

Dwelling Time Prediction Uses Back Propagation Algorithm at Soekarno-Hatta International Airport

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Abstract:

Indonesia is one of the countries that has become a market for international trade. The large number of domestic needs and the presence of e-commerce are the causes of the increasing growth of goods imports in Indonesia, which has triggered dwelling time in air transport. Dwelling time is the length of time calculated from the time the goods are unloaded from the ship to the goods out of the port. Problems that occur are difficulties in predicting dwelling time in air transport and the lack of application integration that can be used to make dwelling time predictions on Freight Forwarding companies. This study aims to predict the dwelling time of Freight Forwarding companies at the Soekarno-Hatta Airport Cargo Terminal using the Neural Network method with the Backpropagation algorithm. Researchers want to build models and applications and test the accuracy of predictive accuracy. In this study the highest accuracy was in the prediction in the yellow lane of 67% while the lowest accuracy was in the prediction on the red lane 31%. So that it can be said that backpropagation does not have high accuracy in dwelling time predictions.

Keywords —Backpropagation, Dwelling Time, Freight Forwarding, Import, Prediction.

I. INTRODUCTION

International trade activities are activities carried out by a country in the context of seeking profits (increasing foreign exchange) or meeting domestic needs due to limited resources (Ichsan et al., 2016). These activities are called exports and imports. Literally exports are the act of sending domestic goods out of the country, while imports are entering goods from abroad into the country (Akhwan et al., 2017).

Indonesia is one of the countries that has become a market for international trade. The large number of domestic needs and the presence of e-commerce that provides ease of trade transactions are the causes of the increasing growth of goods imports in Indonesia. With the increasing import of goods, the need for cargo or shipping of goods will also increase. Especially the use of air transport.

Dwelling time is the length of time calculated from the time the goods are unloaded from the ship to the goods out of the port. Broadly speaking, the process that determines the dwelling time of

imported containers is not from the cargo flow process, but rather from the document flow process. The document process itself is from pre-clearance, customs clearance process, and post-clearance process.

Based on preliminary observations the problem that arises is uncertainty of dwelling time due to the many parties involved in this process, differences in interpretation and grouping of HS Code in deciding the status of goods in the dwelling time process in air transport carried out by PDTT.

Dwelling time has 2 types of obstacles, internal barriers are caused by human resources who are in the process of managing import documents and external barriers are caused by external parties or in terms of infrastructure (Akhwan et al., 2017). This problem often interferes with supply chain management for importers, thus harming many parties including PPJK, because the longer the dwelling time process, the higher the logistical costs incurred.

This study selected Data Mining techniques using the Neural Network method with the

Backpropagation algorithm which aims to improve accuracy in dwelling time predictions so that it can be used as a source of dwelling time predictions that are expected to help Freight Forwarding companies, importers and all interested parties in finding solutions to problems in dwelling time on air transport. This research is expected to be able to find previously hidden knowledge into valuable and useful information.

II. THEORETICAL BASIS

A. Import

Activities for entering goods into the Customs Area. Customs Area is the territory of the Republic of Indonesia which includes land, waters, and air space above it, as well as certain places in the Exclusive Economic Zone and continental shelf in which the Customs Law applies (DJBC, 2007).

From these definitions, it can be concluded that the definition of import is the activity of purchasing or importing goods and services from abroad into the country which includes certain rules in accordance with the policies of the countries that are the destination of imports.

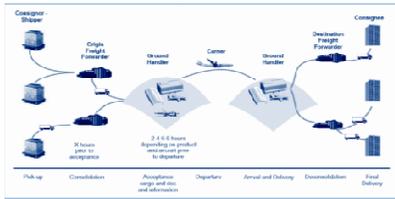


Figure 1. Process of Importing Air Transport

B. Shipments Application

The Imported Goods Application Application System is a service system that can assist the import service process of shipments from starting to receive data from the postal operator until the goods are approved, so that the service can be automated (DJBC, 2017).

