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Prediction for Dengue Fever in Indonesia Using Neural Network and Regression Method

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Abstract. Dengue fever is the most hurriedly diffused mosquito-borne viral disease in the world. More than 33% of the total population in the world is under risk. Currently the prediction of dengue can save a person's life by alerting them to take proper diagnosis and care. The Objectives of this research is (1) To Predict The area with the most potential to suspend dengue fever In Indonesia, And (2) to Predict dengue fever cases. (3). To analyz how many percent the effect factor of dengue fever. There are many ways to predict one of them is Regression and Deep learning Approach. Reseachr tried to analyz the most accurate such as Regression Multyplied, Neural Network , and Sensitivity Analysis. Set of data have been used is timeseries from 1997—2017. The Variable has been used for this research is Humadity , Temperature, Wind, Airpressure, Rainfall Index, income, sunlight , Population density, and output is cases. The Result of this research is first The area with the most potential to suspend Dengue fever In Indonesia 2019 is Jambi, Lampung, Bangka Belitung, West Sumatera, Central java with average Accuracy 87,16%. The Prediction dengue fever cases 2019 is 80233 Cases with accuracy 87,16%. The Third All variable (X1 s.d X8) have been to effect to Partial and Simultaneous to (Y) in the amount of 0.16 (16 %) with a significance level of 0.001 (99%). While the remaining 100% - 16% = 84% is influenced by other variables outside of this research.

1. Introduction

Dengue fever is the mostly hurriedly diffusion mosquito bone viral disease in the world. More than 33% of the total populace the world is under risk. Timely prediction of dengue can save a person's life by alerting them to take proper diagnosis and care. The one of the methods to predict is a Neural Network. At present many methods have been developed to predict dengue fever. There are many ways to predict one of them is machine learning. Machine Learning has many methods such as KNN, SVM, LR, and others. But it is difficult the method provide a high level of accuracy. Sometimes the methods provide accuracy > 90%, but sometime <90% as well as other methods and other cases. We could research to some methods for seeing the most accurate. Therefore, the methods used to predict not stable and accuracy. The problem is prediction of dengue fever cannot be maximized because the results of the prediction are less accurate even when approaching. So that we need a new Prediction Method in that helps in improving performance, accurate, and Smart.





Figure 1. Distribution of Dengue Fever in Indonesia

The estimated from the spread of dengue fever that is problem to needed an analysis to predict how the spread of dengue fever to minimize its spread.

2. Research Objective

The research objectives of this study are as follows First is To Predict The area with the most potential to suspend dengue fever In Indonesia, second is to Predict dengue fever In Indonesia and the third is to predict how many percent the factors to prediction spread of dengue fever in Indonesia.

3. Literature Review

3.1 Predict Using Neural Networks

According [4], Back propagation or backpropagation is one of the most widely used learning training of supervised learning. This method is one of the most excellent methods of dealing with the problem of recognizing complex patterns. In the back propagation network, each unit in the input layer is connected to each unit in the hidden layer.

3.2 Architecture ANN

The Artificial Neural Network architecture used in this case is the backpropagation algorithm network, which consists of: a. The input layer with 9 nodes is ($x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8$). The hidden layer with the number of vertices specified by the user is one node or one hidden with two neurons ie (y_1, y_2). Output layer with 1 node is prediction accuracy Value added a product

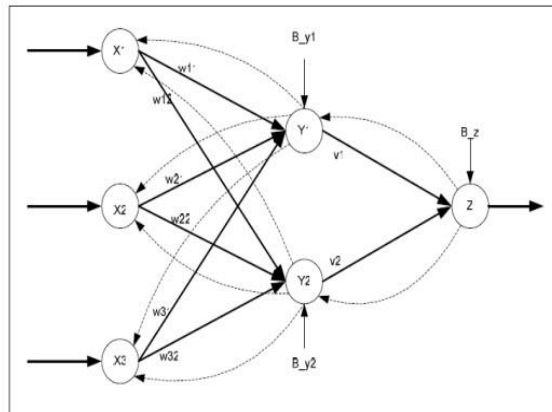


Figure 2. The Architecture of Backpropagation[6]

Network architecture can be seen as in Figure 2 below:

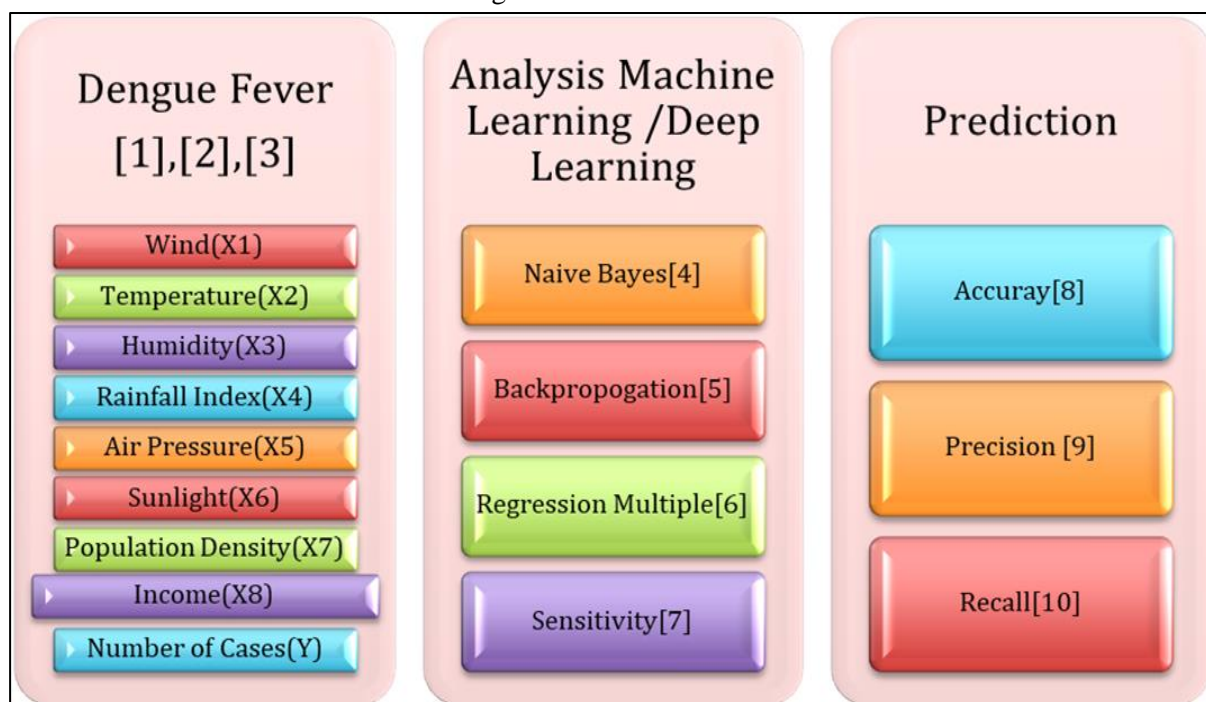


Figure 3. Literature Review of the dengue fever, deep learning and prediction

Prediction Dengue Fever using Support Vector Machine Model[4][5] [6] [7];[8];(Kesorn et al., 2015) [9], from some of these models note that the SVM model produces less stable results and learning speed the model is still low. Prediction Using KNN [10]; [11] from the results of these studies that the accuracy of the model is still not stable.

Prediction using Naïve Bayes and Decision Tree [1]; [12];[13] based on research conducted Naïve Bayes prediction provides better results than the decision tree. Artificial Neural Network is one of the most popular methods for conducting predictive research. Many studies using ANN algorithms include research conducted by [14] were the results of these studies can by the stated that prediction of

dengue fever has an accuracy rate of up to 90%. Next is the research conducted by [15] with the results of the study is to predict the energy obtained by using ANN, and the results of ANN research with modified models can make predictions more accurately. Several other studies also support this statement. So based on previous research that the Prediction ANN Method can be more accurate if it can find and modify the best model [16] [17][18] [19] [20].

