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Development of Application for Early Detection of Childbirth Normalities Based On Artificial Intelligence

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Abstract
Childbirth is the process of expelling the products of conception (fetus, placenta and amniotic fluid) from the uterus to the outside through the birth canal or other means with the help or strength of the mother herself. During the childbirth phase, all care, observations and examinations must be recorded by the midwife assisting the birth. The method currently used by midwives to monitor pregnant women who are about to give birth is to carry out examinations and record the results of the examination manually. By writing the examination results data into the tables in the partograph. Next, to find out if the examination data for pregnant women is normal or not, this is done by looking at the standard data on the partograph. Therefore, midwives have great difficulty filling partographs, midwives also have difficulty monitoring the progress of childbirth and have difficulty making decisions about the normality of childbirth. The aim of this research proposal is to develop an artificial intelligence-based application for early detection of childbirth normality. Development of software for early detection of childbirth normality based on artificial intelligence using the Backpropagation Neural Networks method. The system being developed is also equipped with a graphic display of examination data for pregnant women, which includes heart rate, blood pressure, temperature, cervical opening, urine volume and contractions. The test results of the system being developed obtained an accuracy value of 80%.

Keywords: *Midwife, Backpropagation, Childbirth, Partograph*

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I. INTRODUCTION

In 2020 it was estimated that around 287,000 mothers died worldwide, in fact there were 2.9 million infant deaths in 2020 in the first four weeks after birth, and most of them occurred in developing countries [1]. One effort to reduce maternal mortality and improve the health of mothers and children is to provide birth assistance by midwives or health workers. Blank's research shows that even well-trained health workers often do not carry out their duties to the best of their ability. Health workers (midwives) do not apply their abilities in providing health services, especially in caring for mothers, observing signs of emergencies and taking appropriate and quick action in anticipating situations that occur. One of the competencies of midwives is providing quality services, being responsive to local culture during childbirth, leading clean and safe births, handling certain emergency situations to optimize the health of the mother and her newborn, one of which is through monitoring the progress of normal childbirth using a partograph [2].

A partograph is a device designed to provide continuous images of childbirth and has been shown to improve outcomes when used for monitoring and management of childbirth by health workers. The partograph can be used to monitor the progress of the first stage of childbirth and provide information for making clinical decisions. Fill in according to the contents of the partograph sheet. With a partograph, health workers can ensure that the mother and fetus receive safe, adequate and timely care and help prevent complications that can threaten the lives of the mother and fetus [3].

The method used by midwives to monitor pregnant women who are about to give birth is by using a manual partograph. By writing the examination results data into the tables in the partograph. Next, to find out if the examination data for pregnant women is normal or not, this is done by looking at the standard data on the partograph. Because the midwife had great difficulty filling the partograph. Midwives also had difficulty monitoring the progress of childbirth and making decisions. Another problem is that midwives have difficulty documenting pregnant women's medical record data. If the partograph sheet is lost, data on the health development of the pregnant woman cannot be traced.

The research carried out was to develop an application for early detection of the normality of the birth process based on artificial intelligence. This research covers two main points. The first is the development of

software for early detection of birth normality based on artificial intelligence using the Backpropagation With Momentum method. The second is the development of software to monitor the condition of pregnant women in the form of graphical displays of data on the results of examinations of pregnant women, including graphs of heart rate, blood pressure, temperature, cervical opening, urine volume and contractions. It is hoped that the results of this research will provide tools for midwives to monitor and make decisions if abnormalities occur in the birth process automatically.

