Analysis of the Accuracy Batch Training Method in Viewing Indonesian Fisheries Cultivation Company Development

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Abstract. Analysis of research is very important to do, so that research becomes more precise and directed. As well as analyzing the development of aquaculture companies in Indonesia, studies and the use of appropriate methods are needed to get optimal results. This research is expected to be widely useful, both for the Government of Indonesia and the private sector as one of the study materials in business development in the fisheries sector. The data used in this study is data on the number of aquaculture companies according to the type of cultivation obtained from the Indonesian Statistical Center from 2000 to 2016. This study uses the Batch training method with weight and bias learning rules with 5 architectural models, namely: 8-5-1, 8-10-1, 8-5-10-1, 8-10-20-1 and 8-20-40-1. Of these 5 architectural models, the best is 8-5-1 with an accuracy rate of 75%, MSE 0.0445464533, with an error rate of 0.001 - 0.07.

1. Introducing

Aquaculture is a maintenance and breeding business for fish or other aquatic organisms. Aquaculture is also referred to as aquaculture or aquaculture gave that marine organism is cultivated not only from fish species but also other aquatic organisms such as shellfish, shrimp and aquatic plants. Whereas aquaculture companies are legal entities that carry out fish farming, other marine animals or aquatic plants with the aim that some or all of the results are for sale. Types of aquaculture companies in Indonesia are divided into four: fishponds, hatcheries, freshwater and sea. The Globalization chain of the value of fisheries continues to change data on production and fishing [1], especially in Indonesia. Viewed globally, the increase in trade in fish and fisheries-related products has been quite good, this is due to the significant growth in the aquaculture sector [2]. Impressive industrial growth has important implications for decision makers regarding how to get more significant economic benefits, as well as how to ensure responsible and sustainable fishing practices. Therefore the position of aquaculture companies along the chain has implications for their ability to extract value lasting to get more significant economic benefits from fishery products [3].

Indonesia is known as one of the countries that have a vast fishery potential so that it becomes a significant consideration for the government and the private sector to take appropriate fishing industry planning steps [4]. One of them is by controlling and seeing the level of development of fishery companies, especially aquaculture companies. Because aquaculture companies in carrying out their
work activities participate in maintaining biological resources that are carried out on an area of aquaculture land to take advantage/harvest results. This is what needs to be done so that the level of fisheries production in Indonesia should not decrease. Therefore, aquaculture companies need to be improved every year.

In this study, the technique used to see the level of development of fisheries companies in Indonesia is the Batch training neural network method with weight and bias learning rules. The accuracy of this method will be analyzed using several predetermined network architecture models [5][6]. Metode Batch training with weight and bias learning rules (trainb) trains a network with weight and bias learning rules with batch updates. The weights and biases are updated at the end of an entire pass through the input data. One of the reasons behind the use of this method is because there have been many artificial neural network methods used by previous researchers for similar cases [7]–[11], even with different methods. The results of this study are expected to contribute to the government and the private sector as a reference in determining the policy to be more selective in giving licenses to new companies in the field of aquaculture, as well as for academics to further develop this research for future.

2. Metodologi

2.1. Data Collection
Data on the number of aquaculture companies according to the type of cultivation (Table 1), 2000-2016. Data sourced from Indonesian Statistics Publications.

| Type of cultivation | 2000  | 2001  | 2002  | 2003  | 2004  | ... | 2011  | 2012  | 2013  | 2014  | 2016  |
|---------------------|-------|-------|-------|-------|-------|-----|-------|-------|-------|-------|-------|
| Ponds               | 131   | 172   | 174   | 156   | 193   | ... | 115   | 123   | 136   | 137   | 139   |
| Hatchery            | 67    | 85    | 85    | 89    | 104   | ... | 64    | 63    | 69    | 75    | 75    |
| Freshwater          | 4     | 7     | 7     | 8     | 8     | ... | 12    | 15    | 16    | 16    | 15    |
| Sea                 | 14    | 19    | 19    | 23    | 30    | ... | 31    | 35    | 40    | 42    | 45    |
| **Amount**          | **216**| **283**| **285**| **276**| **335**| **222**| **236**| **261**| **270**| **274**|

Source: Publication of Statistics Indonesia

2.2. Stages of Research
The stages of this study are as follows:

![Figure 1. Stages of Research](image)

From Figure 1 it can be explained that the first stage of research is the selection of datasets, where the dataset used is the number of aquaculture companies according to the type of cultivation, 2000-2016. In this dataset data preprocessing will be carried out to divide the data into two parts: datasets for
training and datasets for testing. The next stage is the selection of network architecture to process training data and testing data so that the best results will be obtained.

2.3. Data Normalization

The formula used is [12]–[14]:

\[
x' = \frac{0.8(x - a)}{b - a} + 0.1 \tag{1}
\]

explanation:

\[ (x' = \text{Data Normalization}, x = \text{Data to be normalized}, a = \text{Lowest data}, b = \text{Highest data}) \]

