

Prototype of Application to Predict the Pregnancy Complication In Rumah Sakit Mitra Bangsa Pati

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DOI: 10.29322/IJSRP.9.07.2019.p9151

<http://dx.doi.org/10.29322/IJSRP.9.07.2019.p9151>

Abstract- Maternal mortality is a challenge for public health field in the world and developing countries account for 99% of maternal deaths globally. It is estimated that 15% to 20% of all pregnant women will experience a high risk state and obstetric complication. The evidence based midwifery comprehensive guideline provided by the midwife is expected to detect early risk factors for pregnancy before complication occurs. Pregnancy complications prediction system through assessment of gestational age, gravida, parity, abortion, complaints, blood pressure, pulse, temperature, presentation, height of fundus uterus, fetal heart rate, hemoglobin and proteinurine using manual recording and reporting takes time to make decisions. The purpose of this study was to build a prototype application for predicting pregnancy complications at Rumah Sakit Mitra Bangsa Pati in order to predict pregnancy complications, and design a pregnancy database and make reports electronically. The system development design uses a prototyping approach. The prediction method for the application of machine learning maternal complications uses the Naïve Bayes Classifier (NBC) algorithm. Applications can provide predictive results for pregnancy complications, such as bleeding, preeclampsia and hyperemesis gravidarum. Collecting data from register books, KIA books and medical records. From the results of the test with 72-fold cross validation, the accuracy value was 87.5% with 270 training data and 72 testing data. The use of prediction data is a basis for decision making.

Keywords: Prediction of pregnancy complications, k-fold cross validation, Naïve bayes classifier

I. INTRODUCTION

Complications in pregnancy can result from conditions that are specifically linked to the pregnant state as well as conditions that commonly arise or occur incidentally in women who are pregnant. Complications of pregnancy can appear in all trimesters; their diagnosis and management are great challenges [1]. Complications of pregnancy are health problems that occur during pregnancy. They can involve the mother's health. Some women have health problems that arise during pregnancy, and other women have health problems *before* they become pregnant that could lead to complications. It is very important for women to receive health care before and during pregnancy to decrease the risk of pregnancy complication.

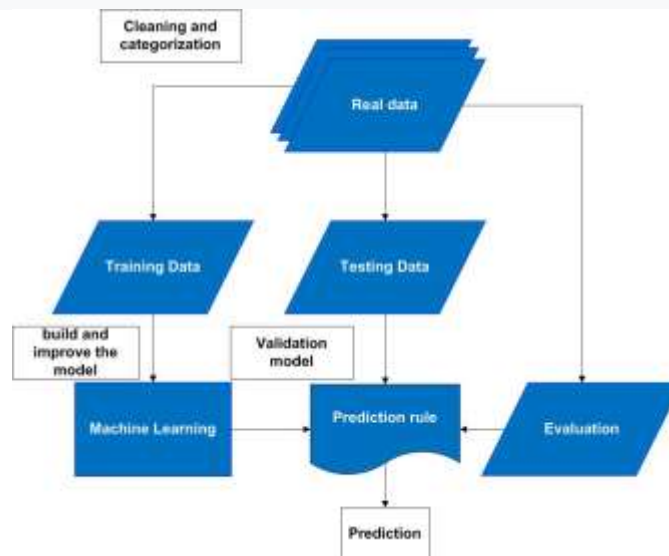
Pregnancies complicated by preeclampsia (PE), antepartum bleeding and hyperemesis are associated with an increased risk of maternal mortality [2]. Efforts to reduce maternal mortality should be focused on the direct causes of maternal mortality, including bleeding (28%), preeclampsia/ eclampsia (24%), etc. 11%. These complications are factors that can increase maternal emergency risk resulting in maternal death [3]. Common risk factors are gestational age, gravida, parity, abortion, complaints, blood pressure, pulse, temperature, presentation, height of fundus uterus, fetal heart rate, hemoglobin and proteinurine [4].

