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Choosing Mutual Fund based on Purpose, Risk Level and Inventor's Profile using Neutral Network

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Abstract

Investment in financial asset these days are easily to be done. The principle in investment is higher return, higher risk. An investment with the very high return, contain very high level of risk. Otherwise if you invest in the financial asset that contain low risk level, then the expected return will be low. Therefore decision of choosing the right investment instrument is very important because it is related to risk, individual readiness in its implementation and suitability of investor profile itself. This thesis propose a machine learning method to develop a decission support system for investment manager in determining the suitable investment instrument for the individual client based on financial objective , risk level and investment period. Machine learning was choosen because it was known of its ability in recognizing the complex pattern based on learning process using the given data set. Artificial neural network multilayer perceptron (MLP) with two layers could be used as a classificator model to predict the mutual fund investment type that was suitable for investor based on investment purpose , risk level and investor profile. Experiment using 2-layers artificial neural network, 9 unit input, 16 hidden units and 4 output units that was trained with 50 data points consists of 9 vestor input component and 4 vector target components. The architecture and the data in the network could done the classification with accuration 93.33 percents.

Keywords: *Mutual Fund, Multi Layer Perceptron, Neural Network*

1. Introduction

In investment there is five factors that affect the investment instrument choice. (i) The safety in investment means minimum loss risk. (ii) Risk factor component. (iii) investment income, which is cash income and certainly. (iv) Investment Growth which is an increase in the value of stock. (v) Liquidity (high or low) (Warsono, 2010)

Investment that is relatively done these days is in financial asset. Investment principle is higher risk, higher return. An investment with the higher hope of return has a very high risk level. Otherwise if you invest in a low risk financial asset then the expected return will be low as well. Therefore the decision to choose the right investment instrument is very important because of its relation to risk, individual readiness in investment implementation and suitability of investor's profile itself.

A few research has been done relation with the effort to develop investment decision support system. One of that has been done by Gao, Wang, Xu & Wang, [HYPERLINK \l "Gao07" 1] who develop a decission support system based on agent for financial planning. They formulate their model concept by following the Simon's decission-making process model and map a step-by-step decision taking into financial planning

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process generally. Gao and friends using Linear programming to solve family financial planning model.

The other research has been done by Chieh Yow and Chun lin who propose that financial planning process is like a trial-and-error approach process or what-if analysis which is not promising optimal planning result when various expense will incriminating the planner 2]**}**. In the taking investment instrument decission, so many factors that affecting and confilcting each other. Chieh and Chun in their paper are suggesting to review the taking decission model which combine fuzzy multiple objective programming method to produce a better solution.

The objective of this thesis is developing a system to choose mutual funcd based on objective, risk level and investor profile using machine learning method. The benefit that can be taken from this research is obtained a system based on machine learning method that will be usefull for choosing the mutual fund based on objective, risk level and investor profile effectively and efficient. This system is expected to help investment managers or individual for choosing the mutual fund that suitable for them.

2. Methodology

These days, there are a lot o financial instrument instrument that published by investment manager. Each of them has a chance to give return and different risk level of the capital return. These two factors has to be considered by investor because the investment is not only give profit but also loss for the investor.

For investment manager, choosing investment instrument for individual is one of a complex problem. This happened because of the instrument determination that suitable for the investor is determined by investor's profile itself. Therefore the investment manager ussualy interview and give the investor quistionaire to recognize their client's profile and objectives. The investment managers ussualy decide the choosen investment instrument based on their experience so it is difficult to translate it into symbolic reasoning representation.

This moment has been developed many of machine learning method that can be used to to develop decission support system. One of them is the Artificial Neural Network (ANN), the Multilayer Perceptron (MLP) that can be usefull as a good classificator model. MLP has been evaluated and successfully implemented in various application like expert system, decission support system, data mining and business intelligence [HYPERLINK \l "Ver09" 3].

The advantages of MLP is its ability in recognizing the pattern from the data that is given by supervised learning. Moreover MLP also has the fault tolerance so that it can give a better and general classification. With its learning ability, MLP can be usefull to recognize investor profile pattern and predict the suitable financial investment instrument for the investor. The Trained MLP can be used by Financial Planner or individual in doing the financial planning.

The sample data that used to test methodology in this research is the client data that obtained from an investment company in Jakarta. These data is obtained from questionaire and interview with the investment manager consultant.

