Implementation of Run Length Method And Simple Naïve Bayes Algorithm To Classification Of Leukemia Based On Image Of Blood

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ABSTRACT

Leukemia is a disease in cancer classification. Leukemia has a different characteristic. How to differentiate these characteristics is to recognize the difference of a texture from image of leukemia. There are several methods to obtain the characteristics of texture from image, a method to obtain the characteristics of texture from image is use run length method. The texture characteristics of run length method are SRE (Short Run Emphasis), LRE (Long Run Emphasis), GLU (Gray Level Uniformity), RLU (Run Length Uniformity) and RPC (Run Percentage). From the results of these characteristics then naïve bayes algorithm will determine the largest value of probability. The object being tested is a blood image of leukemia.

From the research has been done, can be concluded as follows: naïve bayes algorithm can do image classification based on the texture extracted by run length method. Data from feature extraction using run length method is continuous data, so the process of data classification from feature extraction can be directly used as an input in the naïve bayes classification.

From the result, a conclusion obtained is naïve bayes algorithm can classify images of leukemia from extraction of blood image using run length method and generates 91.25% accuracy rate with a total of 20 training data and 20 testing data. Due to the texture from feature extraction of leukemia with a run length method has the advantage of distinguishing between smooth texture and rough texture, so naïve bayes classification can run more leverage when performing image classification of blood were identified of leukemia.

Keywords : Leukemia, Blood of Image, Run Length Method, Naïve Bayes Algorithm

1. INTRODUCTION

Leukemia is a cancer that occurs in human blood cells. When leukemia occurs, the body produces blood cells is abnormal and in large numbers. Leukemia disease is common in people who are under 15 years [1]. Currently leukemia disease into a disease that is very frightening, it is seen from the life expectancy of cancer patients which decreased by 60% and the number of digits kematian.Melihat these problems, hence the need for detection of leukemia in adolescents.

Leukemia disease detection can be done by looking at the symptoms experienced by the patient. But with the invitation current technological developments leukemia disease detection can be done with the help of a system that can manage an image. The introduction of texture is one technique that can be used in detecting leukemia. In addition to the introduction of the texture in the image recognition process is also needed so that the introduction of the classification process which has produced good results. Based on previous research, the process of image recognition can be performed to detect the leukemia disease [2].

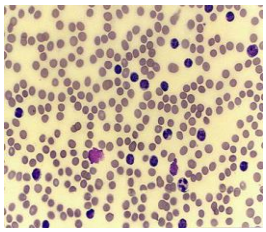
Basically leukemia can be identified based on several aspects including the color, pattern and texture of the blood cells. One method that can be used for the introduction of the texture is run length method. The results of this study can be more accurately when using a better classification techniques [3]. Naïve Bayes classification method is one that uses the concept of probability.

1.1 Leukemia

Leukemia or blood cancer is a disease in the classification of cancer of the blood or bone marrow characterized by an abnormal change in the composition or the malignant transformation of blood-forming cells in the bone marrow and lymphoid tissue, generally occurs in the white blood cells [4]. Leukemia cancer diseases are classified into:

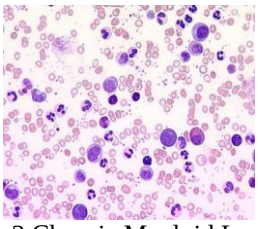
1. Chronic Lymphocytic Leukemia (CLL) is a monoclonal disorder characterized by a progressive accumulation of functionally incompetent lymphocytes. Patients with CLL have a white blood cell count higher than usual. This disease often occurs in adults older than 55 years, sometimes also affects young adults, and almost never occurs in children.

Some patients died quickly, within 2-3 years after diagnosis, due to complications of CLL, but most patients survive 5-10 years.



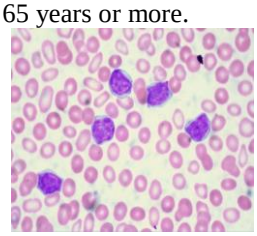
Picture 1 Chronic Lymphocytic Leukemia

2. Chronic Myeloid Leukemia (CML) is a form of leukemia characterized by the increased and unregulated growth of myeloid cells in the bone marrow and also accumulates in the blood. This disease often occurs in adults, can also occur in children.