About 15% to 20% of all pregnant women experience high risk conditions and experience complications that can endanger the lives of both the mother and her fetus if not handled optimally. Pregnancy complications can be prevented by improving the quality of health workers. Health workers must have the ability to identify and provide intervention before or during pregnancy so that they can provide a correct diagnosis. This will minimize the risk of maternal death and morbidity [5]. Clinical records has an important role to monitor the condition of pregnancy. Good quality recording will make it easier for health workers to identify the conditions of pregnancy complications.

One of the things that can support improvement in documentation is computerized recording and reporting so that data is easily accessible and easy to use. Recording and reporting can be optimal if health service management is carried out appropriately in accordance with applicable standards. Service quality can be improved through innovation with a machine learning approach to assist health workers in predicting pregnancy complications [6] [7].

II. METHODS

The methods of application prototypes for pregnancy complications prediction is done by developing machine learning, naïve bayes algorithms approaching mysql database, php-ml library, php, html, and css programming languages and xampp (apache) as web server. This prototype was developed with the aim of users being health workers who are responsible for the maternal health services section at Mitra Bangsa Hospital. Patient data is 342 data, divided into training data (270) and testing data (72) randomly selected (training data: testing data = 80%: 20%). The steps taken in preprocessing are editing, coding and tabulating.



Picture 1. Prediction by *Machine Learning*
[8]

Testing data using naïve bayes algorithm. Naive bayes is a probabilistic classification and is mainly used when training set sizes are lacking. Naive bayes algorithm gets knowledge from the training process, then the probability is determined by how often the occurrence of the event occurs. The bayes theorem formula is as follows:

$$P(A|B) = \frac{P(A)P(B|A)}{P(B)}$$

The library PHP-ML is as follows:

```

samples . [[35,4,2,1,7,160,100,90,36.7,2,1,155,1,2], [29,1 0,0,2,120,80,89,36.2,3,2,140,2,2]];
$labels . ['Preeklampsia', 'Perdarahan Antepartum'];

$classifier . new NaiveBayes();
$classifier->train($samples, $labels);
$classifier->predict([27,1,0,0,10,180,110,90,36.8,2,1,140,1,2]);
// return 'Perdarahan Antepartum'
'Perdarahan Antepartum'
$classifier->predict([[36.5,2 0,1,14,170,110,106,36,2,1,145,3,3],
[34.4,2,1,0,1,120,80,89,36.2,3,2,140 1,2]]);
// return ['Preeklampsia', 'Perdarahan Antepartum']
    
```

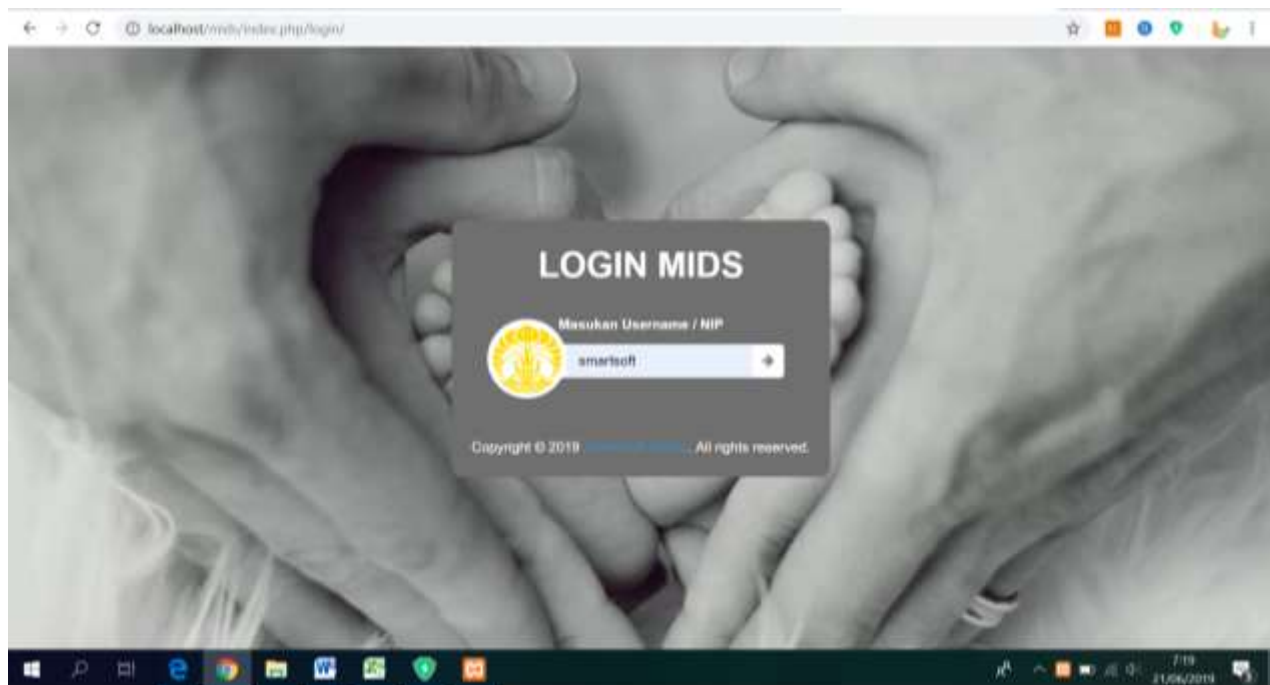
Accuracy calculations using the 72 fold cross validation formula.

