Journal of Information Systems and Informatics
Vol. 4, No. 4, December 2022 e-ISSN: 2656-4882 p-ISSN: 2656-5935
http://journal-isi.org/index.php/isi Published By DRPM-UBD

Learning Vector Quantization 3 (LVQ3) Usage To Determine Recipients of the Family Hope Program (Case Study: Tanjung Lubuk District)

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Abstract

The problem of poverty is a dilemma that the Government must solve. One of the Government's programs is the welfare program for the Family Hope Program (PKH). Tanjung Lubuk district, implementing the Family Hope Program experienced several obstacles in identifying PKH recipients, one of which was selection, limited, and close to officers so that it could lead to the provision of PKH assistance on target. Another problem is that the recipients of the data used are still using old data that has not been updated regularly, so many people who deserve assistance do not receive assistance. The research variables used were 35 variables. The output categories were entitled to receive and not entitled to receive PKH. The research method uses Learning Vector Quantization (LVQ) 3. The data are from 654 low-income families in Tanjung Lubuk District. The data used are 90:10 for practice data and 80:10 for test data. The learning rate values are 0.1, 0.3, 0.5, 0.7, and 0.9, while the learning rate reduction is 0.1, the minimum learning rate is 0.01, the window is 0.1, 0.5, and the m value is 0.1, 0.5. The accuracy obtained is 94.4%.

Keywords: PKH, Artificial Network, LVQ3.

1. INTRODUCTION

The Family Hope Program or known as Program Keluarga Harapan (PKH) is one of the social protection in Indonesia in aid format. According to the Statistic Centre Bureau (BPS). The definition of poverty is the person or someone who cannot afford or cannot fulfill their basic needs, such as food and clothes, measured by their monthly expenses. These limited expenses are called Poverty Line (PL/GK) [1]. PKH aid has also become a work program in Tanjung Lubuk District. However, several obstacles are still found, especially in identifying and determining a family who has entitled to receive the aid, besides that there are still susceptibilities, such as subjective addressee and relative personal closeness with PKH officers, which can make the PKH aid distribution are misleading, also the non-update periodic data are still implemented. The effect is that many entitled recipients do not get aid distribution.

Another problem is that in some implantation, some district officers are still manually surveying data manually and registering every requirement indicator of the PKH agent by visiting every head of the family. Data also can be manipulated by an unauthorized person. So it requires a system that can classify the PKH distribution correctly and quickly. Based on the problem above, there are some research can be related to the PKH aid determination among others research ([2],[3],[4],[5],[6],[7] in this research, the PKH determination are still using manual implementation which the officers surveying family then registering criteria, the results get 0,70 of learning rate grade, 2 epoch grade, 0,01 Min Alpha grade, 0,03 Dec Alpha grade, related research with PKH determination are implemented by [8] have found a problem with is the PKH distribution are misspointed. Researcher determined the recipient by using C4,5 algorithm.

Research [9],[10],[11],[12] use the LVQ algorithm research to determine the classify of a low-income family, examining problems to determine low-income family, determining categories are: type 1 very low-income family, type 2 low-income family include, type 3 nearly low-income family include. LVQ is the algorithm used to classify and duplicate determined input-output. This research uses 70 data sheet, 10 neuron input, 3 neuron output, 100 MaxEpoh and 0,05 learning rate (α) in prediction. The testing is conducted 5 times so that the accuracy level and error rate shall be directly compared to the amount determined of training data and testing data. The next research [13] is where the research objects are a set of data from heads of families from Mlandingan's district, Situbondo. The collected data contains 7 poverty parameters such as age, number of family members, income, expenses, house condition, house status, and recent education. This research used 5 testing scenario, which delivers grade 0,1 for learning rate recommendation, 0,1 for learning rate subtraction, 30% for practice data, 0,01 MinAlpha, and 2 iterate maximum, so that can get 98% accuracy. Other researchers who use LVQ3 to classify the research from (Jasril, 2018)[6], this research use learning rate grades of 0,0001, 0,01, 0,1, 0,4, 0,7, 0,9, and 0,0001, 0,4, 0,7 window grade. Tested and for practice, used data are 90:10%. Maximum epoch uses are 1000 iterations. Based on the test result, the highest accuracy is 91,67%.