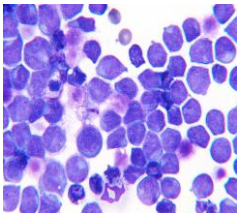
Picture 2 Chronic Myeloid Leukemia

3. Acute lymphoblastic leukemia (ALL) is a disease in which cells that normally develop into lymphocytes become malignant and will soon replace the normal cells in the bone marrow. ALL is a common leukemia in children under the age of 15 years. Most often occurs in children aged between 3-5 years, but it sometimes occurs in the teens and adults who are aged 65 years or more.



Picture 3 Acute Lymphoblastic Leukemia

4. Acute Myelogenous Leukemia (AML) is a type of cancer of the blood and bone marrow. AML is characterized by rapid growth of abnormal white blood cells that accumulate in the bone marrow and interfere with normal blood cell production. This disease affects the blood cells are immature and growing rapidly. This disease usually occurs in children and adults.



Picture 4 Acute Myelogenous Leukemia

1.2 Artificial Intelligence

Artificial intelligence (Artificial Intelligence) is a branch of science which deals with the use of machines to solve complex problems in a more humane way.

Artificial intelligence is used to analyze the image of the scenery in the calculation of the symbols that represent the content of the scene after the image is processed to obtain a special characteristic. Artificial intelligence can be seen as three integrated unity of perception, understanding and action. Perception decodes the signals from the real world in images become symbols of a more simple, understanding manipulating these symbols to facilitate extracting certain information, and action to translate the symbols that have been manipulated into other signals that can be the end result [5].

1.3 Run Length Method

Grey level run length matrix commonly abbreviated with GLRLM is one popular method to extract the texture in order to obtain statistical characteristics or attributes contained in texture to estimate the pixels that have the same degree of gray. Extraction texture with run-length method is done by making a series of value pairs (i, j) in each row of pixels. Orientation is formed by a four-way shift at intervals of 45^0, which is 0^0, 45^0, 90^0, and 135^0.

Based on research conducted by Galloway [6], there are several types of textural characteristics that can be extracted from the matrix run-length. The following variables contained in the extraction of the image by using statistical methods Grey Level Run Length Matrix:

i = the value of the degree of gray
j = pixels in sequence (run)
M = Number of degrees of gray in an image
N = number of pixels in an image sequence
r (j) = Number of pixels sequentially by many the sequence (run length)
g (i) = number of pixels in sequence by value grey degrees
s = Number of total value of the resulting run on the direction certain
p (i, j) = the set of matrices i and j
n = number of rows * number of columns.

Where these variables will be used to find the value of the attributes of a texture like SRE, LRE, GLU, RLU and RPC.

$$SRE = \frac{1}{n_r}\sum_{i=1}^{M}\sum_{j=1}^{N}\frac{P(i,j)}{j^2}$$

$$LRE = \frac{1}{n_r}\sum_{i=1}^{M}\sum_{j=1}^{N} P(i,j) * j^2$$

$$GLU = \frac{1}{n_r}\sum_{i=1}^{N}\left(\sum_{j=1}^{M}P(i,j)\right)^2$$

$$RLU = \frac{1}{n_r}\sum_{j=1}^{M}\left(\sum_{i=1}^{N}P(i,j)\right)^2$$

$$RPC = \sum_{j=1}^{M}\sum_{i=1}^{N}\frac{P(i,j)}{n}$$

1.4 Naive Bayes Classification

Naïve Bayes is a simple probabilistic based prediction techniques are based on the application of Bayes' theorem [7]. Naïve Bayes classification is a method simplest to use the existing opportunities, where it is assumed that every variable X is free (independence).
In naïve classification steps are as follows:
training:
1. Calculate the average (mean) of each feature in the training database with

$$\mu = \frac{\sum x_i}{n}$$

Where:
μ = mean
n = value of data
$\sum x_i$ = the number of data values

2. Then calculate the variance of the training dataset

$$\sigma^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \mu)^2$$

Where:
σ^2= varians
μ= mean
x_i = value of data
n = the number of data values

Test:

1. Calculate the probability (prior) for each class that is by counting the amount of data each class divided by the total number of overall data

2. Next, calculate the probability density

$$\varphi_{\mu\sigma}(x) = \frac{1}{\sqrt{2\pi\sigma^2}}e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

Where :
x = input of data
π = 3,14
σ = standar deviation
μ = mean

3. Having obtained the probability density values, then calculate the posterior of each class.

$$posterior = \frac{prior\ x\ likehood}{evidence}$$

4. Having obtained the posterior value, and then determine the appropriate grade to see the value of the largest posterior.

1.5 Confusion Matrix Test

Confusion matrix is a table that states the amount of test data that is properly classified. Here's an example confusion matrix for binary classification:

Tabel 1 Confusion Matrix for Biner Classification

		Prediction Class	
		1	0
Real Class	1	TP	FN
	0	FP	TN

Information:
1. True Positive (TP), ie the number of documents from Grade 1 right and are classified as Class 1.
2. True Negative (TN), ie the number of documents of class 0 is correctly classified as grade 0.
3. False Positive (FP), ie the number of documents from grade 0 incorrectly classified as Class 1.
4. False Negative (FN), ie the number of documents from one class incorrectly classified as grade 0.

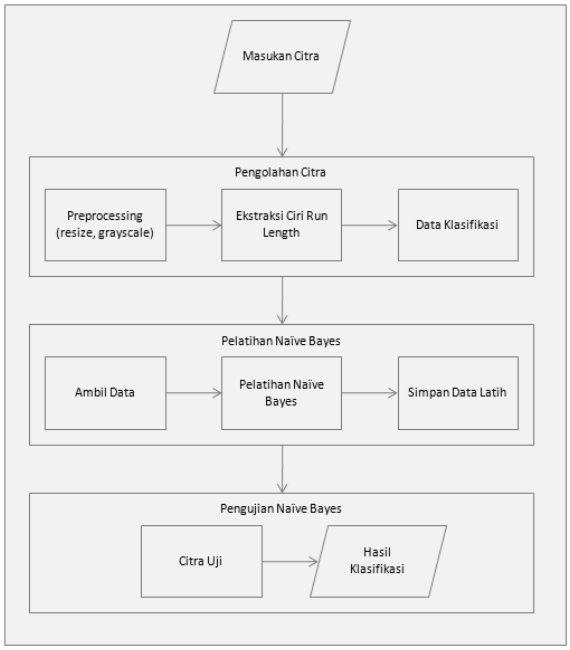
To calculate the accuracy of the equation [8]:

$$\frac{TP + TN}{TP + FN + FP + TN}\ x100\%$$

2. Experiments

2.1 Procedur Analysis System

The procedure is a collection of processes in a system that is interconnected with each other to achieve the objectives that have been applied. Here are the stages of the process within the classification ranging from data input to output data.



Picture 5 Flow Analysis System Procedure

Here are explanations of each stage are as follows:

1. Input image

A step retrieval of image data input into the system media. The input image in the form of an image file in which there are abnormalities in the blood types of leukemia and then scanned.

2. The image processing

At this stage the image is entered will be the process of changing the image size (resize) to 32x32 pixels [16], after which the process is carried out by changing the color grayscale image becomes grayish to get value matrix grayscale. Having obtained the matrix grayscale and then do the run-length feature extraction and classification data store feature values obtained after an average run-length.

3. Training naïve Bayes

The training stage on naïve Bayes ie retrieve the data that have been named classification and has an average value run-length features to count and look for the mean and variance.

