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# Implementation Of Secos Algorithm In Forecasting Gold Prices To Improve Business Intelligence Using Mse Accuracy Value Measurement

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**ABSTRACT**

SECOS is one of the artificial neural networks that can be used in this study to make a prediction or forecasting of gold prices. This research will produce a combination of parameters, namely learning rate 1, learning rate 2, error threshold that will be carried out on the system then in the training process the data is quite influential on the resulting error value. From the results of the combination of parameters and testing with the SeCos algorithm shown in Figure 4.2, the smallest error value at layer 3 is 54262,375, which is obtained from the learning rate 1 parameter is 0.5, learning rate 2 is 1, learning rate 3 is 1.5. while the largest error value is 46023.9375. The results of the SECOS algorithm in forecasting the gold price can run well, which shows that the model from the implemented training and testing data can predict gold prices.



## 1. Introduction

Gold is usually a valuable item that is often used or commonly available for business processes such as long-term investments. There are many advantages to investing in gold because it is easy to collect, clean and tax free. Another benefit of investing in gold is resistance to a process of inflation that often occurs. When inflation occurs, the value of money falls. This is not the case with gold. Gold rose due to high inflation (Andriyanto, 2017). Gold is a valuable asset that is constantly evolving, and it is important for someone here to have gold deposits, not stocks whose value varies depending on market conditions. most people decide to invest in other ways and do not realize the benefits of investing in gold (Sari, 2018). When making an investment, it is necessary to consider information when making investment decisions to ensure the investment is successful according to plan. The cost of gold investment is uncertain because the price of gold can fluctuate at any time. Whenever the price of gold goes down or up. Investors still need information to track changes in gold prices to decide when to buy or sell gold. (Andriyanto, 2017). Gold investors now read a variety of print and electronic news to gather the information they need to confirm their investments. This requires more effort and time. It is difficult for investors to predict the price of gold because of the difficulty of obtaining accurate information. From the description above, it is necessary to build a system that allows investors to predict gold prices accurately. This study uses the Secos algorithm to predict the price of gold which has been very popular over the past decade. The Secos algorithm is applied to this prediction application to optimize the weights in the training process. (Al-Khowarizmi, 2017). System developed with using the measurement of the accuracy of predictions using MSE (Mean Squared Error) (Al-Khowarizmi et al., 2020). SECoS application is a technique that develops the structure, functionality and representation of internal knowledge through continuous learning from data (Kasabov, 2007). Based on this, this thesis calculates the SECoS activation value using the normalized hamming distance formula to get a good learning rate and minimize the error value in gold price prediction problems.



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## 2. Method

### 2.1. Evolving Connectionist Systems

The Evolving Connection System (ECoS) is a form of the Evolving Intelligent System (EIS). ECoS is a step by step, adaptive learning method that develops unique structures and functions. The ECoS system is based on a connection architecture that contains active neurons (information units for processing) and interneuronal connections (Kasabov, 2007). Watts (2006) explains that the Evolving Connection System is a system that contains an intelligent computer through a neural network that uses other intelligent computer technology that works continuously and adjusts its parts and functions through constant interaction with the system itself. The process is re-explained by Kasabov (2007) as follows:

a. A set of parameters that can be changed during system operation.
b. Continuous flow of input information. This can happen with an unlimited distribution of data.
c. A set of objective criteria for maximizing the performance of a system. The above is illustrated in figure 1.