Sample data for the training consist of input vector and target. The input is in form of a nine components vector. The target vector consist of four components vector that used for mutual fund code representation. Each input data component is variable that used to measure these three parameters : objective, risk and invetor's profile. These things are unique for each investor. Scoring spectrum is given in the Table 1.

Table 1. Scoring Spectrum for each Paramter / Variable

PARAMETER		SPEKTRUM PENILAIAN			
		1	2	3	4
TUJUAN					
1	Tujuan Investasi	Penging-katan	jangka panjang	spekulasi	income
RISIKO INVESTASI					
2	Jangka waktu (tahun)	< 1	1-3	3-5	>5
3	Alokasi pendapatan utk investasi (%)	< 10%	10% - 25%	25% - 50%	> 50%
PROFIL INVESTOR					
4	RD yg pernah dimiliki	RD Pasar Uang	RD Pend Tetap	RD Campuran	RD Saham
5	Pemantauan perkemb investasi	tidak	jarang	periodik	detail
6	Toleransi thd fluktuasi (%)	-5%-10%	-10%-20%	-20%-30%	<-20% - 30%
7	Tingkat risiko yang bisa diterima	nol	rendah	moderat	tinggi
8	Alokasi aset ke Reksadana (%)	< 10%	10% - 25%	25% - 50%	> 50%
9	Penempatan aset investasi terbesar	Tabungan / Deposito	Valas	Reksadana	Saham

The data in this research is 50 data point, divided into three parts : 70% for training (train the machine learning), 15% for testing and 15% for validation.

This research was done by artificial neural network, Multilayer Perceptron as classificator model that used to identify mutual fund investment. The number of input node that used are equal to the number of variable that used as mutualfund determination parameter which are consist of investment objectives parameter, investment period and investor's profile. The number of output node are 4 node to code 4 mutual fund targets. The whole ANN learning process was done by supervised learning. MLP network that used is 2 layers MLP.

MLP network training is done within 2 phases, which are: training phase and testing phase. For each phase using different data. Neural network model that was trained then used to validate using the special data that were separated from the training and testing phase data. The process is shown in the Figure 1.

MLP network that has been trained then its accuracy is evaluated with the validation data that has never been trained to the network. From this test then calculated its accuracy presentation. Calssification accuracy measrurement is done by the confusion matrix which illustrate theMLP's classification result distribution. Confusion matrix also used for classification result using training data and testing data. The ANN performance is calculated based on these three data. Confussion matrix and its calculation is shown with the table Figure 2.

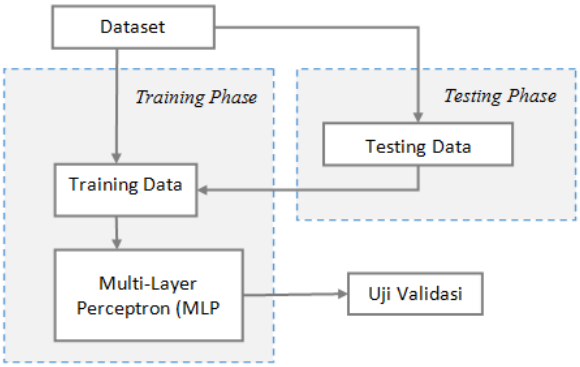


Figure 1. MLP Experiment Method

		Aktual			
		C1	C2	C3	C4
Prediksi	C1	a	b	c	D
	C2	e	f	g	H
	C3	i	j	k	L
	C4	m	n	o	P

Figure 2. Confusion Matrix to Evaluate 4 Categories

$$accuration = \frac{a + f + k + p}{(a + f + k + p) + (b + c + d + g + h + l + e + i + m + j + n + o)}$$

3. Results and Discussion

Experiment in this research is done by ANN method, MLP with the architecture as below:

Network : 2 Layers MLP.
Number of input unit : 9 input unit.
Number of output unit : 4 output unit.
Number of hidden unit : various.

The objective of this experiment is to test MLP that are used to develop model that could help the investment manager decide the suitable mutual fund based on investment objective, risk level, and investor profile. These three variable is measured with a few parameter that become input for MLP. To test this MLP method therefore used the client data (questionaire and interview) as much as 50 data points, consist of 9 vector inputs and 4 vector output which become target output from the output neurons. The data divided into 3 parts : 70% for training, 15% for testing , and 15% for validation.

Experiment is done with the various number of hidden node : 4, 7, 10, 13, 16, 19, 22, 25. For each number on neurons, we do the experiments as much as 6 times. This network variation was done to get the best network with the smallest error overall. The experiment result evaluated with the confussion matrix that show the accuracy for each data input.