4. Testing naïve Bayes

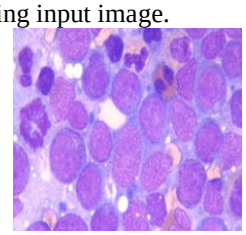
In the testing process naïve Bayes, the input image to be tested. Image which is input will be processed to find the value of the probability density and seek the greatest posterior value. Having obtained the largest posterior value then known classification results of the test images.

2.2 Analysis Methods

The analysis algorithm is an analysis of a system that contained the steps of the process flow algorithms. This analysis aims to analyze how the naïve Bayes methods in classifying images based on texture. The following stages are carried out in classifying the image:

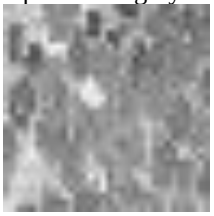
2.2.1 Analysis of Image Processing Stages

Analysis of image processing stage is a stage to get the extraction characteristics that exist in an image. The initial step in the analysis stage is to insert the image processing input image.



Picture 6 Input image

After the image is inserted, then the preprocessing process is carried out by resizing and grayscale of the input image to produce a grayscale matrix.



Picture 7 resize image and grayscale



Picture 8 Matrix Grayscale

2.2.2 Feature Extraction Run Length

The main steps in the process of feature extraction is to take a run length matrix grayscale value. Feature extraction value to be searched is the value of SRE (short run emphasis), LRE (long run emphasis), GLU (gray level uninformity), RLU (run length uninformity) and RPC (run percentage). Values obtained through the feature extraction matrix table run length.

Table 1 Run Length Matrix 0^0

Gray Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	mP(i,j)
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4	9	3	0	0	0	0	0	0	0	0	0	0	0	0	0	12
5	24	2	0	0	0	0	0	0	0	0	0	0	0	0	0	26
6	66	9	2	0	1	0	0	0	0	0	0	0	0	0	0	78
7	128	34	6	2	0	0	1	0	0	0	0	0	0	0	0	171
8	120	40	10	3	4	0	0	0	0	0	0	0	0	0	0	177
9	102	22	6	0	0	0	0	0	0	0	0	0	0	0	0	130
10	90	13	4	0	0	0	0	0	0	0	0	0	0	0	0	107
11	35	5	3	1	1	0	0	0	0	0	0	0	0	0	0	45
12	18	3	0	0	0	0	0	0	0	0	0	0	0	0	0	21
13	9	3	0	0	0	0	0	0	0	0	0	0	0	0	0	12
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
nP(i.j)	602	134	31	6	6	0	1	0	0	0	0	0	0	0	0	780

Table 2 Run Length Matrix 45^0

Gray Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	mP(i,j)
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4	11	2	0	0	0	0	0	0	0	0	0	0	0	0	0	13
5	20	4	0	0	0	0	0	0	0	0	0	0	0	0	0	24
6	69	11	0	1	0	0	0	0	0	0	0	0	0	0	0	81
7	106	37	11	4	0	0	0	0	0	0	0	0	0	0	0	158
8	105	47	12	5	0	0	1	0	0	0	0	0	0	0	0	170
9	105	22	5	0	0	0	0	0	0	0	0	0	0	0	0	132
10	84	19	2	0	0	0	0	0	0	0	0	0	0	0	0	105
11	29	12	2	1	0	0	0	0	0	0	0	0	0	0	0	44
12	16	4	0	0	0	0	0	0	0	0	0	0	0	0	0	20
13	9	3	0	0	0	0	0	0	0	0	0	0	0	0	0	12
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
nP(i,j)	555	161	32	11	0	0	1	0	0	0	0	0	0	0	0	760