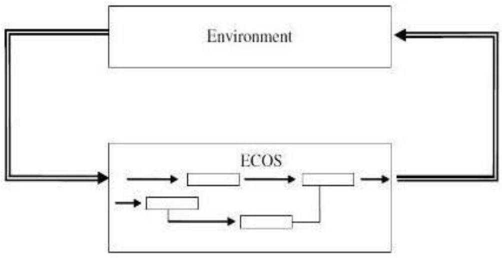


**Fig 1**. Architecture (Kasabov, 2007)

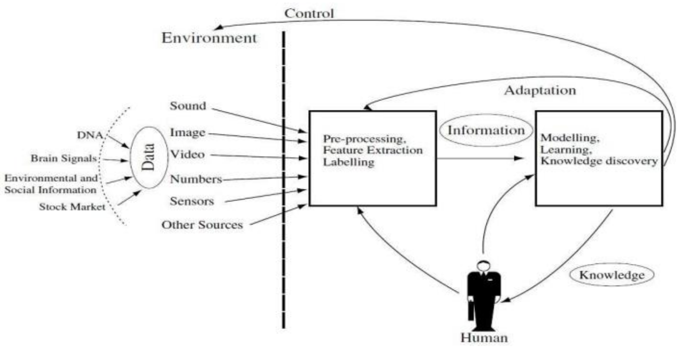


**Fig 2.** Interaction process (Kasabov, 2007)

Figure 2. It shows the process of adaptive and continuous interaction of various types of information and intelligent communication with users to generate knowledge. Data can be obtained from various sources, including DNA, brain signals, social data and then processed in the environment. ECoS can be in the form of human-system interaction, system-system interaction. Ryo et al (2007) ECoS described this as an artificial neural network model similar to a human neural network. ECoS is stable enough to support observable learning models and flexible enough to learn new models from new data.

### 2.2. Simple Evolving Connectionist System (SECoS)

SECoS is a simplified version of EFuNN (Evolving Fuzzy Neural Network). There are several advantages to using SECoS over EFuNN. First, the SECoS architecture is much simpler where SECoS is easier to understand and analyze. Second, the input space is lower so that
allows SECoS to work with less training data (Gloubaklou, et al. 2003). The SECoS architecture is shown in Figure 3. following

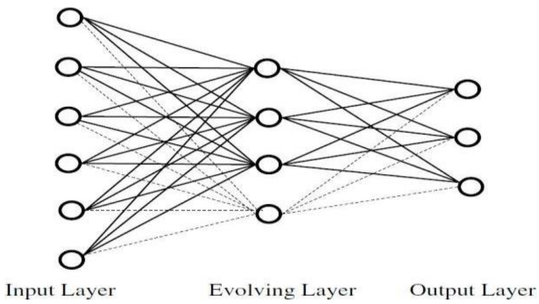


Fig 3. SECoS Architecture (Watts, 2009)

The activation of A at the nth layer evolution node when the linear activation function is used is Determined:
= 1 ............................................................ ..................................................... ........ ........ (2.1)

An is the number of an activation for the formula process n and Dn is the distance normalized number of the input vector and the input weight vector for that node. The value of the distance Dn can be calculated using the normalized Hamming distance.:

$$D_n = \frac{\sum_i^K |I_i - W_i|}{\sum_i^K |I_i + W_i|} \quad \text{..........} \quad (2.2)$$

The SECoS algorithm is as follows (Rahmat, et al. 2016):

a. The distribution of the input vector I in the network.
b. If the maximum activation of the node (Amak) is lower than the sensitivity factor threshold (Sthr):
c. But. Add a new node. If not, run the following command:
d. But. Calculate the error value between the expected result (output vector Oc) and the actual value (output vector Od).
e. If the error value is greater than the error limit value (Etrh) or if the desired output node is too small, do the following:
f. Add a new node to another node.
g. Change the connection weight of the hidden winning node. Repeat the steps for each input vector.

## 3. Results And Discussion

### 3.1. Data used

This research that discusses gold price predictions uses data which is data from gold prices which are in the period 2019 to 2020. The data is 757 and then divided into training data and testing data. Testing data as much as 228 data or 30% =, training data as much as 529 data or 69.88%. The following will display the distribution of data in Figure 4.


**Fig 4**. Distribution of training and testing data

### 3.2. Secos. Algorithm Prediction Results

In training with the SECoS method, the first thing is to determine the parameter values as follows:

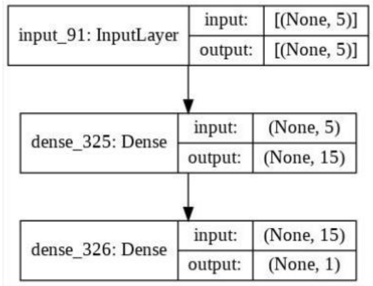


**Fig 5.** Neuron parameter values

The explanation of Figure 5 explains that the number of neurons in the input layer value is 5, in the first hidden layer there are 15 and in the second hidden layer 1. Then there are the results from the Secos algorithm and which consists of the first, second and third data train models that show the results of forecasting gold prices from 2019 to 2020. The following will show the forecasting results in Figure 6.