Figure 3. Confusion Matrix in 2 Layers MLP with 16 Hidden Units

From the experiment test obtained that MLP with 16 hidden units scoring the average accuracy 93.33%.

Table 2. Experiment Result that Scored wih 16 Hidden Nodes

	Samples	MSE	%E
Training	34	2.54838e-6	0
Validation	8	3.2589e-2	12.500 e-0
Testing	8	1.34494e-1	25.000 e-0

We do the experiment with 2 layers MLP with various number of neurons (4, 7, 10, 13, 16, 19, 22 and 25). And for each of them we do the experiments as much as 6 times. All the experiment result is summarized in Table 3.

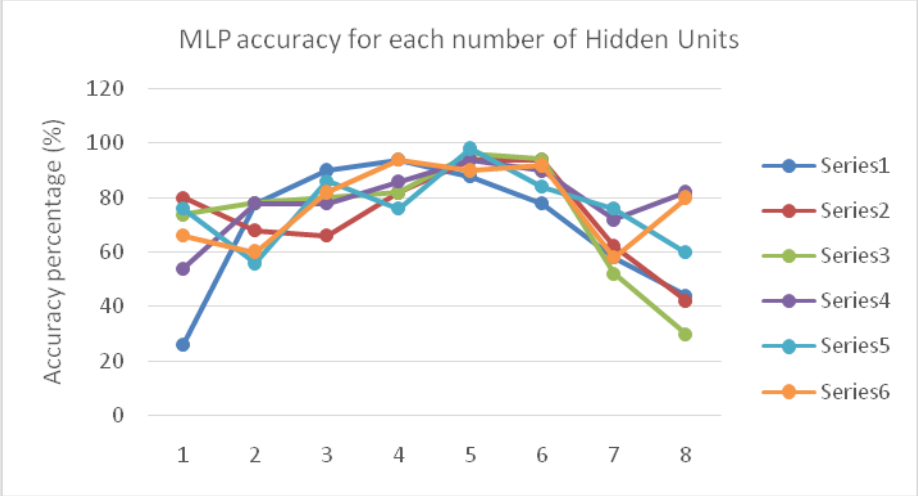
Table 3. MLP Experiment Result with Various Hidden Units

		Number of Hidden Units (Neurons)							
		4	**7**	**10**	**13**	**16**	**19**	**22**	**25**
Akurasi Eksp. Ke- (%)	**1**	26%	78%	90%	94%	88%	78%	58%	44%
	2	90%	68%	66%	82%	94%	94%	62%	42%
	3	88%	78%	80%	82%	96%	94%	52%	30%
	4	54%	78%	78%	86%	94%	90%	72%	88%

	5	80%	56%	86%	76%	98%	84%	76%	60%
	6	66%	60%	82%	94%	90%	92%	58%	82%
Akurasi Rata-rata (%)		**67.33**	**69.67**	**80.33**	**85.67**	**93.33**	**88.67**	**63.00**	**57.67**

For example, we used 4 neurons, on the first attempt, we got the accuracy 26%. On the second until the sixth experiment we got (90%, 88%, 54%, 80% and 66%). From all our experiments we got the average accuracy as much as 67.33%. From all our experiments, it shows that the best average accuracy is gotten from the 16 numbers of hidden units (93.33%).

Figure 4; describe the MLP accuracy for each attempt. For example, see the blue line that tagged with 'Series1', it describe that on the first experiment the 4 hidden units get the accuracy as much as 26%, the 7 hidden units scored 78% accuracy, the 10 hidden layers 90%, the 13 hidden layers 94%, the 16 hidden layers 88%, the 19 hidden layers 78%, 22 hidden layers 58% and 25 hidden layers 44%. As shown in the number 5 (represent the 16 hidden layers) it score the highest accuracy average.



Picture 4. MLP Experiment Result with the Various Number of Hidden Unit

Experiment that has been done has give result that MLP network could be used as a classificator model to decide which the most suitable mutual fund based on criteria that si given before. The proposed methodology in this research give the high classification accuracy with the average 93.33% which scored by 16 hidden units.

4. Conclusions

Based on research result, it could be summarized that ANN 2 layers MultiLayer Perceptron could be used as classificator model to predict suitable mutual fund for the investor based on investment objectives, investment risk and investor profile. Experiment using ANN 2 layers MultiLayer Perceptron, 9 input units, 16 hidden units and 4 output units that were trained with 50 data points that could do the classification with 93.33% accuracy.

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