Table 3 Run Length Matrix 90^0

Gray Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	mP(i,j)
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4	11	2	0	0	0	0	0	0	0	0	0	0	0	0	0	13
5	21	2	1	0	0	0	0	0	0	0	0	0	0	0	0	24
6	60	13	3	0	0	0	0	0	0	0	0	0	0	0	0	76
7	98	30	17	5	0	0	0	0	0	0	0	0	0	0	0	150
8	114	34	13	4	1	0	0	0	1	0	1	0	0	0	0	168
9	96	19	7	1	1	0	0	0	0	0	0	0	0	0	0	124
10	67	20	4	1	1	0	0	0	0	0	0	0	0	0	0	93
11	32	8	5	0	0	0	0	0	0	0	0	0	0	0	0	45
12	18	3	0	0	0	0	0	0	0	0	0	0	0	0	0	21
13	6	3	1	0	0	0	0	0	0	0	0	0	0	0	0	10
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
nP(i,j)	524	134	51	11	3	0	0	0	1	0	1	0	0	0	0	725

Table 4 Run Length Matrix 135^0

Gray Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	mP(i,j)
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
4	11	2	0	0	0	0	0	0	0	0	0	0	0	0	0	13
5	22	3	0	0	0	0	0	0	0	0	0	0	0	0	0	25
6	59	18	0	0	0	0	0	0	0	0	0	0	0	0	0	77
7	133	27	11	1	1	0	0	0	0	0	0	0	0	0	0	173
8	144	36	11	2	1	0	0	0	0	0	0	0	0	0	0	194
9	118	16	2	2	0	0	0	0	0	0	0	0	0	0	0	138
10	80	18	4	0	0	0	0	0	0	0	0	0	0	0	0	102
11	33	8	3	0	1	0	0	0	0	0	0	0	0	0	0	45
12	18	3	0	0	0	0	0	0	0	0	0	0	0	0	0	21
13	11	2	0	0	0	0	0	0	0	0	0	0	0	0	0	13
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
nP(i,j)	630	133	31	5	3	0	0	0	0	0	0	0	0	0	0	802

Calculations run length matrix 0^0

$$SRE = \left(\frac{602/780}{1^2}\right)+\left(\frac{134/780}{2^2}\right)+\left(\frac{31/780}{3^2}\right)+\left(\frac{6/780}{4^2}\right)+\left(\frac{6/780}{5^2}\right)+..+\left(\frac{0/780}{32^2}\right)$$
$$= 0.771795 + 0.042949 + 0.004416 + 0.000481 + 0.000308 + 0$$
$$= 0.819974$$

$$LRE = \left(\frac{602.1^2}{780}\right)+\left(\frac{134.2^2}{780}\right)+\left(\frac{31.3^2}{780}\right)+\left(\frac{6.4^2}{780}\right)+\left(\frac{6.5^2}{780}\right)+..+\left(\frac{0.32^2}{780}\right)$$
$$= 0.771795 + 0.687179 + 0.357692 + 0.123077 + 0.192308 + 0$$
$$= 2.194872$$

$$GLU = 0+0+0+\left(\frac{1^2}{780}\right)+\left(\frac{12^2}{780}\right)+\left(\frac{26^2}{780}\right)+\left(\frac{78^2}{780}\right)+\left(\frac{171^2}{780}\right)+\left(\frac{177^2}{780}\right)$$
$$+\left(\frac{130^2}{780}\right)+\left(\frac{107^2}{780}\right)+\left(\frac{45^2}{780}\right)+\left(\frac{21}{780}\right)+\left(\frac{12^2}{780}\right)+0$$
$$= 0 + 0.001282 + 0.184615 + 0.866667 + 7.8000 + 37.488462 + 40.165385$$
$$+21.666667 + 14.678205 + 2.596154 + 0.565385 + 0.184615$$
$$= 126.197436$$

$$RLU = \left(\frac{602^2}{780}\right)+\left(\frac{134^2}{780}\right)+\left(\frac{31^2}{780}\right)+\left(\frac{6^2}{780}\right)+\left(\frac{6^2}{780}\right)+..+\left(\frac{0^2}{780}\right)$$
$$= 464.620513 + 23.020513 + 1.232051 + 0.046154 + 0.046154$$
$$= 488.966667$$

$$RPC = \left(\frac{602}{1024}\right)+\left(\frac{134}{1024}\right)+\left(\frac{31}{1024}\right)+\left(\frac{6}{1024}\right)+\left(\frac{6}{1024}\right)+..+\left(\frac{0}{1024}\right)$$
$$= 0.587891 + 0.130859 + 0.030273 + 0.005859 + 0.005859 + 0$$
$$= 0.761719$$