Several studies on detecting normality of childbirth that have been carried out can be explained as follows. The first is research from Blank. Detection is carried out using an electronic partograph from WHO, which can be used to monitor the childbirth process on a computer screen and provides a feature to view detailed recommendations. The way it is used is that the officer enters data on the progress of childbirth in the yellow area 4 hours after the active phase of childbirth has begun. When the 6 hours have crossed the action line, there will be a red confirmation explaining that the necessary action must be taken. There will be a similar decision support chart throughout the postpartum stage up to 24 hours postpartum. Even though electronic partographs are considered to have many benefits in implementing health services for the community, there are several things that become problems or obstacles in implementation in the field. There are four obstacles that become problems in implementation in the field, including organizational or government, for example, use of resources, access to computers, organizational or government support, secondly from the provider's perspective, for example, computer skills, knowledge and training, electronic partograph programs does not detect all complex medical problems, thirdly from the patient's perspective, for example, patient characteristics and interactions during consultations, and fourthly the specifications of the electronic partograph. These obstacles become problems in the use of electronic partograph systems in the field [4].

According to Moxey, several weaknesses in implementing the electronic partograph program include the partograph not detecting all complex health problems so that health workers may not follow the instructions given by the system, this can cause health workers to falsify data in carrying out documentation, because not all interventions are carried out. notified through the system by health workers. Another factor is that the costs are quite high for implementing an electronic partograph because apart from providing a computer or laptop and a system that has been adapted to WHO guidelines, before implementing an electronic partograph, health workers who will be tasked with using the electronic partograph program must receive special training regarding the program. Another important factor is that there is no written documentation regarding the antenatal examination held by the patient during the visit, while written evidence is an important document for pregnant women [5].

The next research is research from Irmayana [6]. The research carried out was to develop an expert system that is used to diagnose the beginning of childbirth for pregnant women, where users can diagnose for themselves the delivery that will take place based on the symptoms experienced. This initial diagnosis is only to help the patient for the next steps. An expert system for disease diagnosis is built by applying the certainty factor method. This system provides results in the form of the probability of childbirth that will be experienced and the percentage of confidence based on facts and confidence values given by users in answering and filling complaints when using this system. The implementation of this system is used to evaluate the knowledge acquisition process in building a knowledge base.

The research carried out by Hanif was to create an expert system for diagnosing pregnancy health problems using the Forward Chaining method. The method used in designing this application system uses the forward chaining method which is read from bottom to top, namely starting from the facts of the pregnancy period until a conclusion is reached regarding the disorders suffered by pregnant women. Supported by this application, it can increase information or knowledge for pregnant women. This application only aims to provide information and knowledge for the general public about diseases that often occur during pregnancy [7].

The latest research is research conducted by Rusdiana. The research carried out was a study of the implementation of the Adaptive Neuro Fuzzy Inference System (ANFIS) to determine the normality of pregnancy. The ANFIS method can be implemented to determine the normality of pregnancy by recognizing periods and complaints during pregnancy. To identify the determination of normality during pregnancy [8].

Research that has been carried out by previous researchers, to detect the normality of *Childbirth*, is still done manually. Research on developing intelligent systems for detecting the normality of childbirth is still rarely carried out, but there is research on detecting the normality of pregnant women. The expert system used to detect normality of pregnant women uses the Certainty Factor and Adaptive Neuro Fuzzy Inference System (ANFIS) methods. The weakness of the Certainty Factor method is that modeling the uncertainty of the calculation process using the certainty factor method is usually still debated, for more than 2 pieces of data, data processing must be carried out several times. Meanwhile, the weakness of the ANFIS method is that the accuracy obtained can decrease. This decrease was because the data used had a lot of error values and did not vary. Apart from that, the data used does not go through a preprocessing process first.

Our research is to develop an application for early detection of birth normality based on artificial intelligence. The method used is Backpropagation Artificial Neural Network (ANN) [10]. The backpropagation

algorithm was developed with the addition of momentum. Momentum in a neural network is a change in weight based on the gradient direction of the last pattern and the previous pattern. The addition of momentum parameters to the Artificial Neural Network [11] aims to speed up the learning process towards convergence. Experimental results have also shown that this method can make the network converge quickly and stably. This backpropagation With Momentum algorithm is the contribution and novelty of the proposed research. An intelligent system will be very necessary, especially in the classification process in determining normality childbirth.

