

Classification of Nutritional Status of Pregnant Women at Risk of Stunting in Prospective Babies Using the Support Vector Machine (SVM) Algorithm


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ABSTRACT

Stunting describes the existence of chronic nutritional problems, influenced by the condition of mothers/mothers-to-be, fetal period, and infants/toddlers, including diseases suffered during toddlerhood. According to a WHO report quoted from Riskesdas, in 2018 the stunting target in Indonesia was 20%, but in 2013 the stunting rate was 37.2%, but in 2018 there was a decrease to 30.8%. However, the stunting rate in Indonesia is still very high and far from what is targeted by WHO. The method with the best level of accuracy for classification in this study is SVM. This study uses the Support Vector Machine (SVM) method as criteria and attributes which take benchmarks in pregnant women with attributes as a reference including gestational age, maternal weight, blood pressure, and pregnancy problems. The reason for taking benchmarks in pregnant women is because in the first 1000 days of a baby's life determines the baby's nutrition. The first 1000 days of life or 1000 HPK is a critical period in the growth and development of children starting from the beginning of pregnancy (270 days) to 2 years old (730 days). Data was obtained from the Tanah Luas Health Center totaling 684 data on pregnant women. The process of manual calculation is data normalization, kernelization, calculating the alpha and alpha delta E_i values, calculating weights, calculating bias values, and calculating $f(x)$ values. In this study, the dataset totaled 680 data with 544 training data and 136 test data with the criteria of gestational age, pregnant woman's weight, blood pressure, and pregnancy problems. The accuracy obtained was 38.90 %. The variables that have the most influence on this classification are 3, namely the weight of pregnant women, blood pressure, and complaints experienced in pregnant women.

Keyword : Stunting, Pregnant women, SVM

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1. INTRODUCTION

According to a WHO report quoted from Riskesdas, in 2018 the stunting target in Indonesia was 20%, but in 2013 the stunting rate was 37.2%, but in 2018 there was a decrease to 30.8%. However, the stunting rate in Indonesia is still very high and far from what is targeted by WHO. According to data from the WHO, worldwide, 178 million children under the age of five are estimated to experience stunted growth due to stunting. Stunting is a chronic nutritional problem caused by a lack of nutritional intake for a long time, generally this is due to food intake that is not in accordance with nutritional needs. The problem of stunting occurs starting from the womb and will only be seen when the child has reached the age of two.

For UNICEF, stunting is defined as the percentage of children aged 0 to 59 months, with a height below minus (moderate and severe stunting) and minus three (chronic stunting), this is measured using child growth standards issued by WHO. In addition to experiencing stunted growth, stunting is also often associated with the cause of suboptimal brain development. This can affect mental abilities and learning not optimally, as well as poor learning achievement (Ministry of Health, 2018).

The development of stunting is a slow, cumulative process and does not mean that the current food intake is inadequate. And the symptoms of stunting include, children are shorter for children their age, body proportions tend to be normal but children look younger/smaller for their age, low weight for children their age, and delayed bone growth.

Stunting describes the existence of chronic nutritional problems, influenced by the condition of mothers/mothers-to-be, fetal period, and infants/toddlers, including diseases suffered during

toddlerhood. The long-term adverse effects of stunting are decreased cognitive ability and learning achievement, decreased immunity, and high risk for the emergence of diabetes, obesity, heart and vascular disease, cancer, stroke, and disability in old age, as well as poor quality of work. One of the improvement efforts needed to overcome stunting is through specific nutritional interventions for pregnant women. Pregnant women's classes are one way that can be used to disseminate information related to nutrition and health during pregnancy to prevent stunting. The purpose of the study was to know the influence of pregnant women's classes on increasing knowledge and attitudes about stunting prevention.

Therefore, with this problem, it is necessary to classify the risk of stunting in prospective toddlers who are identified during pregnancy. The appropriate method for this classification is the Support Vector Machine because the Support Vector Machine is a classification that can classify the nutritional status of pregnant women so that they are able to identify the baby to be born.