4. Methodology

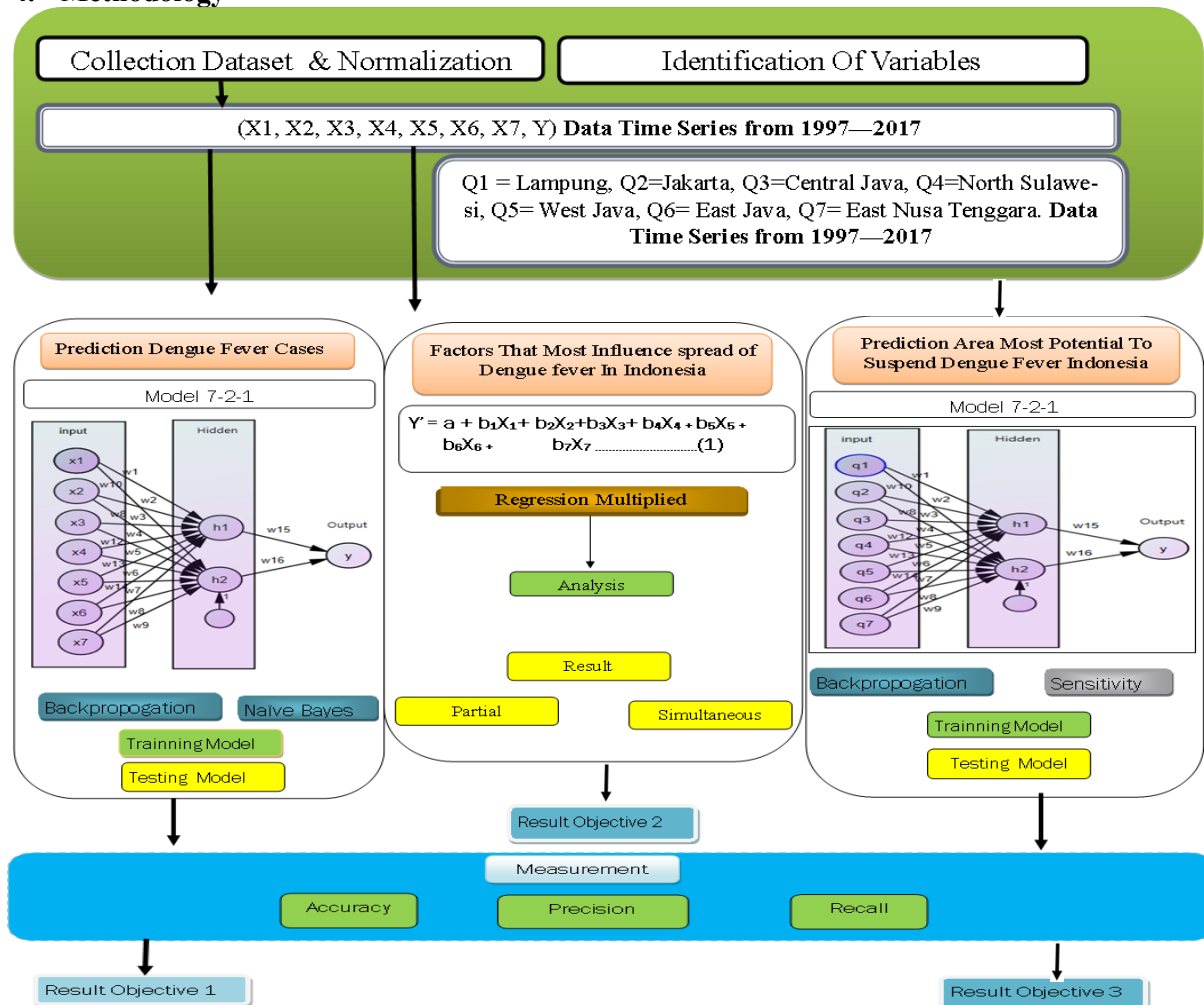


Figure 4. Methodology Research

The research methodology used has several stages namely the first collection of data sets and the next normalization is identifying variables. The next step is to determine seven variables consisting of temperature (x_1), humidity (x_2), rainfall index (x_3), wind (x_4), Air Pressure (x_5), Sunlight (x_6), Population density (x_7), to be used to do predicting dengue cases and determining the factors that most influence in the spread of dengue using regression. Furthermore, 7 regions will be predicted as the most potential areas to develop dengue fever. Namely Lampung (q_1), Jakarta (q_2), Central Java (q_3), North Sulawesi (q_4), West Java (q_5), East Java (q_6), East Nusa Tenggara (q_7). Then the method used is backpropagation neural network and Multiple regression.

5. Result And Discussion

To predict how many percent effect factors to prediction spread of dengue fever in Indonesia.