$$\begin{aligned} \text{Accuracy} &= \frac{TP+FN}{TP+TN+FP+FN} \times 100\% \\ &= \frac{63}{72} \times 100\% \\ &= 87.5\% \end{aligned}$$

III. RESULTS

Data is used that are not found in the training process. When testing data is entered into the system, the process that will be passed is the determination of features, extracting features and classifying them according to the model that has been made. The system will provide predictive output of maternal complications. In testing Naive Bayes this Classifier uses the PHP ML library. The purpose of this test is to be able to automatically predict maternal complications. In the Naive Bayes Classifier method, the data classification process is based on previously stored training data. The test results showed that the accuracy of predictions of maternal complications in the ANC group showed an accuracy of 0.875 or 87.5%.

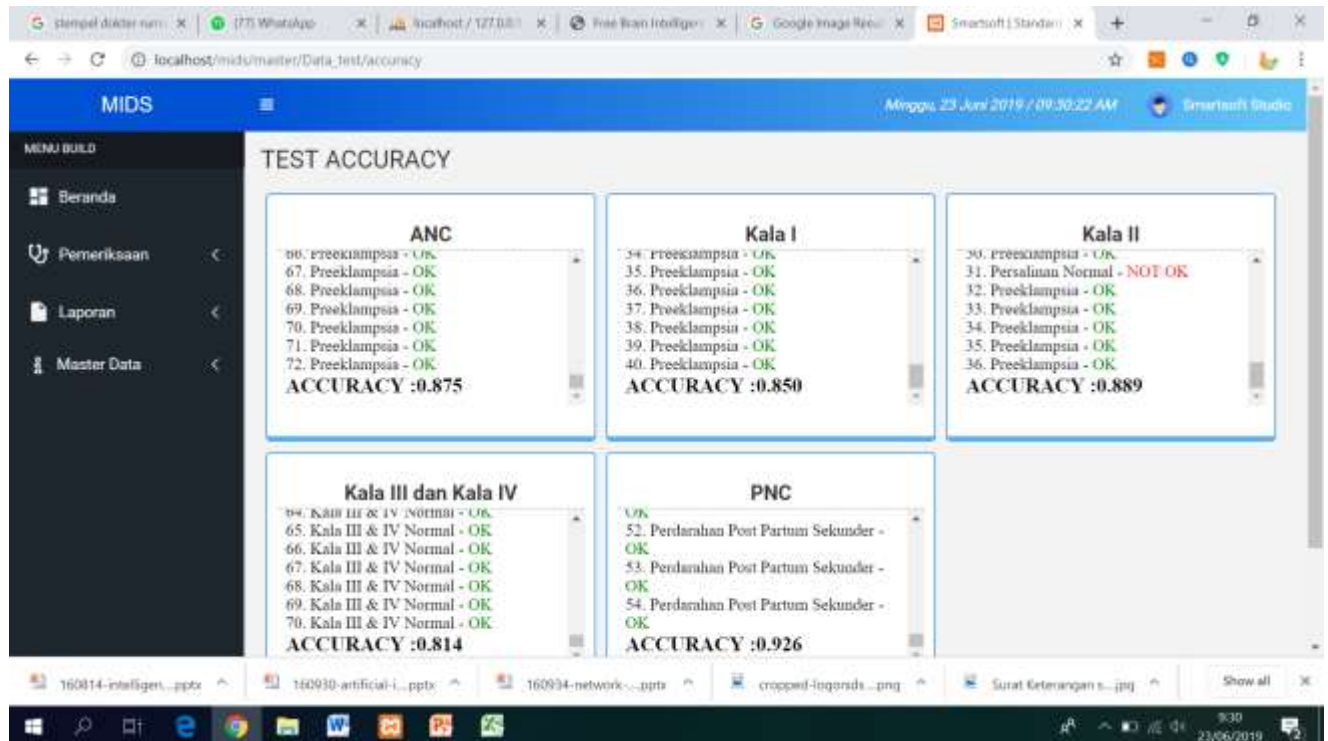
The following is the application interface:



Picture 2. Login

The screenshot shows a web application interface for 'MIDS'. The top navigation bar includes a menu icon, the title 'MIDS', and the date 'Jumat, 21 Jun 2019 / 07:23:04 AM'. The left sidebar contains a 'MENU BUILD' section with links to 'Beranda', 'Pemeriksaan', 'Laporan', and 'Master Data'. The main content area is titled 'Pemeriksaan Baru (ANC)'. It features a 'Pasien' section with a '+ Add New' button and a 'choose pasien' dropdown. Below this are input fields for 'Nama', 'Tanggal Lahir', and 'Alamat'. To the right, there is a table titled 'ITEM PEMERIKSAAN' with rows for 'LUK', 'Gravida', 'Paritas', 'Abortus', 'Kehamilan', 'TD sistolik', 'TD diastolik', 'Nadi(x/mnt)', 'Suhu', and 'Presentasi', each with an adjacent input field.

Picture 3. New assessment



Picture 4. Accuracy

The screenshot shows a web browser displaying the MIDS application. The URL is localhost/mids/index.php/master/Result_pemeriksaan/detailpemeriksaan/6. The page has a blue header with 'MIDS' and a date/time stamp 'Jumat, 21 Juni 2019 / 11:58 15 AM'. A sidebar on the left contains a 'MENU BUILD' with links to 'Beranda', 'Pemeriksaan', 'Laporan', and 'Master Data'. The main content area is divided into two columns. The left column contains patient information: 'NAMA PASIEN', 'TANGGAL LAHIR: 0000-00-00', 'ALAMAT PASIEN', and 'TANGGAL PERIKSA: 2019-06-21 11:58:03'. The right column contains a list of clinical data points with their corresponding values: UK (34), Gravida (3), Paritas (2), Abortus (0), Keluhan (2), TD sistolik (190), TD diastolik (100), Nadi(s/mnt) (100), Suhu (36), Presentasi (2), TFU(cm) (1), DJJ(x/mnt) (144), Hb(gr/dL) (2), and Proteinuri (3). At the bottom of the right column, there is a green box with the text 'Berdasarkan hasil pemeriksaan hasil pasien menunjukkan gejala: Pre-eclampsia'.

Picture 5. Prediction

IV. DISCUSSION

Manual record is an additional burden for officers in performing services with the many forms that must be filled out by midwives. With manual recording methods can result in duplication of visits to maternal health services or not even recorded at all. In addition, in the manual recording process, it is quite difficult to analyze mothers with risk factors because the analysis is done by relying on the memory of the midwife who has been screened and what maternal complications might occur in the patient.

Register books and medical records as a basis for predictions left in the health service place are not filled in completely. Filling out clinical data forms in a health service will help improve the availability of reliable data for making decisions, planning and appropriate interventions.