The previous research by Monica Yoshe TitimEidara a, Wiwien Hadikurniawati b entitled Implementation of the Naïve Bayes Classifier Method for Classification of Stunting Nutritional Status in Toddlers. Based on this study, the Naïve Bayes Classifier Method can be used to classify stunting nutritional status in toddlers based on gender, age, weight, height, poor status and nutritional status category. The accuracy of the Naïve Bayes Classifier Method in classifying stunting nutritional status in toddlers is 88% of 300 data divided into 2, namely 275 data as training data and 25 data as test data (Titimeidara & Hadikurniawati, 2021).

Related research conducted by Widya Cholid Wahyudin, using the Naïve Bayes Classifier algorithm based on the selection of the forward selection feature in classifying the nutritional status of stunting in toddlers, can be concluded from the data, namely if $jk_{el} = 1$, $age = 2$, $weight = 1$, $height = 1$, $poor = 1$, $category = 1$ and $status = 2$, then the results of the classification of stunting nutritional status of toddlers with stunting classification are obtained, because the Posterior Probability value of stunting nutritional status is higher than the normal value (Wahyudin, 2020).

Related research conducted by C. Oganis, S. Musdalifah, and D. Lusiyaniti, A pregnant woman who has a malnourished status, will experience many problems during her pregnancy, such as anemia and ProtEin Energy Deficiency (KEP) also have a bad effect on the baby's nutrition. To facilitate the classification process, a computer-based program was built using the Matlab program with the Support Vector Machine (SVM) method (C. Oganis S. M., 2017).

Related research conducted by Nur Ghaniaviyanto Ramadhan and Azka Khoirunnisa succeeded in detecting and classifying severe malaria based on patient history data. The SVM model was able to produce the highest akura of 92.3% by applying cross validation techniques and min-max normalization. The K value in the cross validation technique has an influence on the accuracy results (Ramadhan & Azka, 2021).

As for the previous research conducted by Anita Ahmad kasim, and Muhammad Sudarsono, research related to the economic classification of the population using predetermined parameters, these parameters were processed using the Support Vector Machine (SVM) algorithm This research used data consisting of 320 training data and 80 test data. Based on the results of the SVM algorithm accuracy test, an accuracy result of 98% was obtained (Anita Ahmad Kasim, 2019).

From the above research, the author uses the Support Vector Machine (SVM) method as criteria and attributes. Where the author takes benchmarks on pregnant women with attributes as a reference which include gestational age, maternal weight, blood pressure, and pregnancy problems. The reason for taking benchmarks in pregnant women is because in the first 1000 days of a baby's life determines the baby's nutrition. The first 1000 days of life or 1000 HPK is a critical period in the growth and development of children starting from the beginning of pregnancy (270 days) to 2 years old (730 days).

So that this study aims to prevent babies who have been detected stunting in the womb by providing nutritional intake to pregnant women and in critical periods, namely the first 1000 days of baby birth using a system that will be built by the author. Therefore, the author raised the title "Classification of Nutritional Status of Pregnant Women at Risk of Stunting in Prospective Babies Using the Support Vector Machine (SVM) Algorithm".

2. Research Stages

The following is a schematic of the system with the Support Vector Machine (SVM) method.



Fig 1. System Schematics



Fig 2. Vector Machine Support Method Schematic

When classifying the nutritional status of pregnant women, doctors or health workers often get mistakes due to busyness, lack of concentration, drowsiness or other factors. To address this problem, researchers submitted an application to classify the nutritional status of pregnant women that allows health workers to quickly find out whether a prospective baby is stunted or not. Based on the data needs that will be applied to this application, the data was obtained from the Tanah Luas Health Center. The data obtained by the author is data from pregnant women who visit the Tanah Luas Health Center as many as 680 data. Building a system on classifying nutritional status at risk of stunting in pregnant women to prevent stunting in prospective babies to be born.