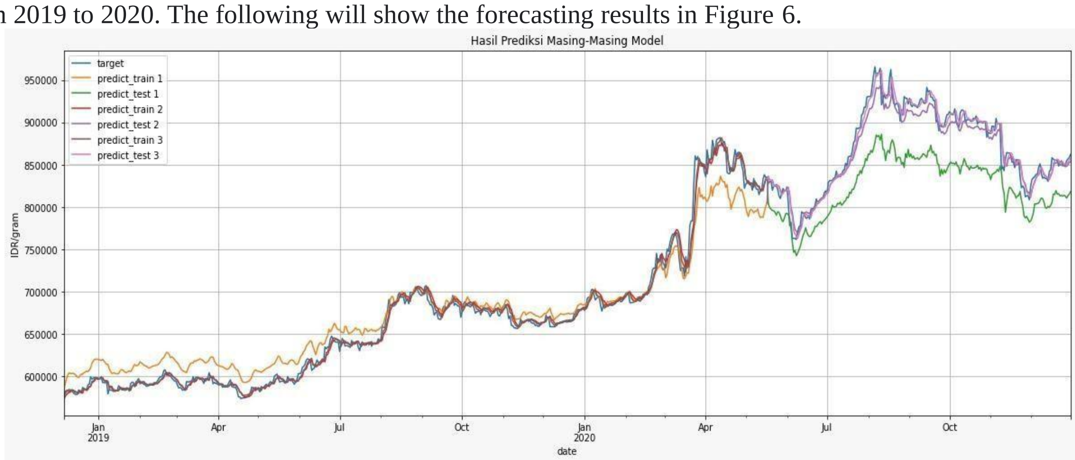


**Fig 6.** Results of forecasting with the Secos algorithm

### 3.3. Performance of the Secos. Algorithm

The performance of the Secos algorithm shown in predicting the gold price from 2019 to 2020. There are several learning rate values that will be used to see the performance of the Secos algorithm as follows

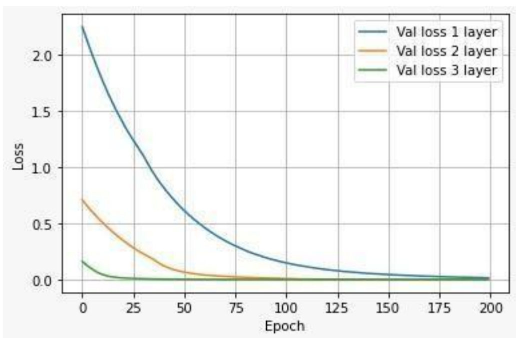


**Fig 7.** Secos Algorithm Performance Graph

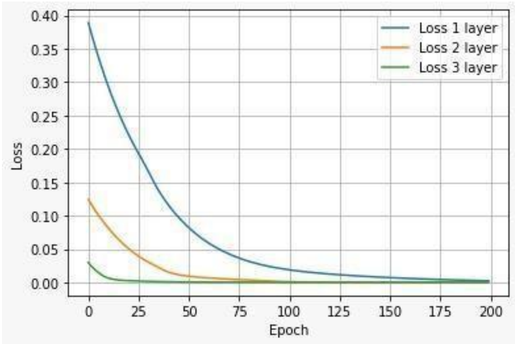


**Fig 8.** Performance Graph of the Secos. algorithm

### 3.4. Monthly gold price distribution

The distribution of gold prices every month will be shown in the following diagram

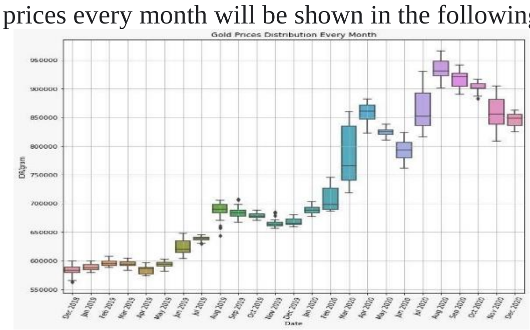


**Fig 9**. distribution of gold prices every month

### 3.5. Root Mean Square Error (RMSE)

RMSE is the root mean squared error (RMSE) The default is the magnitude of the predicted error rate. Here, the lower the RMSE (closer to 0), the more accurate the prediction results.