Based on research [14], the vector quantization method (LVQ) 3 was chosen because this method has the advantage of being able to find the closest distance. Besides that, during learning, the output units are positioned by adjusting and updating the weights through supervised learning to estimate classification decisions. In LVQ 3, 2 vectors are updated if some conditions are met. Developing a decision support system process to determine the social assistance program for the Family Hope Program (PKH) in Tanjung Lubuk District uses LVQ 3; namely, if the input has the same estimated distance as the winner and runner-up vectors, then each Vector must learn. The variables used in this study were 35 data, namely: the number of family members, building/house status, land status, floor of house

area, house floor type, house wall type, house roof type, number of house rooms, drinking/fresh water source, cooking fuel, toiletry, septic tank, wall of toilet room condition, the roof of toilet room condition, light source, power source, closet, another house, any existing 5 Kg/more cooking gas, existing refrigerator, air conditioner, heater, static phone, TV, and jewelry/savings, existing laptop/computers, bicycle, motorcycle, car, boat, yacht, static asset and business status from all family members, amount of collected data are 564 data.

2. METHODS

2.1. Research Methods

Figure 1 shows the methodology which is used in the research.

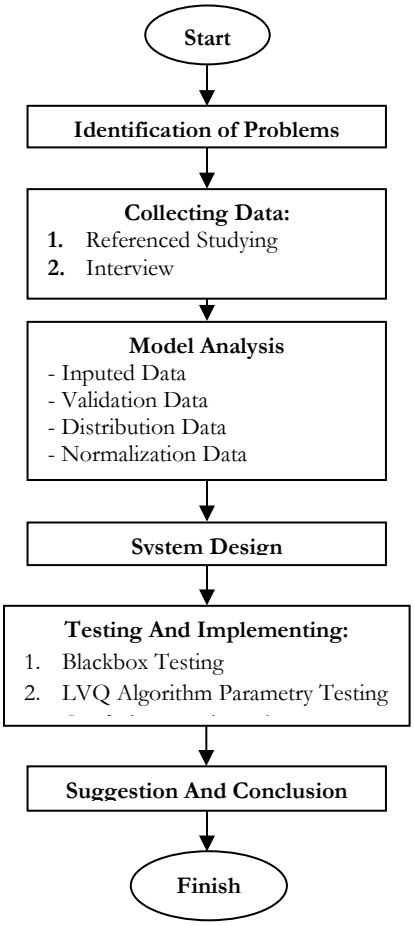

Figure 1. Stages of research

2.2. Data Research

The numbers of data used are 654, then processed based on requirement so that it can be used as tested data and for practice data to facilitate and simplify the author/writer to design a PKH recipients determination system.

3. RESULTS AND DISCUSSION

The data analysis process and input variable can be seen in Table 1.

Table 1. Input Data Criteria

Variable	Variable Name	Scoring Unit / Value	Rating Weight
X1	Numbers Of Family Members	Person	1
X2	Building Unit	State-Owned Rent Rent Free Owned Other	2
X3	Land Status	Other Person State Land Owned Other	3
X4	Land Area	Floor Area (M2)	4
X5	House Floor Type	Granit Ceramic Tiled Rug Tiles / Terrazzo High-Quality Wood Floor Brick / Concrete Bamboo Low-Quality Wood Floor Soil Others	5
X6	House Wall Type	Walled Cemented, Bamboo Mesh / Wire Mesh Wood Bamboo Mesh Wood Log Bamboo Others	6
X7	House Roof Type	Concrete Roof Ceramic Roof Steel Roof Clay Roof	7

