Optimization Data Transfer Using the Neural Network method Based on Signal Level

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Abstract. The use of the internet that is very high at this time in all fields requires continuous development to improve the quality of data transfer. By improving the quality of data transfer, all activities that use the internet for transactions can run well. Good data transfer is influenced by speed, while speed is influenced by strength. There are several things that affect the data transfer process, but this research only focuses on speed and signal. Neural Network algorithm is used to determine the optimal point of the signal, where the optimal signal point is the maximum data transfer rate. This algorithm can be used to determine the optimal point with an accuracy rate of 10%

1. Introduction

The internet is a technology that is needed by the world today. The internet can connect the whole world, make no more distance and make information easily spread. Almost every day humans today use the internet as a tool to connect with each other. By using the human internet and making transactions easier that can benefit humans both personally and an organization. Internet use is also in all fields. The internet has a very important role for the world. The process of data transactions and connections between people can take place if the internet used can work optimally. But if this disturbance occurs will result in chaos on the transaction and even very large losses.

The main process carried out when using the internet is the data transfer process, the data transfer must be executed quickly even in real time. It can be imagined if a banking transaction is carried out with a very low data transfer situation it will result in the cancellation of a transaction of course this will result in losses and this is not very good.

According to [2] Michael Lok that the data transfer process is influenced by 2 variables namely signal strength and speed. The data transfer rate will increase at a certain point in proportion to the increase in signal length. There are times when the data transfer process is very good when the signal is strong but at the same time the speed is low and vice versa. For this reason the neural network method is used to find the optimal point so that the data transfer process can occur optimally. There are several factors that can affect the speed of data transfer, but the most important is the signal strength. Figure 1 is a graph showing the relationship of the effect of signal strength on data transfer rates.
2. Study Literature

2.1. Neural Network

Neural Network (artificial neural network) is a simulation of the biological brain. The purpose of NN is to learn to recognize patterns in data and simulate biological adaptive learning processes, even on a very simple scale. Once NN has been trained on data, it can make predictions by detecting the similarity / similarity of input data patterns. NN is one form of engineering from Artificial Intelligence. NN is seen as a Black Box that can predict the output of an input pattern that he recognizes. For this reason, NN must first be trained on a number of input patterns and the expected targets of each of the input patterns (Supervised Learning). Once trained, NN will be able to recognize similarities when faced with new input patterns, and produce predictions of their output patterns.

NN can detect the similarity of input, even some input that may not have been trained or given before. Because NN has the ability to interpolate, especially if the input data is inexact, there is a lot of interference in it. So that NN is used as a direct substitute for auto correlation, multivariable regression, trigonometry, and other regression techniques. When the data is analyzed using NN it will be possible to make predictions of important patterns as an expert analyzes the data, because NN can act like an expert in its field [7].

2.1.1. Basic concept of Neural Network

Neural networks have a parallel distribution architecture consisting of many nodes and links. Between the connecting points from one node to another is connected with a weight. To make the construction of a neural network includes rules consisting of: Network properties: network topology (relationship), type of relationship, order of the relationship, and weight limit. Node property: Activation value and dynamic System activation function: compose initialization weights, activation calculation formula and learning rules [6].

The topology of neural networks refers to frameworks as interconnection schemes. Framework usually often consists of several layers (slabs) and several nodes per layer. The type of layer consists of: Input Layer. Nodes in this case are called input units, which encode in a case displayed on the network for processing. For example, each unit input may be designed by a random attribute value in a case. Hidden Layer. Nodes in this case are called hidden units, which are not directly visible and have hidden effects. hidden layer provides nonlinearity for the network. Output Layer. Nodes in this case are called output units, encoding may be a concept (value) allocated to a case. For example, each output unit represents a class on an object.
The neuron model shown in Figure 1, also includes an external applied $\theta K$ threshold, which has the effect of decreasing network input on the activation function. On the other hand, even this network for the activation function might be enhanced by making a period of bias compared to a threshold, the bias value is negative from the threshold. In mathematical terms, it can be described that a neuron is written with the following pair of equations:

$$n_k = \sum_{j=1}^{p} w_{kj} x_j$$

$$y_k = \varphi_k (u_k - \theta K)$$

Where $x_1, x_2, ..., x_p$ is the input signal; $w_{k1}, w_{k2}, ..., w_{kp}$ is the synaptic weight of the neuron $k$; $u_k$ is a linear combinerary output; $\theta K$ is the threshold; $\varphi_k$ is an activation function, and $y_k$ is the output signal from neurons.

2.2. Optimization

Optimization is the process of finding the best possible solutions to a problem. There is no single method that can be used to solve all optimization problems. Many optimization methods have been developed to solve different types of optimization such as the Lagrange method. In optimization, the problem of determining a minimum point for a function in a subset of real non-empty space numbers is investigated. To be more specific, it is formulated as follows: Let $R$ be a real number space and $S$ an empty subset of $R$, and suppose $f: S \rightarrow R$ a given function. We will look for the minimum point $f$ on $S$. An element $x\in S$ is said to be the minimum point $f$ at $S$ if $(x) \leq (x)$ for all $x\in S$ Sets $S$ are called constraint sets and functions $f$ are called objective functions.