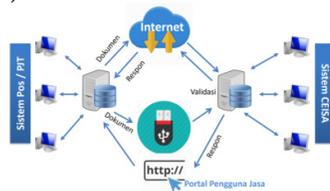


Figure 2. Application Mechanism of Shipments

Shipment Goods Application is a medium or means to exchange data electronically between DJBC and Postal Operator, monitor the movement of goods and monitor the completion of imports of shipments. The system used in data exchange is using web service technology. Web Services is an application service component that can be accessed through open protocols that use the Web through Simple Object Access Protocol (SOAP) with Web Services Description Language (WSDL) and are registered in Universal Discovery Description and Integration (UDDI). Web services support communication between applications and application integration using XML and the Web. XML (eXtensibleMarkupLanguage) is a standard for defining data in a simple and flexible format. Web service Shipment is a shared web service and aims to bridge the information format equation between the input or output of the Internal Post or PJT Application and the Application Server. In this case, system integration needs to be supported by an interface application, so that document transactions, shipping and receipts will take place transparently.

C. Artificial Neural Network

Neural network is a human effort to model the workings or functions of the human nervous system in carrying out certain tasks. This modeling is based on the ability of the human brain in organizing its constituent cells called neurons, so as to be able to carry out certain task tasks, especially pattern recognition with very high effectiveness (Suyanto, 2014).

In general, neural networks are formed from millions of basic structures of neurons that are organized and integrated with one another so that they can carry out activities regularly and continuously according to their needs.

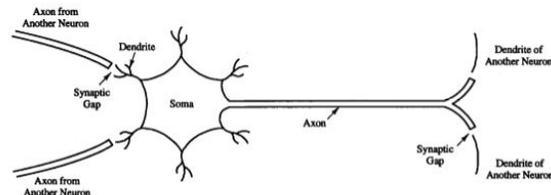


Figure 3. Structure of Neurons in the Human Brain
D. Backpropagation (Reverse Propagation)

Backpropagation is a supervised learning type of learning or training technique that is often used. This method is a very good method of dealing with complex pattern problems. Within this network, each unit is in the input output layer.

Backpropagation (BP) is a multi-layer Neural Network. His findings overcome the weaknesses of ANN with a single layer which resulted in the development of ANN had stagnated around 1970. The BP algorithm is a generalization of the rule of delta (Widrow-Hoff), namely applying the gradient descent method to minimize the error of the total square of output calculated by the network.

E. Review of Research Objects

PT Tata HarmoniSaranatama, PT Citylink Express and PT Mandiri Prima Andalan is a company engaged in freight forwarding and cooperates to carry out export and import activities with four countries, namely Taiwan, China, Hong Kong and Vietnam.

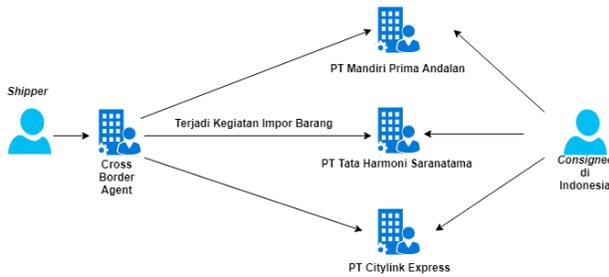


Figure 4. Illustration of the Process of Import Activities

In figure 4, it can reach the consignee). The Shipper is the sender of the goods or the seller and Consignee are the recipients of the goods or buyers. When consignees in Indonesia (recipients or buyers) want to buy goods from abroad using freight forwarding services (there is a process of importing goods to Indonesia), the Shipper must go through freight forwarding services that work together or partner to get to Consignee (consignee or buyer) so that Shipper uses freight forwarding services called cross border agents (overseas freight forwarding services that work together then the goods are sent to Indonesia by air. When the item arrives, then the

process of shipping goods to the Consignee (goods recipient or buyer).

Data Master Manifest	
Drone	MAWB
Pesawat	HAWB
Helikopter	HAWB
Meja Kecil	HAWB

Figure 5. Example of Master Manifest Data

Freight forwarding companies always process import activities every day so that in one day PML imports a lot, each imported item is called House Airway Bill and all goods to be imported every day are called MAWB (Maseter Airway Bill). HAWB is a document or package contained in a master manifest (MAWB).



Figure 6. Process of Importing Goods by Air

III. RESULTS AND DISCUSSION

A. Data Analysis and Walking System

Analyzing this business process from the running system is intended to find out activities related to the dwelling time process by Saranatama Harmony, PT Mandiri Prima Andalan, PT Citylink Express. This was done to design a prototype dwelling time prediction to be built. Based on the results of a system of reviews, observations, literature studies and documentation, data were obtained relating to dwelling time predictions. Data obtained based on the documentation results are presented in Table 1.

