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Decision Support System To Monitoring Maternity Process Using Support Vector Machine Method

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ABSTRACT :*Maternity is process of removing conception results (fetus, placenta and amniotic fluid) from uterus to outside world through the birth canal or other path with the help or by the mother's own strength. During maternity phase, all care, observation and examination should be recorded by midwives who help maternity process. The current method used by midwife in monitoring maternity process is partograph manually. Monitoring process is done by writing data of examination results into tables on the partograph. Then, to find out data of pregnant women normal examination or not, done by looking at standard data in partograph..Midwives also have difficulty in determining birth status of normal pregnant women or not. The research was conducted aimed at developing application of Decisian Support System to monitoring maternity processusing Suppor Vector Machine Method.This research consists of 2 (two) main points. The first is development of applications for data management of maternity medical records. Second is development of applications to monitor maternity process use Support Vector Machine (SVM).The results of this study are expected to provide a tool for midwives in monitoring progress of maternity process automatically, so that if an emergency occurs in childbirthprocess it can be overcome.*

KEYWORDS:*Midwives, Maternity, Partograph, SVM.*

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I. INTRODUCTION

In 2010 it was known that around 287,000 mothers were estimated to die worldwide, in fact there were 2.9 million infant deaths in 2011 in the first four weeks after birth, and most of them occurred in developing countries. One effort to reduce maternal mortality and improve maternal and child health is coverage of childbirth assistance by midwives or health workers. Research from Blank has shown that even trained health workers often do not perform their duties to the fullest in accordance with their abilities. Health workers (midwives) do not apply their abilities in providing health services, especially in maternal care, observing signs of emergencies and taking appropriate and prompt actions in anticipating situation [1]. One of the midwives' competencies is to provide high quality care, be responsive to local culture during childbirth, lead clean, and safe deliveries, handle certain emergency situations to optimize the health of women and newborns, one of them is by monitoring the progress of normal labor using partographs[2]**.**

Partograf is a tool designed to provide a continuous picture of the workforce and has been shown to improve results when used to monitor and manage maternity by health workers [3, 4]. Partograf can be used to monitor the progress of childbirth at the time of delivery and information to make clinical decisions. Filling in accordance with the contents of partograph sheet. With partographs, health workers can ensure that mothers and fetuses receive safe, adequate and timely care and help prevent complications that can threaten the safety of the mother and fetus [5].

According to Moxey [6], some deficiencies in the application of electronic partograph programs include partograph not detecting all complex health problems so that health workers may not follow the instructions provided by the system, it can cause health workers to fake data in documenting, because not all interventions notified through the system carried out by health workers. Another factor is in terms of costs that are high enough to implement electronic partographs because in addition to providing computers or laptops and systems that have been adapted to WHO guidelines, before implementing electronic partographs health workers who will be assigned to use electronic partograph programs must receive special training on the program. Another important factor is the absence of written documentation of antenatal examinations held by patients during visits, while written evidence is an important document for pregnant women.

Current method used by midwives in monitoring the examination results of mothers who are going to deliver labor is to use partograph manually, by writing the examination data into the tables in partograph. Furthermore, to find out whether the checkup data for normal pregnant women or not is done by looking at

standard data in partograph. Because midwives are very difficult in filling partographs. Midwives also have difficulty monitoring the progress of childbirth and difficulties in making decisions. Another problem is that midwives have difficulty in documenting medical records of pregnant women. If the partograph sheet is missing data from the progress of childbirth progress cannot be traced.

The research aims to develop software to monitor the progress of childbirth as a tool for midwives to make decisions in the event of maternitycomplicating factors. The software developed includes recording medical records of pregnant women, detecting maternal health status automatically, and charting the development of maternitycheckup data including graphs of baby's heartbeat, cervical opening, uterine contractions, blood pressure, temperature and urine. This research includes 2 (two) main things. First is development of software for management of medical records for pregnant women. Second is development of software to monitor development of maternity automatically. Results of this study are expected to provide a tool for midwives and health workers to monitor the progress of childbirth, as well as facilitate decision making in the event of an emergency during childbirth.

II. MATERIAL

Data used in this study can be divided into two. First is data used as training data.Training data is data that will be used in classification process. Data is taken from checkup result of mothers who will carry out childbirth which includes data on heart rate, blood pressure, pulse, uterine contraction, cervical opening, urine volume. Second is the data used in the testing process. These data are data of pregnant checkup that will carry out connection from the maternity home. Data collection was carried out at the SukoAsih Maternity Home, Sukoharjo, Middle of Java, Indonesia. Data taken included data on maternal medical records and maternal examination data which included: heart rate, blood pressure, pulse, uterine, contraction, cervical opening, urine volume.