Optimization without constraints Optimization problems that do not involve any constraints are called optimization without constraints and are stated as: Minimize $f = f (X)$ (2.1) $X = (x_1, x_2, ..., x_n)$ $T$

Optimization with constraints Optimization problems involving any constraint are called optimization is constrained and is expressed as: Minimize $f = f (X)$ (2.2) $X = (x_1, x_2, ..., x_n) T$ with constraints: $g_i (X) \leq 0 i = 1, 2, ..., m ; l_j (X) = 0 j = 1, 2, ..., p$ where $X$ is a dimensionless vector $n$ called a design vector or decision variable, $f (X)$ is called an objective function, $g_i (X)$ and $l_j (X)$ are known as inequality constraints and constraints similarity.
3. Methodology
This research was conducted in the village of DurinTonggal by observing all connected devices using a proxy router. There are 50 points connected every day on the device. Observations are made every day for 1 month to determine the optimal point that can be used as a reference to determine a data transfer point with a maximum speed. The equipment used is 2 units of UniFi AP-AC-Mesh and is connected to approximately 50 devices dynamically.

Furthermore, using the Neural Network input data method is simulated using Matlab 2019. There are 50 of these can be observed in Table 1 below.

| No | Connected device | Sinyal Data | Speed Data | No | Connected device | Sinyal Data | Speed Data |
|----|------------------|-------------|------------|----|------------------|-------------|------------|
| 1  | 2e3a749e         | -45         | 541        | 26 | 32715af2         | -55         | 370        |
| 2  | 0bef4f20         | -41         | 163        | 27 | E04a3a18         | -50         | 406        |
| 3  | 79214d70         | -48         | 389        | 28 | 61fd314a         | -40         | 390        |
| 4  | F5ad35b5         | -46         | 78         | 29 | Ba88890f         | -50         | 288        |
| 5  | Badd3e23         | -47         | 561        | 30 | 4e0e7761         | -44         | 506        |
| 6  | 29d354ed         | -60         | 109        | 31 | C124bedf         | -42         | 539        |
| 7  | 08eaf979         | -52         | 163        | 32 | 0a556d10         | -57         | 495        |
| 8  | 90b8037b         | -55         | 488        | 33 | 0d975ec07        | -59         | 129        |
| 9  | 3d70e99f         | -48         | 361        | 34 | 79b50bec         | -42         | 359        |
| 10 | 64ee553d         | -45         | 407        | 35 | A3a333ec         | -60         | 270        |
| 11 | Dba7fb41         | -41         | 83,7       | 36 | 5cc7391b         | -50         | 273        |
| 12 | Eae9d7f4         | -54         | 563        | 37 | Ab0be875         | -58         | 502        |
| 13 | 6d15e356         | -43         | 274        | 38 | C02c555d         | -46         | 497        |
| 14 | D45ff92e         | -51         | 573        | 39 | 2f947478         | -54         | 177        |
| 15 | 3ef25274         | -53         | 589        | 40 | De39ce30         | -45         | 202        |
| 16 | A6130793         | -44         | 493        | 41 | F1d09d27         | -51         | 308        |
| 17 | C124bedf         | -42         | 539        | 42 | B818a040         | -54         | 218        |
| 18 | 294267dd         | -40         | 400        | 43 | 81e02f35         | -58         | 373        |
| 19 | A21f271c         | -59         | 293        | 44 | 51d55c9e         | -51         | 483        |
| 20 | E9560fbb         | -45         | 281        | 45 | 8f3455e          | -45         | 463        |
| 21 | 3e9d52e9         | -54         | 294        | 46 | 6dc5a38          | -51         | 468        |
| 22 | 8f3456e          | -45         | 463        | 47 | 3cb0f6f          | -46         | 362        |
| 23 | 413aeba7         | -51         | 254        | 48 | 413aeba7         | -51         | 254        |
| 24 | 8521dcfa         | -56         | 430        | 49 | C640456f         | -54         | 166        |
| 25 | 942b9632         | -46         | 279        | 50 | 8521dcfa         | -56         | 430        |

4. Result & Discussion
Testing is done by taking 50 data. With an accuracy rate of 10% of the amount of input data. The input data are signal data and target data, which are speed data. The simulation is done using the Neural Network nntool in the 2019 matlab application. The type of training conducted is Levenberg-Marquardt. And MSE (Mean Squared Error) is used to measure if the value is approaching the target. The following is a picture displaying the parameters of the training results.
Figure 3a through the data input is done using hidden layer 10. The target (optimal point) signal is found in Iteration 8. Next, Figure 3b shows that in iteration 8, the graph has not decreased anymore and has not changed, and the target is found in iteration 2.

The training state display plot image. Show in figure 4 In the picture shows a graph of the relationship between epoch, mu and validation. The gradient value at the optimal point is found in epoch 8 which is 559.5343 with your value = 10 and validation check = 8.

In Figure 5 is a regression plot in the preprocessing process, in the target image with output values ranging from 0-600, the output and target training data are analyzed by linear regression. It can be seen that the output with the target has a correlation of r of 0.21. This shows good results for matching output to the target. This is because the graph is linear with the data point position, the output is the same as the target at linear fit.
5. Conclusion
Based on the results of the study, the conclusion is that the determination of the optimal signal point to speed can be done by using the neural network method. This is evidenced by an accuracy rate of 10%. The speed will be optimal at epoch 8, time 0, performance $0.122 \times 10^{-4}$, gradient 560, mu 10.0 and check validation 6.
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