Variable	Variable Name	Scoring Unit / Value	Rating Weight
		Asbestos Roof Zinc Roof Shingle Roof Bamboo Roof Thatched Roof / Palm Fiber Roof / Leaf Roof / Rumbia Roof Others	
X8	Rooms/Bedrooms	Rooms	8
X9	Drinking / Fresh Water Source	Branded Drinking Water Refilled Drinking Water Water Company Retailed Drinking Water Boreholes Freshwater / Pump Protected Welled Freshwater Unprotected Welled Freshwater Protected Water Springs Unprotected Water Springs Rivers / Lakes / Reservoirs Rain Others	9
X10	Cooking Fuel	Electric Cooking Gas > 3 Kg Cooking Gas 3 Kg City Gas Company / Biogas Kerosene Coal Bricket Charcoal Firewood Not Cooking At Home	10
X11	Toiletry / Sanitation / Defecation Facility	Owned Conjunction Public None	11
X12	Septic Tank	Tank SPAL / Sewage Systems Dirt Pit / Hole Pool / Ricefield / River / Lake / Sea Beach / Field / Plantation Garden Others	12
X13	Wall Of Toilet Room Condition	Good / High Quality Poor / Low Quality	13
X14	Roof Of Toilet Room Condition	Good / High Quality Poor / Low Quality	14

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Variable	Variable Name	Scoring Unit / Value	Rating Weight
X15	Light Resources / Electricity Resources	State Electricity Company / PLN Non-State Electricity Company / Non-PLN No Electricity	15
X16	Electricity Power	450 Watt 900 Watt 1300 Watt 2.200 Watt > 2.200 Watt	16
X17	Toilet Type	Duckneck Type Plengsengan Pit Latrine (Cemplung) / Pit Privy (Cubluk) N/A	17
X18	Other House	Yes No	18
X19	LNG Gas 5,5 Kg / More	Yes No	19
X20	Refrigerator	Yes No	20
X21	Air Conditioner / AC	Yes No	21
X22	Heater	Yes No	22
X23	Static Phone	Yes No	23
X24	Television / TV	Yes No	24
X25	Jewelleries / Savings	Yes No	25
X26	Laptop/Computer	Yes No	26
X27	Bicycle	Yes No	27
X28	Motorcycle	Yes No	28
X29	Car	Yes No	29
X30	Boat Without Engine	Yes No	30
X31	Outboard Motor Boat	Yes No	31
X32	Motor Boat	Yes No	32

Variable	Variable Name	Scoring Unit / Value	Rating Weight
X33	Yacht	Yes No	33
X34	Static Asset	Yes No	34
X35	Business Status From All Family Members	Yes No	35

Determination targeting/classification used in the LVQ method has already been determined first. Targeting/classification used to specify the PKH recipients are shown in Table 2.

Table 2. Description of PKH targeting/classification

Scoring Unit	Description
1	Not entitled to receive
2	Entitled to receive

An architectural drawing of an LVQ3 artificial neural network system that will achieve based on inputed variable data and the grade who wants to reach to classify PKH recipients determination is shown in Figure 2.

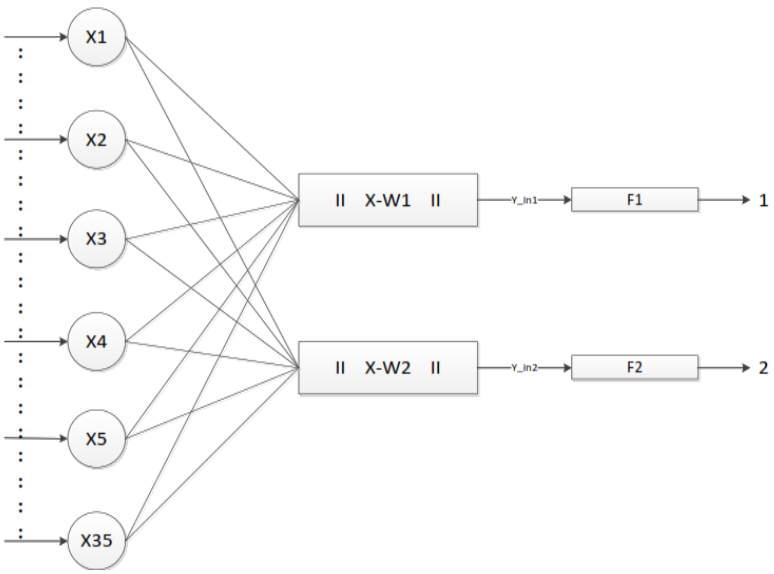

Figure 2. JST LVQ3 architecture to classify PKH recipients

Variable normalization or inputted data are conducted to get the smallest data value between 0 to 1, which represents the exact value, so it can not relieve the value of accurate data. It has been explained that the use of LVQ3 depends on

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

the range between the input vector with the quality of each grade and inputted vector GP into the grade with the closest range. Hence, to get recognized by the LVQ network, the existing data in the inputed variable data should be first modified into numeric form. The Diagram LVQ3 learning process can be seen in Figure 3.