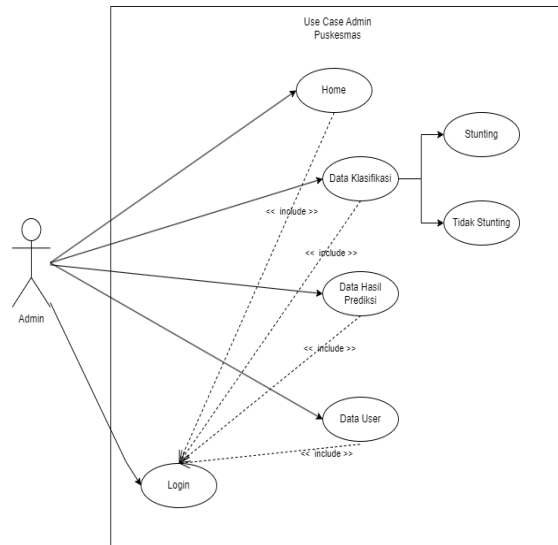


Fig 3. Use Case Diagram Admin

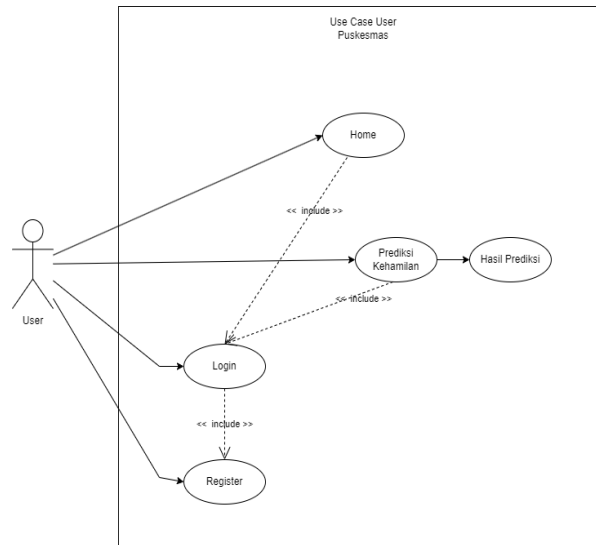


Fig 4. Use Case Diagram User

It can be seen from the figure 3 that the admin logs in to be able to access the system and enter the sequence page. After the admin successfully logs in, the admin sees the data of users who have registered, then the admin can see the data of the prediction results made by the user and can also predict the possibility of stunting or not stunting. Then the admin sees the data from the classification results from the previous data and from the user registration data which shows that there is a risk of stunting or not stunting. From figure 4 above, it can be concluded that the user registers and then logs in. After that, the system displays a sequence page, then the user inputs pregnancy data, then the system displays the results of the prediction of stunting risk or non-stunting.

A class diagram consists of class names, attributes, and operations/methods that users can perform. The following is a class diagram of the sentiment analysis system that has been built:

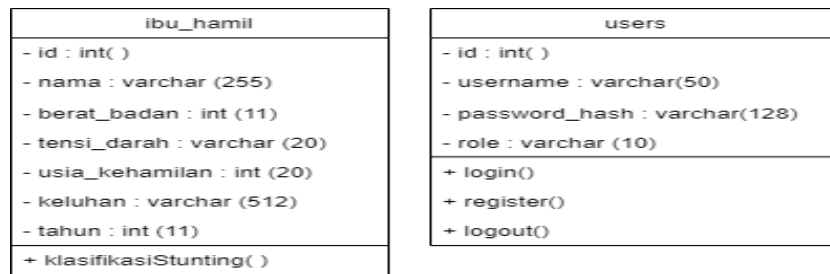


Fig 5. Class Diagram

3. RESULTS AND DISCUSSION

Starting from looking for the training data process and continuing the process to calculate the test data in order to get the classification results.

The calculation using the SVM algorithm is first carried out on the training data. The training data below has been weighted with the following conditions.

For blood pressure criteria:

1. High blood pressure from 130/80 to higher is weighted with a value of 3.
2. Normal blood pressure from 90/60 to 120/80 is weighted with a value of 2.
3. Low blood pressure less than 90/60 weighted with a value of 1.

For gestational age criteria:

1. Young pregnancy is calculated from the gestational age under 18 weeks weighted with a value of 1.
2. Old pregnancy is calculated from the gestational age above 18 weeks weighted with a value of 2.

For complaint criteria:

1. With complaints of itching in the abdomen, severe anemia, dizziness, nausea and vomiting, swollen legs and hands weighted with a value of 2.