III. METHOD

Software to monitor childbirth progress can detect maternity status using an intelligent system. Method used is detection of abnormal status based on baby's heartbeat, cervical opening, uterine contractions, blood pressure, temperature and urine using Support Vector Machine which is rarely done by other researchers, so that each mother's examination can immediately find out her health status, so that midwives can make decisions quickly if things that are not desirable. In addition, software developed is a continuous management of maternal medical record data, so that data when mother begins to feel symptoms of delivery until mother gives birth can be well documented. Another contribution is the graphic display to make it easier for midwives to monitor the progress of childbirth progress which includes charts of cervical opening, uterine contractions, pulse, blood pressure, temperature and urine automatically.

Steps in the software development process to monitor maternity progress can be explained as follows:

a. Development of databases for management of continuous medical records for pregnant women, so that the medical record data of mothers began to be treated until the mother finished childbirth was well documented, including the status of maternal health development.
b. Development of methods for detecting the health status of pregnant women using intelligent systems. The method used is detection of maternal health based on blood pressure, pulse, uterinecontraction using Support Vector Machine. The steps of maternal health status detection can be explained as follows:

1. Data acquisitionfrom a Maternity Home

Data collection was carried out in the Maternity Home. Data taken from chekupresult of mother before childbirth from a Maternity Home.

2. FeatureSelection

Feature selection is a process to get accurate information so that the identification process can be carried out[7, 8, 9]. The features used to detect maternal health status include: blood pressure, pulse, uterine and contraction. The selected features will be used for the classification process of maternal health status which includes: normal and abnormal pregnant women.

3. Detecting Maternity Status Using Support Vector Machine (SVM)

Maternity status detection of pregnant women is done by doing the classification process. One classification method is Support Vector Machine (SVM) [10, 11]. The result of this process is index value of largest decision function that states class of test data. If class resulting from the testing classification process is same as test data class, then detection is declared correct. The final result is a pregnant woman with normal and abnormal maternity, which corresponds to index value of decision function using the SVM method. In addition, it can also detect every inspection result.

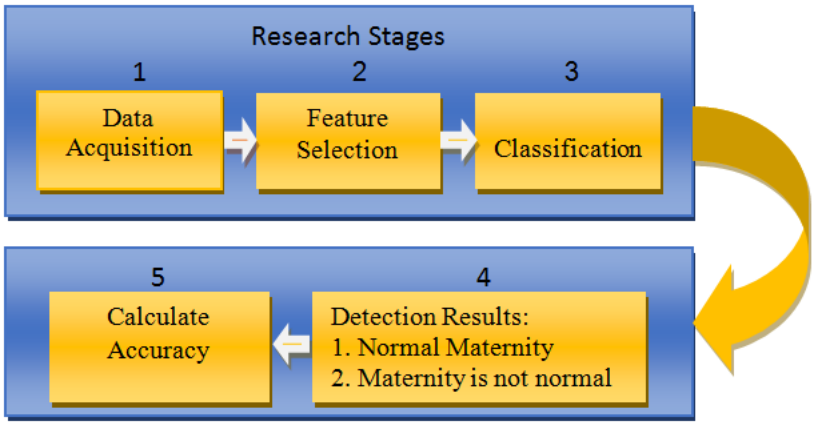

Figure 1. Stages of Methods for Detecting Maternity Status of Pregnant Women

4. Calculating Accuracy of Maternity Status Detection

The classification results will be compared with groundtruth (midwife) using the ROC method[12], so that four values will be obtained, each of which is true positive, false negative, false positive, and true negative. True positive (TP) indicates maternity statusthat is correctly identified according to its class. False positive (FP) is maternity statusof pregnant women who should be identified correctly in their class, in fact the identification process is incorrect. True negative (TN) is maternity status that is not identified as a member of the class, not a member of the class. False negative (FN) indicates maternity status that should not be a member of the class identified as a member of the class. Based on the four values, the true positive rate (TPR) is known as sensitivity. The sensitivity formula is as follows:

$$TPR = \frac{TP}{TP+FN} \quad (1)$$

The false positive rate (FPR) or specificity is a value that indicates the level of error in identification obtained based on the following equation

$$FPR = \frac{FP}{FP+TN} \quad (2)$$

While the value that shows the accuracy of the identification (accuracy) is obtained from the following equation:

$$Accuracy = \frac{TP+TN}{TP+FP+TN+FN} x100\% \quad (3)$$

IV. RESULT AND DISCUSSION

The software to monitormaternity status is designed aims to facilitate midwives in terms of recording medical records of pregnant women, monitoring progress of childbirth, and equipped with a graph of the monitoring of maternity data. The Main menu of developed application can be seen in Figure 2 below.