Table 1. Data on Documentation Results

No.	Document Type	Document Name	Document Source	Availability
1.	File Ms. Excel	1. Data on PDE Pre Clearance Response 2. Custom Clearance	PT Tata HarmoniS aranatama, PT Mandiri Prima	Ok

		Data 3. Data Post Clearance Handling 4. Data on Import of Goods 5. HSCode data	Andalan, PT CitylinkExpress
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From the results of observations by observing the existing situation directly and what happened to PT Tata HarmoniSaranatama, PT Mandiri Prima Andalan, PT Citylink Express obtained data in the form of a company that has good infrastructure. However, the company does not yet have a method for predicting dwelling time. Data obtained from learning outcomes through previous papers, journals and theses are presented in Table 3.

In Table 1, the data obtained are responses to PDE Pre Clearance, Custom Clearance, Handling Post Clearance, Import of Goods and HSCode from PT Tata HarmoniSaranatama, PT Mandiri Prima Andalan, PT Citylink Express based on the documentation. Data obtained based on observations are presented in Table 2.

Table 3 Data on Library Study Results

No.	Type	Information
1.	Neural Network Backpropagation	From the results of learning several papers, journals and theses, the backpropagation neural network method has high accuracy in making predictions.

Table 2 Data on Observation Results

No.	Type	Information
1.	Facilities and infrastructure	From the results of observations obtained data: PT Tata HarmoniSaranatama has 1 office for importing goods and 2 warehouses for storing activities for importing goods. PT Mandiri Prima Andalan has 1 office for importing goods and 1 warehouse for storing goods import process activities. PT Citylink Express has 1 office in Indonesia for goods import activities, head office in Malaysia with almost all representative offices throughout ASEAN countries and 1 warehouse for storing goods import process activities in Indonesia..
2.	IT Systems and Infrastructure	From the results of observations obtained data: PT Tata HarmoniSaranatama has an integrated online-based Import Operational System and IT infrastructure consisting of Computers, printers, and Virtual Private Servers PT Mandiri Prima Andalan already has Import Operations as well as Computer devices, printers. PT Citylink Express already has an International scale Import Operational System.

B. Model Design

The design model proposed by the author is a model that describes the stages of processing dwelling time data as shown in Figure 7 below:

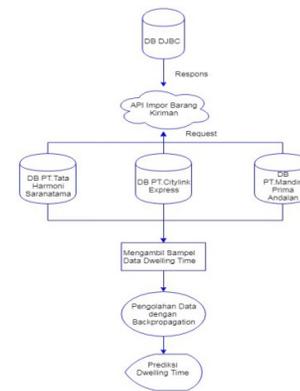


Figure 7. Dwelling Time Data Processing Model

In Figure 7 the prediction is done by taking the dwelling time data on the pre clearance, custom clearance, previous post clearance that has been grouped based on the type of path that is determined through HS code, namely green lane, yellow lane, red lane, and priority lane on the three research objects.

After getting the sample data then the data processing is performed using the backpropagation algorithm by conducting training, testing up to the

results of dwelling time predictions. Prediction results will be displayed on the system dashboard of the three research objects as well as on the tracking module to inform the consignee about the prediction of the dwelling time process.

C. Dwelling Time Data Prediction Stage

Table 4. Dwelling Time Data Test Results

Document Path	MAPE	ACCURACY
Green Line	45.8424	54.1576
Yellow Line	32.6168	67.3832
Res Line	68.5603	31.4397
Priority Path	41.8717	58.1283

The results above show that Artificial propaganda neural networks are able to do good learning with data patterns that have high fluctuations using the right training method, Levenberg-marquardt.

In this study all document paths in dwelling time can be predicted with high accuracy. This is influenced by proper training and test data. So as to produce predictions that have high accuracy.

Broadly speaking, Backpropagation artificial neural networks can do dwelling time testing and predictions well. This can be a starting point in building further research to get maximum results.

IV. CONCLUSION

1. The dwelling time prediction model is designed according to the dwelling time data path of the research object so that existing data can be processed to predict dwelling time with the backpropagation algorithm.
2. The use of the activation function and the appropriate training method when implementing the backpropagation algorithm can improve accuracy which is better to make dwelling time predictions. The development was carried out by using the Matlab software as a prototype of the backpropagation calculation which would later be applied to the operational system of the research object.
3. In this study the highest accuracy is in the prediction in the yellow lane of 67% while the accuracy is lowest, namely the prediction on the red lane is 31% on the red lane. So that it can be said that backpropagation does not have high accuracy in dwelling time predictions.

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