By using the same steps to symmetrical angles of 45^0, 90^0 and in 135^0 it will get its value as follows:

Table 5 Feature Value Angle Imagery Feedback

Fitur	Sudut 0	Sudut 45	Sudut 90	Sudut 135
SRE	0.819974	0.788834	0.777924	0.831829
LRE	2.194872	2.252632	2.72000	1.990025
GLU	126.197436	121.184211	115.637241	132.633416
RLU	488.966667	440.910526	407.262069	518.184539
RPC	0.761719	0.742188	0.708008	0.783203

2.3 Analysis Training

At the stage of this analysis will be trained to use naïve Bayes algorithm, training in naïve Bayes made to obtain training data are estimated by the mean and variance. Step - a step on the stage of this training is to find the mean and variance of each feature in every classroom training data.

Table 6 Dataset for Training

Kelas	SRE	RLE	GLU	RLU	RPC
ALL	0.80464	2.289382	123.9131	463.831	0.748779
ALL	0.800206	2.52889	78.91465	443.8536	0.727295
AML	0.889653	1.711747	78.1726	650.9412	0.844482
AML	0.896835	1.524693	71.83932	675.1909	0.862305
CLL	0.85138	2.040801	80.72218	551.1259	0.791016
CLL	0.852265	2.517193	69.87904	534.6269	0.764404
CML	0.840194	2.593832	72.97291	505.1915	0.744629
CML	0.828181	3.879872	63.71542	447.3502	0.679443

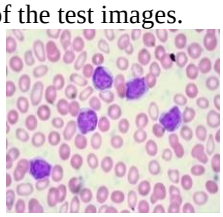
By using the calculation of the mean and variance are equal then the obtained value of SRE, LRE, GLU, and RPC for class RLU ALL, AML, CLL and CML

Table 7 Mean Value and Variety

	Kelas	SRE	RLE	GLU	RLU	RPC
Mean	ALL	0.802423	1.920955	114.698138	542.349092	0.794921
	AML	0.893244	1.618220	75.005962	663.066031	0.853393
	CLL	0.851822	2.278996	75.300611	542.876387	0.777099
	CML	0.834188	3.516087	66.949643	464.497171	0.700928
Varians	ALL	0.0000098	0.006091	365.506693	378.506694	0.000138
	AML	0.000026	0.017495	20.055250	294.024550	0.000159
	CLL	0.0000003	0.113475	58.786836	136.108146	0.000354
	CML	0.000072	0.264679	20.920352	588.034777	0.000923

2.4 Testing Analysis

Having obtained the mean and variance of the training data, then further testing can be done on the new data, the first step to do is to enter the test images, then calculate the value of feature extraction characteristics of the test images.



Gambar 9 Citra Uji

Tabel 8 Nilai Fitur Ekstraksi Ciri Citra Uji

Kelas	SRE	LRE	GLU	RLU	RPC
?	0.8449	1.9304	107.4115	546.8075	0.7971

Having obtained the feature values of the image feature extraction test, the next step to calculate the value of probability density.

Table 9 Probability Density Value Data Testing

	Kelas	SRE	LRE	GLU	RLU	RPC
φ	ALL	0.0000	0.0000	0.0001	0.0000	0.0000
	AML	0.0000	0.0000	0.0000	0.0000	25.2196
	CLL	0.0000	0.0001	0.0000	0.0000	0.0361
	CML	21.2009	0.0138	0.0000	0.0000	0.1358

Then calculate the value of evidence and posterior

Evidence =
(0.25 x 0 x 0 x 0.0001 x 0 x 0)
+ (0.25 x 0 x 0 x 0 x 0 x 25.2196)
+ (0.25 x 0 x 0.0001 x 0 x 0 x 0.0361)
+ (0.25 x 21.2009 x 0.0138 x 0 x 0 x 0.1358)
= 0.0000001