2. With complaints of cough, cold, numbness of the hands, and vaginal discharge are weighted with a value of 1.

For classification criteria:

1. With the stunting classification, it is labeled 1.
2. With a non-stunting classification, it is labeled -1.

There are several stages for manual calculation using the SVM method as follows:

1. Data Normalization: This data normalization relies on the minimum and maximum average values of the data by subtracting the data to be normalized.
2. Kernelization: Kernelization is carried out using the rbf kernel function. The K kernel matrix is calculated with a dimensional matrix of $n \times n$ where n is the amount of training data used. The kernel is divided using $c = 1$ and $\gamma = 0.1$.
3. After obtaining the rbf kernel matrix value between the training data, the max value for all data is sought.
4. Calculate alpha and alpha deltas
5. Recalculate the E_i delta alpha and alpha values: To get the results of the E_i value, a search for the E_i value is carried out by multiplying the rbf kernel value between the training data with the a_i value that has been obtained.
6. Calculating Weights: Before calculating the weight value, first calculate the RBF kernel on positive/index 1 data and negative/index data
7. Calculating Bias Values

The bias value is calculated to find the SVM function value or the $f(x)$ value in the Support Vector Machine (SVM) calculation. The following are the results of the accuracy of the test data taken from 680 data sets divided between 80% of the training data and 20% of the test data. With a total of 136 test data and 544 training data.

Table 1. Accuracy Results using SVM Method

Classification	Precision	Recall	Accuracy
Stunting	20%	53%	
No Stunting	71%	35%	38.90%
Sum	45.50%	44%	

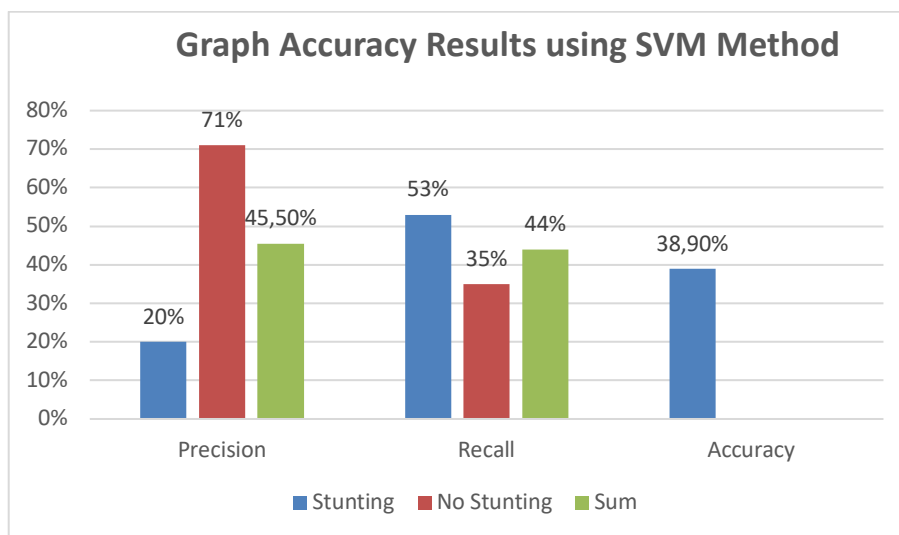


Fig 6. Graph Accuracy Result

4. CONCLUSION

Data was obtained from the Tanah Luas Health Center totaling 680 data on pregnant women. In the manual calculation, the data taken amounted to 680 datasets and was divided into 544 training data and 136 test data with the criteria namely gestational age, pregnant woman's weight, blood pressure, and pregnancy problems. According to the results of the study, the SVM method was used on the criteria of pregnant women which greatly affected the risk of stunting in prospective babies with the first ranking, namely on the weight of pregnant women under 42 kg, the second ranking with low blood pressure below 90, and the third ranking with complaints from pregnant women who have severe illness or severe complaints. The classification of the nutritional status of pregnant women at risk of stunting in prospective babies using the SVM method was tested on 544 training data and 136 test data with accuracy values of 38.90%, accuracy 45.50% and recall 44%.

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