The prediction application for maternal complications that will be developed is the development of the existing system. However, the existing system will be made more concise and sequential after conducting midwifery services. Midwives and obstetricians who will conduct screening also do not require special qualifications because identification of maternal complications is automatically carried out by the system every time the patient performs an examination.

In addition, the application system will be created using a website approach where users of access rights can open this system on any media, whether laptop, tablet or PC. The time that midwives use to record electronically and predict maternal complications manually takes approximately 5 to 10 minutes, and the time needed by midwives to predict maternal complications by using the application will take between 1 to 3 seconds. This system will also cut the time needed in the process of recording and reporting to the Director of RSMB Pati.

The prediction process uses programming languages php, html and css with libraries for data preprocessing, Naïve Bayes Classifier algorithms with PHP-ML libraries, to performance accuracy. The inputted data will automatically be entered into the MySQL database, and can later be called back if the mother will make a repeat visit. This application is named MIDS, namely Midwifery Innovation Decision Support. This web-based information system was chosen because it has several advantages, namely the ease in developing the system and the application does not need to be installed into the hardware but simply by accessing the address of the application online using the browser engine (Internet Explorer, Mozilla, Chrome, etc.) so that easy to update. In addition, web-based applications are not only accessible through PCs or laptops, web applications tend to be more flexible so that they can be accessed through a variety of devices and various operating systems, such as tablets with devices based on Windows, Linux, iOS, Mac OS, Blackberry, Android , or other.

Accuracy results obtained in testing prediction models using 72-fold cross validation obtained an average accuracy of 0.875 from training data of 270 data and 72 data testing data with a comparison of training data: data testing = 80%; 20%. This accuracy is included in the high accuracy class for predicting maternal complications.

This prediction application for maternal complications has advantages and disadvantages as shown in the following table:

Table 1: Advantages and Disadvantages of Applications

Advantages	Disadvantages
<ol style="list-style-type: none"> 1. The recording system is done through the web that can be accessed in the media (PC, or laptop) that is owned by the Pati Bangsa Pati Hospital, the data can be input anytime and anywhere provided that it is connected to the internet network. 2. Data will be stored on a secure server 3. Information in the form of results of examination of mothers in the form of health status of pregnant women, maternity, and postpartum as well as related reports. Reports will be immediately presented in the system. The resulting report can be changed to excel and can be downloaded. 4. The form is adopted from the hospital medical record and is made easier. Midwives can immediately see the results of predictions and see reports after completing input without the need to process data. 5. Information produced is in line with the data inputted into the system. Report according to information needs. 6. Information can be obtained directly after inputting the results of the inspection. Automatic reports are made on the report menu. Inspection reports can be printed directly. 7. Users can add complications data that will be predicted by export excel into the application, so that the application allows to produce pregnancy complications according to the patient's condition and the decision of the midwife / obstetrician 8. The application can predict each patient to do an examination. 	<ol style="list-style-type: none"> 1. This application system depends on whether or not the internet network connection is good. 2. The system has not been able to analyze all pregnancy complications due to data limitations.

V. CONCLUSION

There are several conclusions in this study.

- a. The Naïve Bayes Classifier method can be applied to predict maternal complications.
- b. The application for predicting maternal complications developed is considered sufficient. The results of the classification accuracy test performed by the application using k-fold cross validation obtained good results with an average accuracy of 0.875 or 87.5%.
- c. The information system design in the resulting application is able to predict each examination.
- d. The application prototype can collect data into the mother's database with risk factors and perform data processing directly so that it makes it easier for midwives to record and provide quality reports.
- e. The prototype application for predicting maternal complications can predict bleeding, preeclampsia and hyperemesis.
- f. The application prototype can predict within 1 to 3 seconds.

VI. RECOMMENDATION

For the next research can be done by increasing the training data. The more training data used it will increase the accuracy and accuracy of the system in recognizing testing data and periodic evaluation needs to be done to improve machine learning capabilities in predicting pregnancy complications.

ACKNOWLEDGMENT

We are grateful to Ministry of Health of Indonesia for study funding. Thank you very much to Budi Utomo for his support and assistance acknowledgments.

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