**Table 1.**
Measurement of SeCos algorithm performance error

| Layer | Layer | MSE | RMSE | max_error | r2_score |
|---|---|---|---|---|---|
| **1 layer** | 1 layer | 2,43E+09 | 49277,53 | 89699,125 | -0,0058 |
| **2 layer** | 2 layer | 1,51E+08 | 12292,54 | 46023,9375 | 0,937411 |
| **3 layer** | 3 layer | 92374401 | 9611,16 | 54262,375 | 0,961738 |

### 3.6. Mean Square Error (MSE)

MSE shows that forecast results are consistent with actual data and can be used in forecasting calculations for future periods. The following results from the MSE will be displayed as follows:

**Table 2.**
Measurement of SeCos algorithm performance error

| Layer | Layer | MSE | RMSE | max_error | r2_score |
|---|---|---|---|---|---|
| **1 layer** | 1 layer | 2,43E+09 | 49277,53 | 89699,125 | -0,0058 |
| **2 layer** | 2 layer | 1,51E+08 | 12292,54 | 46023,9375 | 0,937411 |
| **3 layer** | 3 layer | 92374401 | 9611,16 | 54262,375 | 0,961738 |

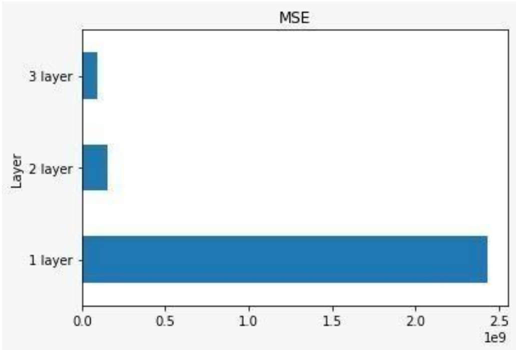


**Fig 10**. MSE error measurement

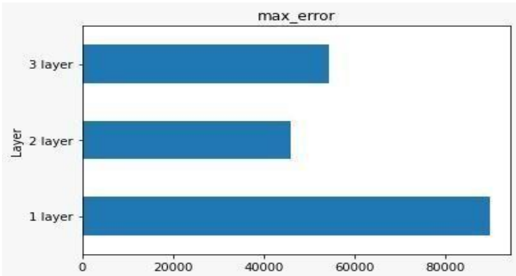


**Fig 11**. The maximum error of the Secos algoritma algorithm

### 3.7. Discussion

In this study, a discussion will be carried out based on the results that have been carried out, namely the results of the combination of parameters used in the training data process, which has quite an effect on the resulting error value. From the results of the combination of parameters and testing with the SeCos algorithm shown in Figure 4.2, the smallest error value at layer 3 is 54262,375, which is obtained from the learning rate 1 parameter is 0.5, learning rate 2 is 1, learning rate 3 is 1.5. while the largest error value is 46023.9375. The results of the SECOS algorithm in forecasting gold prices can run well as evidenced by Figure 4.2 which shows the model from the implemented training and testing data can predict gold prices.

## 4. Conclusions

In the previous chapter, gold price forecasting has been tested using the Secos algorithm in calculating the activation value where each distance formula gives the smallest error result. After conducting the test, the following conclusions were obtained: (a). The results of the artificial neural network architecture design obtained consist of 3 layers which include 5 neurons in the input layer, 20 neurons in the hidden layer, and 1 neuron in the output layer. The parameters used to form the network model include the learning rate with a value of 0.01 and the activation function used is binary sigmoid (logistic). During the training process, the network reaches 800 steps to train the artificial neural network. (b). The level of accuracy generated when testing the network obtained reaches an accuracy rate of 98.99%.

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