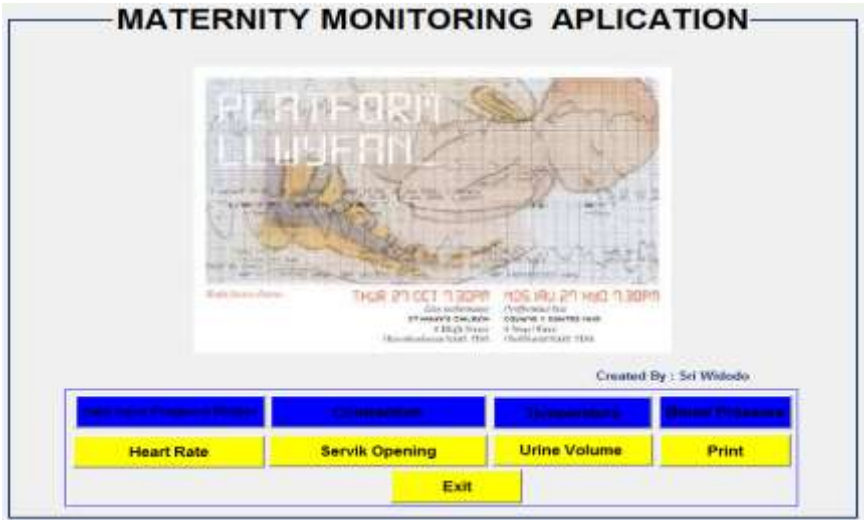

Figure 2. Main Menu

Management of maternity checkup data can be shown in Figure 3. Result of a decision taken automatically by the software to determine status of maternity can be shown in Figure 4. While the graph display to facilitate midwives in monitoring progress of maternity can be seen in Figures 5 and 6 .