Posterior (ALL) = P(ALL) . P(SRE | ALL) . P(LRE | ALL). P(GLU | ALL). P(RLU | ALL). P(RPC | ALL) / Evidence

Posterior (ALL) =(0.25 x 0 x 0 x 0.0001 x 0 x 0) / 0.0000001 = 1

Posterior (AML) = P(AML) . P(SRE | AML) . P(LRE | AML). P(GLU | AML). P(RLU | AML). P(RPC | AML) / Evidence

Posterior (AML) = (0.25 x 0 x 0 x 0 x 0 x 25.2196) / 0.0000001 = 0
Posterior(CLL) = P(CLL) . P(SRE | CLL) . P(LRE | CLL). P(GLU | CLL). P(RLU | CLL). P(RPC | CLL) / Evidence

Posterior(CLL) = (0.25 x 0 x 0.0001 x 0 x 0 x 0.0361) / 0.0000001 = 0

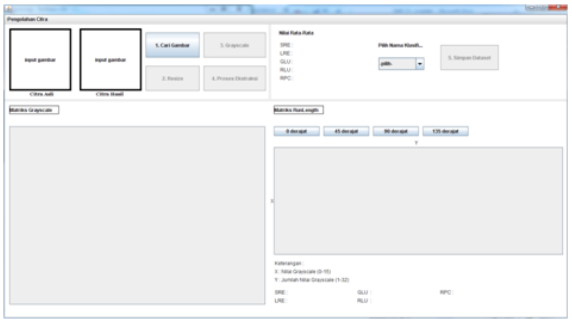
Posterior(CML) = P(CML) . P(SRE | CML) . P(LRE | CML). P(GLU | CML). P(RLU | CML). P(RPC | CML) / Evidence

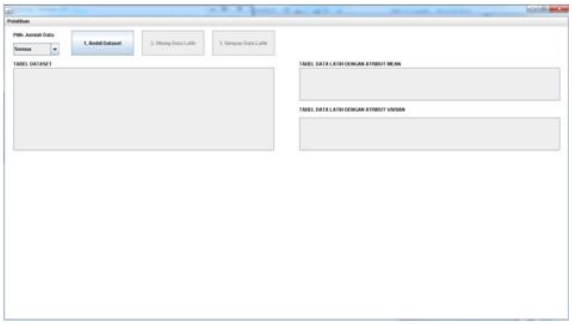
Posterior(CML) = (0.25 x 21.2009 x 0.0138 x 0 x 0 x 0.1358) / 0.0000001
= 0.000001

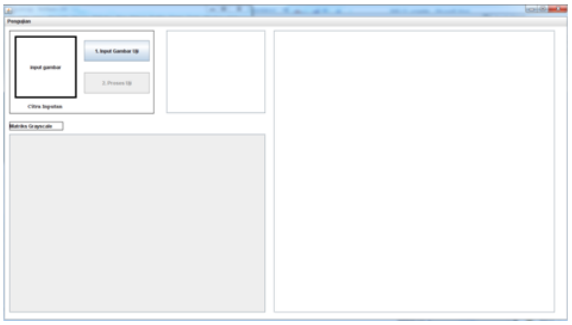
2.5 Implementation Interface
Implementation Interface explain and describe the implementation of each of the existing processes in this system:



Picture 10 Display Main Menu


Picture 11 Menu Display Processing


Picture 12 Training Menu Display


Picture 13 Display Menu Tests

3. CONCLUSION
Based on the results of the testing that has been done, it was concluded that the naïve Bayes method can classify the input image by statistical data directly comparing the closest distance to the training. Testing image classification based on the texture using image data that has been trained to have an average accuracy rate of 100% and for the

image that has not been trained in the average accuracy rate of 90% and the level of accuracy using three training data is 85% and the use of four training data is 90 %.
From the results of the entire test, naïve Bayes algorithm produces 91.25% accuracy rate with a total of 20 training data and 20 test data.

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