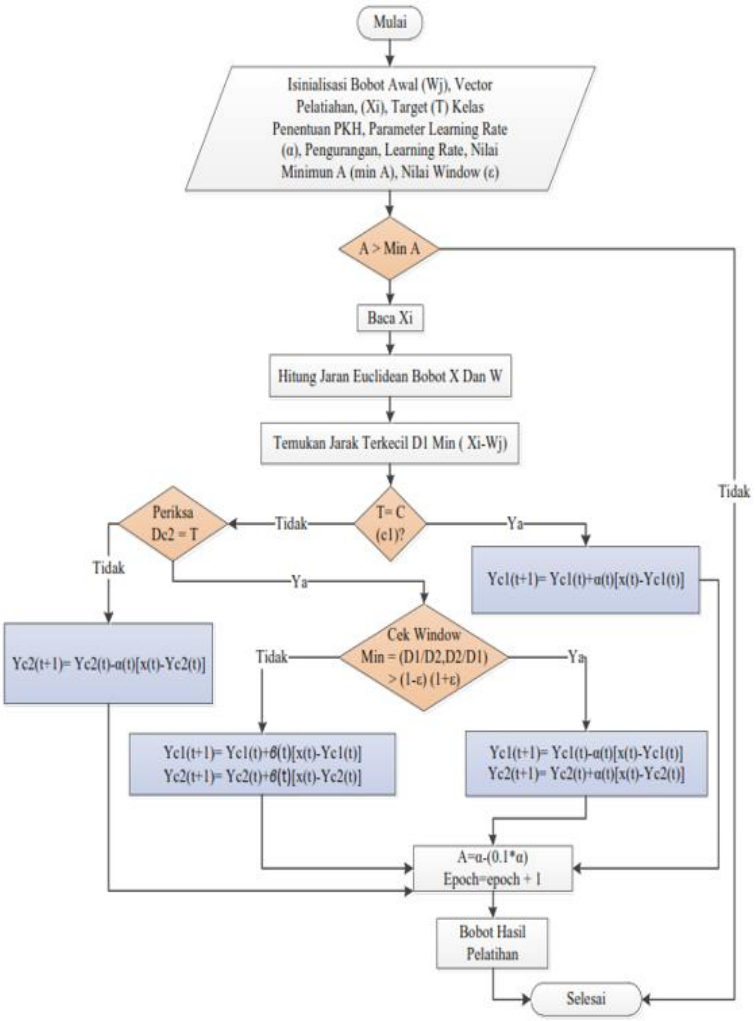

Figure 3. LVQ3 learning method flowchart

The Steps in the LVQ3 algorithm are as follows:
1. Grade W and X initiation
2. Determine of Learning Rate value (α). The value of α, which is $0<\alpha<1$
3. Subtraction of Learning Rate value (α) which is 0,1*α
4. Determine learning rate minimum value (min α)

p-ISSN: **2656-5935** http://journal-isi.org/index.php/isi e-ISSN: **2656-4882**

5. Determine window value (ε): Min[dc1/dc2, dc2/dc1]>(1-ε)(1+ε) (1)
6. The below formula conducted if the search result uses the window(ε) equation have true value:
   $w1,t+1 = w1,t- \alpha t\ (x-w1,t)$ (2)
   $w2,t+1 = w2,t+ \alpha t\ (x-w2,t)$ (3)
7. If the search result uses the window (ε) equation to have a false value, the conducted formula is (Lee, 1993):
   $w1,t+1 = w1,t-\beta(t)\ (x-w1,t)$ (4)
   $w2,t+1 = w2,t+\beta(t)\ (x-w2,t)$ (5)
8. Learning score β(t) is the multiplication from mα(t), equation mα(t)=εα(t). The multiplication value is to gain the grade update while the window has a false value (m) (Fausett, 1994) between 0,1 and 0,5, the equation:
   $\beta(t) = m\alpha(t)$, dengan $0,1 < m < 0,5$ (6)

After the learning process, they will get the final grade (W). This grade value will be used in the testing process. The design of the research application for the accustomed data menu and testing data of PKH recipient candidates are shown in Figures 4 and 5.