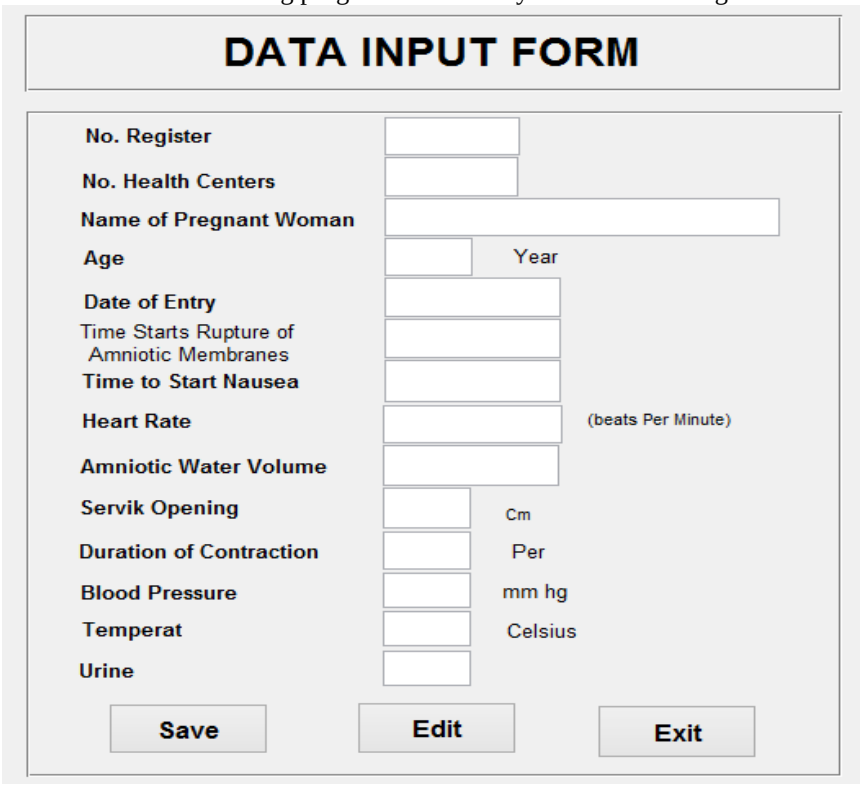

Figure 3. Forms of Pregnant Women Medical Record Data Input

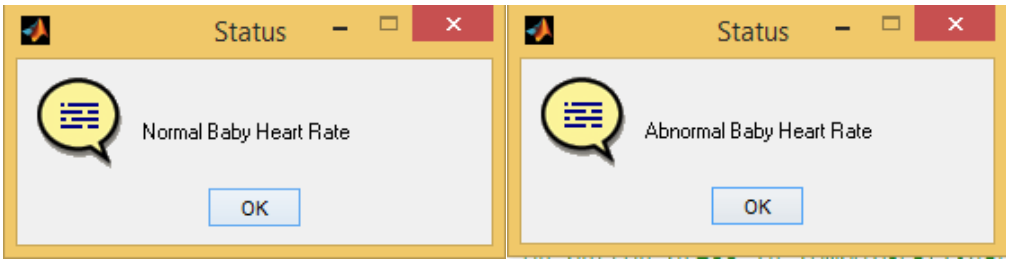

Figure 4. Display of Results of Determination of Childbirth Status

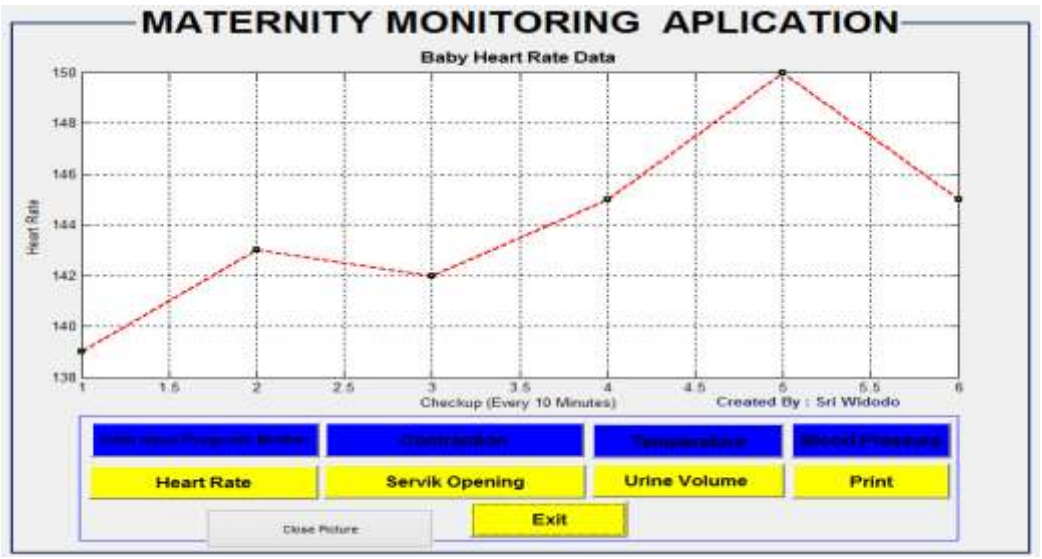

Figure 5. Heart Rate Graph

Table 1. Data Testing Results

No	Number of Test Data	Test Result					
		Test 1 (heart)	**Test 2** (contraction)	**Test 3** (cervical opening)	**Test 4** (urine volume)	**Test 5** (blood pressure)	**Test 6** (heart, contraction, cervical opening, urine volume, blood pressure)
1	15	92.4%	95.6%	94.1%	97.3%	97.4%	95.7%

The process of determining maternitystatus is performed per indicator and all indicators. These indicators include: heart rate, contraction, cervical opening, temperature, urine volume and blood pressure. The number of training data for each indicator is 40 data. The data consists of 0 to 20 data data for normal indicators, 21 to 40 are data for abnormal indicators. The trial was conducted using 15 data testing. The results of the trial software monitoring the progress of maternity showed that the average accuracy of hearindicator was 92.4%, contraction indicator was 95.6%, cervical opening indicator was94.1%, urine volume indicator was97.3%, blood pressure indicator was97.4% and all indicator was 95.7%. This shows that the method used can detect the development of maternity statusaccurately.

V. CONCLUSIONS

Based on results of testing that have been carried out, it can be concluded that maternity progress monitoring software developed with Support Vector Machine (SVM) method has been proven to be able to be used as a model to monitor progress of maternity intelligently. This is indicated by accuracy value of all indicator was 95.7%.

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