Table 1. Result regression Analysis

Actual Output	Prediction 2017	Real Result	Accuracy	Difference	Prediction 2019
1. Aceh	0.5373	0.5454	99.19	0.0081	0.4851
2. North Sumatera	0.5267	0.475	94.83	0.0571	0.4399
3. West Sumatera	0.5392	0.5701	96.91	0.0309	0.4923
4. Riau	0.5407	0.4816	94.1	0.059	0.4771
5. Jambi	0.5300	0.4817	95.17	0.0483	0.4936
6. South Sumatera	0.5401	0.5825	95.76	0.0424	0.464
7. Bengkulu	0.5374	0.6328	9.46	0.0954	0.4875
8. Lampung	0.5437	0.5855	95.82	0.0481	0.4949
9. Bangka Belitung Island	0.5420	0.4753	93.33	0.0667	0.4917
10. Riau Island	0.5222	0.5925	92.97	0.0703	0.4713
11. Dki Jakarta	0.5470	0.5474	99.96	0.0004	0.4811
12. West Java	0.5377	0.4264	88.87	0.1113	0.487
13. Central Java	0.5503	0.5214	97.11	0.0289	0.4915
14. Banten	0.5560	0.5576	99.84	0.0016	0.4904
15. East Java	0.5471	0.3341	78.7	0.213	0.4695
16. Yogyakarta	0.5418	0.4762	93.44	0.0656	0.4245
17. Bali	0.5499	-0.1089	34.11	0.6589	0.4775
18. West Nusa Tenggara	0.5493	0.4049	85.56	0.1444	0.4775
19. East Nusa Tenggara	0.5525	0.3858	83.34	0.1666	0.3725
20. West Kalimantan	0.5326	0.3934	86.09	0.1391	0.4769
21. Central Kalimantan	0.5321	0.499	96.7	0.033	0.4462
22. South Kalimantan	0.5556	0.3494	79.38	0.2062	0.4179
23. East Kalimantan	0.5240	0.4973	97.33	0.0267	0.4313
24. North Kalimantan	0.5281	0.5502	97.79	0.0221	0.4022
25. North Sulawesi	0.5361	0.1954	65.93	0.3407	0.4889
26. Central Sulawesi	0.5398	0.4775	93.77	0.0623	0.4826
27. South Sulawesi	0.3838	0.376	99.21	0.0079	0.3485
28. Southeast Sulawesi	0.5331	0.4312	89.81	0.1019	0.367
29. Gorontalo	0.5531	0.1814	62.84	0.3716	0.2481
30. West Sulawesi	0.3929	0.3773	98.43	0.0157	0.287
31. Maluku	0.5113	0.2256	71.44	0.2856	0.189
32. North Maluku	0.5083	0.3388	83.06	0.1694	0.3133
33. Papua	0.5198	0.1921	67.23	0.3277	0.1997
34. West Papua	0.5119	0.1605	64.86	0.3514	0.3329
Average error				87.16	

Table 2. Result Analysis sensitivity

Input Factors	Partial	Sensitivity	sig 5%	Simultaneous	Sig 1 %
Temperature (x1)	-3.893	2	0	0.16	0

humudity (x2)	0.173	8	0.863
Rainfall Index (x3)	-0.337	7	0.736
Wind (x4)	0.906	5	0.365
Air Pressure(x5)	-1.416	3	0.157
Sunlight(x6)	-0.514	6	0.607
Population density (x7)	10.406	1	0
Income (x8)	-3.337	4	0.001

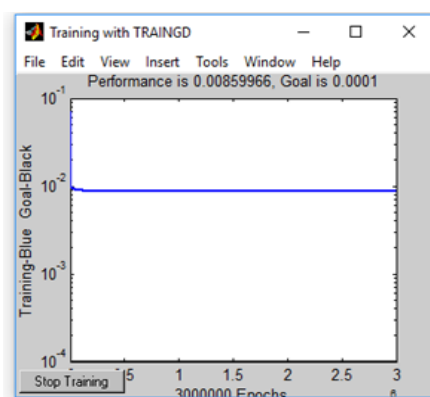


Figure 5. Result Neural Network Backpropagation

All variable (X1 s.d X8) have been to effect to Partial and Simultaneous to (Y) in the amount of 0.16 (16 %) with a significance level of 0.001 (99%). While the remaining $100\% - 16\% = 84\%$ is influenced by other variables outside of this research.

6. Conclusion

The area with the most potential to suspend Dengue fever In Indonesia 2019 is (1) = Jambi, (2) = Lampung, (3) = Bangka Belitung, (4) = West Sumatera, (5) = Central Java with average Accuracy 87,16%, the Prediction Dengue Fever 2019 is 80.233 Cases with accuracy 87,16% and All variable (X1 to X8) have been to effect to Partial and Simultaneous to (Y) in the amount of 0.16 (16 %) with a significance level of 0.001 (99%). While the remaining $100\% - 16\% = 84\%$ is influenced by other variables outside of this research.

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