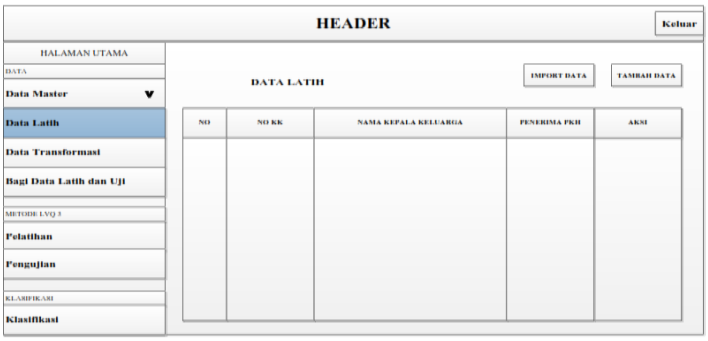

Figure 4. Accustomed PKH recipients' data interface design

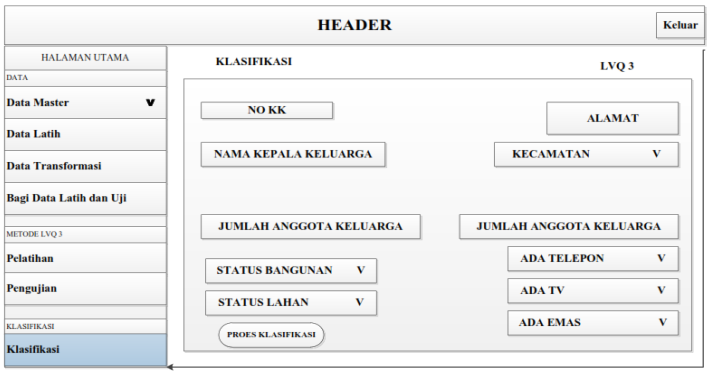

Figure 5. Classification menu interface design

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The LVQ3 learning in this research uses 90:10 or 90% accustomed value and testing value (588 data) and 10% (65 data) of testing data. The result of initial grade testing (w) and Vector x and w, excluding range testing, can be seen in Tabel 3 and 4.

Tabel 3. Inital grade (w)

No.	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17
1	0.525	0	0.3167	0.97	0.5556	0	0.5556	1	0.2727	0.25	0	0.41	0	1	0	0	0
2	0.4775	0	0	0.191	0.9039	0	0.5556	-	0.5577	0.9031	0.6967	0.391	0	-	0	0	0

No.	W18	W19	W20	W21	W22	W23	W24	W25	W26	W27	W28	W29	W30	W31	W32	W33	W34	W35	Target
1	1	0	0	0	1	0	0.95	0.95	0	0	1	0.95	0.05	0.05	0	0.21	0	1	1
2	-	0	0	0	1	0	0	0	0	0	1	0	1	1	0	1.027	0.6967	1	2

Table 4. The result of Vector x and w, excluding range testing

Family Identity Card Number	W1 Range (NO)	W2 Range (YES)	Target Class	Testing Result	Description
1602023012520000	3.0489	3.2	1	1	Benar

Based on Tabel 3 and 4, we can conclude that the value on LVQ3 window, range testing, and Vector x and w can affect the learning result. Bigger window value, so the amount of learning required to accomplish the best accuracy is smaller to speed up the requirement time for the learning process.

4. CONCLUSION

Based on the results of research and discussions that have been carried out, the following conclusions are obtained:

1. The LVQ3 (Learning Vector Quantization 3) method can recognize patterns and classify the criteria for PKH program recipients based on the Government's criteria.
2. The amount of training data used can affect learning. The more the amount of training data, the higher the percentage value of accuracy
3. The result of accuracy is 94%. The testing uses Learning Rate 0,1, 0,3, 0,5, 0,7 and 0,9, 0,1 Learning Rate subtraction, min α = 0.01, window 0.1, 0.5, and epsilon 0.1, 0.5, gained the highest accuracy which is 94,4% on accustomed distribution data and testing data 90:10 which is window value and apply of effect on data processing.

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