Data on aquaculture companies will be divided 2 parts. The first part of the 2006-2007 as data training, with a target for 2008. The second part of the 2008-2015 data is used as testing data, with a target for 2016. Based on Table Data 1 will get the following normalization results:

| Data | 2000  | 2001  | 2002  | 2003  | 2004  | 2005  | 2006  | 2007  | Target |
|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 1    | 0.637566 | 0.811111 | 0.819577 | 0.743386 | 0.900000 | 0.468254 | 0.616402 | 0.654497 | 0.696825 |
| 2    | 0.366667 | 0.442857 | 0.442857 | 0.459788 | 0.523280 | 0.210053 | 0.311640 | 0.332804 | 0.311640 |
| 3    | 0.100000 | 0.112698 | 0.112698 | 0.116931 | 0.116931 | 0.100000 | 0.121164 | 0.138095 | 0.112698 |
| 4    | 0.142328 | 0.163492 | 0.163492 | 0.180423 | 0.210053 | 0.176190 | 0.171958 | 0.197354 | 0.176190 |

| Data | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | Target |
|------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| 1    | 0.637566 | 0.811111 | 0.819577 | 0.743386 | 0.900000 | 0.468254 | 0.616402 | 0.654497 | 0.696825 |
| 2    | 0.366667 | 0.442857 | 0.442857 | 0.459788 | 0.523280 | 0.210053 | 0.311640 | 0.332804 | 0.311640 |
| 3    | 0.100000 | 0.112698 | 0.112698 | 0.116931 | 0.116931 | 0.100000 | 0.121164 | 0.138095 | 0.112698 |
| 4    | 0.142328 | 0.163492 | 0.163492 | 0.180423 | 0.210053 | 0.176190 | 0.171958 | 0.197354 | 0.176190 |

3. Results and Discussion

There are 5 architectural models used in this study, namely: 8-5-1 (8 are input layers, 5 are hidden layer neurons, and 1 is output), 8-10-1 (8 are input layers, 10 are hidden layer neurons, and 1 is output), 8-5-10-1 (8 is the input layer, 5 is the first hidden layer neuron, 10 are the second hidden layer neurons, and 1 is the output), 8-10-20-1 (8 is the input layer, 10 are the first hidden layer neurons, 20 are the second hidden layer neurons, and 1 is the output) and 8-20-40-1 (8 are the input layers, 20 are the first hidden layer neurons, 40 are the second hidden layer neurons, and 1 is the output) 8 which is the input layer taken from 2000-2007 and 2008-2015, the determination of the free hidden layer, but the authors use 5, 10, 5-10, 10-20 and 20-40. While output is 1 which is the target or output from the network.

Error level (Minimum error) used 0.001-0.07. Whereas the Batch method parameters training with weight and bias learning rules (trainb) used in general can be seen in the following Figure:
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Figure 2 above it can be explained, that after the training data is inputted into Matlab, the next step is to create a new network (Example using the 8-5-10-1 network model). Input data is not included in the formula when building a new network, because the input has been entered and processed first (P and T) which is normalization (Table 2). The transfer function used is ‘tansig’ and ‘logsig’. While the method used is Batch training with weight and bias learning rules (trainb).

Maximum number of epochs to train (Epoch) = 1000, Performance goal (goal) = 0, Maximum validation failures (max_fail) = 5, Epochs between displays (show) = 25, Generate command-line output (showCommandLine) = false, Show training GUI (showWindow) = true, Maximum time to train in seconds (time) = inf.

Program code

```matlab
net = train(net,P,T);
```

is a data simulation stage, wherein this process will bring up the results of training in the form of error values and training charts, while

```matlab
[a,Pf,Af,e,Perf] = sim(net,P,[],[],T);
```

used to see the results issued by the network.

Table 4. Best Model Architecture with 8-5-1

| Data | Target Training | Output Error | SSE | Target Testing | Output Error | SSE | Results |
|------|----------------|--------------|-----|----------------|--------------|-----|---------|
| 1    | 0.69683        | 0.69340      | 0.00253 | 0.0000063776   | 0.84930      | 0.43550 | 0.41380 | 0.1712269431 | 0    |
| 2    | 0.31164        | 0.32380      | -0.01216 | 0.0001478605   | 0.48873      | 0.43730 | 0.05143 | 0.0026452912 | 1    |
| 3    | 0.11270        | 0.11980      | -0.00710 | 0.0000504325   | 0.15070      | 0.15350 | -0.00280 | 0.0000078164 | 1    |
| 4    | 0.17619        | 0.13810      | 0.03809 | 0.0014508844   | 0.31972      | 0.25410 | 0.06562 | 0.004305762 | 1    |

| 0.0016555550 | Sum          | 0.1781585133 | MSE | 0.000435672 | MSE | 0.0046891003 | 75% |

Explanation:

1 = True
0 = False

Error = Target-Output
SSE = Error^2

Sum = Number of SSE generated from data1 to data 4
Results = If the error value in data testing <= 0.07, then the result is true (1). If not then false (0)

Accuracy = The number of correct results on ((Data / 4) * 100), yields 75% of the total accuracy

Margin Error = The number of incorrect results on ((Data / 4) * 100) or obtained from the maximum number of accuracy (100%) minus the resulting accuracy, resulting in 25%.

MSE = Total SSE / 4 (number of Data)
Table 5. Results Batch training with weight and bias learning rules Method

| Architecture | Time  | MSE         | Accuracy |
|--------------|-------|-------------|----------|
| 8-5-1        | 0.11  | 0.0445464533| 75%      |
| 8-10-1       | 0.22  | 0.0219738696| 25%      |
| 8-5-10-1     | 0.20  | 0.4599010407| 0%       |
| 8-10-20-1    | 0.20  | 0.0135736420| 50%      |
| 8-20-40-1    | 0.15  | 0.1239216062| 25%      |

Figure 3. Graph of Accuracy and MSE Level of Batch training with weight and bias learning rules Method

Explanation of Table 5 and Figure 3: that the best architectural model of the 5 models used is 8-5-1 which produces 75% accuracy and MSE 0.0445464533.

4. Conclusion
The conclusion of this study is:
- The 8-5-1 architectural model using Batch training with weight and bias learning rules method produces 93% accuracy.
- Although MSE from the 8-5-1 architectural model is not the smallest the accuracy is higher and the time is faster than the other 4 models.

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