue results. The steps that is looking for a mean of matric results

preprocessing, looking for a matrix of covariance matrix, looking for a center, look for the value of eigenvalue and eigenvector, and multiplication eigenvector Matrix value multiplied between results of preprocessing. The extraction flow characteristic of the image:

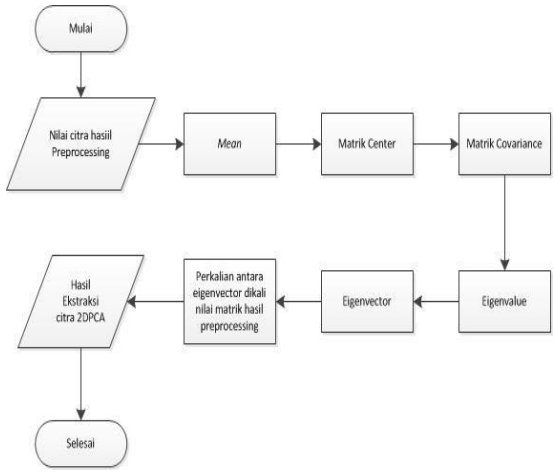


Figure 12 Groove of the Extraction Process

2.6.2 Analysis Training

The result of the extraction process is the vector that will be used as input to the process of LVQ, in stages of the training process have the following process stages:

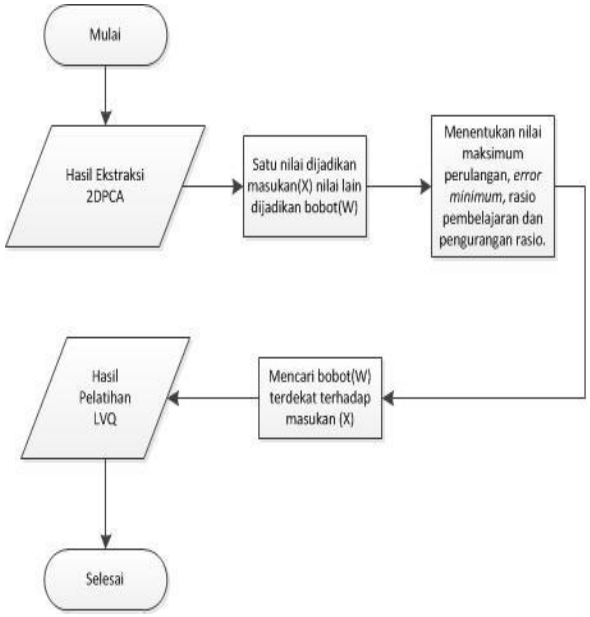
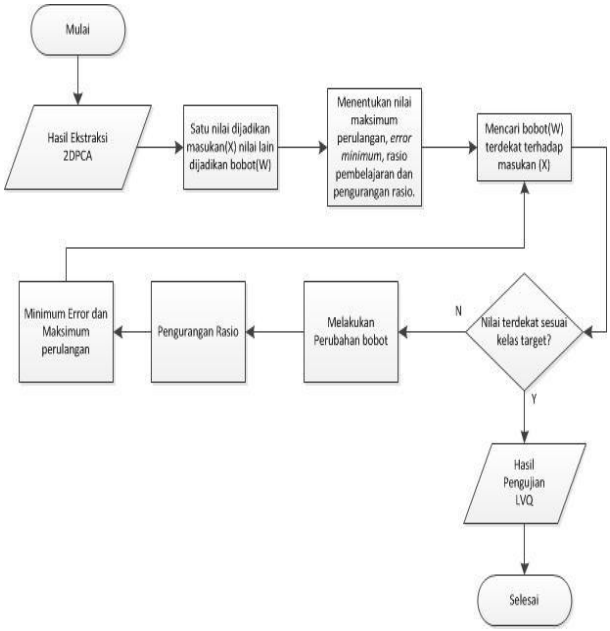


Figure 13 Groove LVQ training process

2.6.3 Analysis Testing

The process of testing the LVQ also has several stages of the process, as follows:



Gambar 14 Alur Proses Pengujian LVQ

2.6.4 Data Analysis Outputs

The output data is data classification results from the image, this data is obtained from a series of processes ranging from image processing using the method that produces the characteristic extraction with the help of grayscale and quantization image to make the image has a single value in each pikselnya, then in training and testing using Learning vector quantization in order to produce the results of the classification.

The output data is data the results of a series of processes. In this study, the data will be input through a stage of image processing which consists of: (preprocessing and extraction of characteristics), and then going through the stage of classification i.e. training and testing. After all is finished it will be generated in the output data in the form of the results of the classification. The output data are obtained from the results of the classification, which is the nearest value of the intended target.

2.7 Testing

Testing method of aiming to know the performance of the LVQ method 2DPCA and implemented on this system. Performance testing in this study was to measure the level of accuracy and the long processing time by using multiple testing methods that have been prepared, to measure the

degree of accuracy of the method that can be used, i.e. using multiple testing scenarios are as follows:

1. *test image included in the data base (training set test).*
2. *Test the image which is not included in the data base (supplied set of test).*

2.7.1 Test with scenario 1

Test method 1 is done with a test image that is included in the datalatih, the test aims to find out the level of introduction of imagery that is already trained, data image used there are 80 images consisting of 4 classes, with each class there were 20 images. There are test results data in the appendix contained in Chapter 4.

2.7.2 Testing with scenario 2

Testing with method 2 is done with a test image that is not included in the training data, the test aims to find out the level of image recognition test outside the datalatih against trainer image that exists in datalatih. The image data is used there are 8 fruit image consists of 4 classes, with each class there are 2 images. The test results data there are attachments found on Chapter 4.

2.8 Test Conclusion

Based on the results of the test scenario 1 that is testing the same test data with data training, can be drawn the conclusion that the LVQ method can be distinguished with the accuracy of 51.3%.

Based on the test scenario 2 IE testing test data which is not found in the training data, method of LVQ can be distinguished with accuracy testing 2 of 60%.

Based on the conclusions and results of the test scenarios using the confusion matrix, LVQ method can be distinguished with an average accuracy of 68.75%.

3. Cover

3.1 Conclusion

From the research that has been done, the following conclusions can be drawn:

1. *2DPCA method and usage between LVQ in extraction and image classification. LVQ can perform image classification based on texture that is extracted with the 2DPCA method. Due to the results of the data extraction feature of 2DPCA is a vector feature data, so that when the process of classification of the characteristic extraction results data can be directly used as input in the classification of LVQ.*
2. *Based on the conclusions and results of the test scenarios using the confusion matrix, LVQ method can be distinguished with an average accuracy of 68.75%.*

3.2 Advice

Based on the results of research and implementation method of 2DPCA extraction and classification of LVQ was proposed some suggestions as follows:

1. *Expand the dataset to add to the precision or accuracy in the classification of materials type of skin. So that it can be known with certainty, the accuracy of the LVQ method.*
2. *Need to be developed and considered returning to the use of this method with other method in classifying some other skin types.*
3. *Add some other traits, such as the extraction the extraction of color, shape, etc.*
4. *Expected to develop it towards the identification of the research data so that later can be useful for certain parties such as the manufacturer of the new shoes would be pioneering and other parties.*
5. *Doing research image classification using the classification algorithms, such as using a Decision Tree, neural networks, SVM and other miscellaneous in order to compare the results of the accuracy and speed of the process.*

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