II. MATERIALS

The data used in this research can be divided into two. The first is the data used as training data. This data is the data that will be used in the classification process. Second is the data used in the testing process. This data is taken from data from examinations of mothers who are about to give birth, which includes heart rate, blood pressure, temperature, cervical opening, urine volume and contractions. Data collection was carried out at the Suko Asih maternity home, Sukoharjo, Central Java, Indonesia.

III. METHODS

The steps in developing an intelligent application for early detection of birth normality for pregnant women based on Artificial Intelligence can be explained in Figure 1.

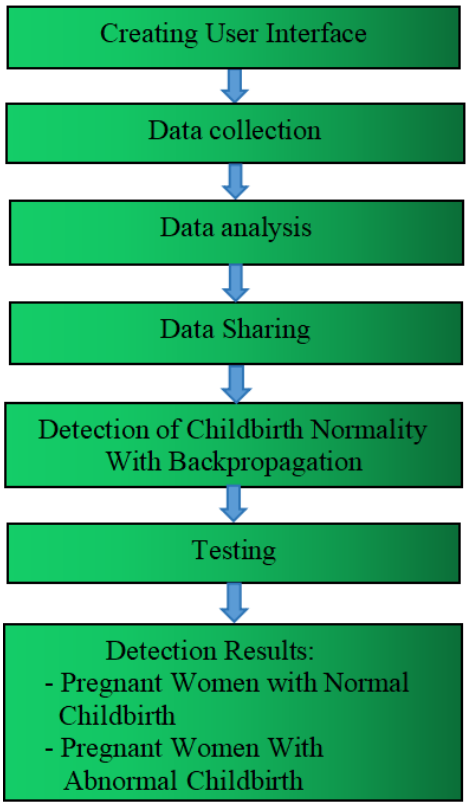

Figure 1. Research steps

3.1. Creating User Interface

Creating a user interface aims to make it easier for users to operate the software being developed.

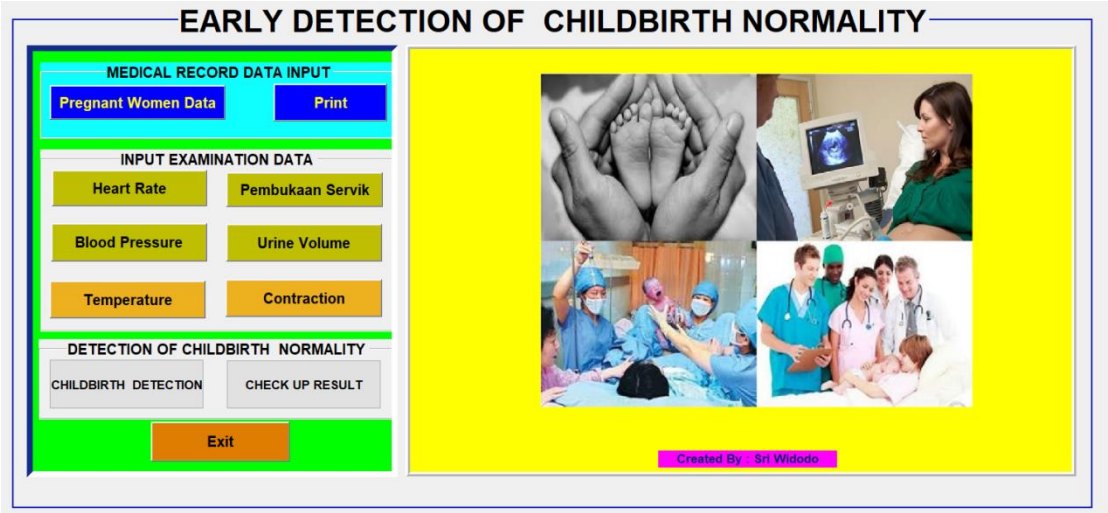

Figure 2. Main Menu

3.2. Data Collection

The stages in data collection are the stages for analyzing, designing and building artificial neural network systems. The data collected in this research is secondary data from the Maternity Home. The secondary data used in this research has been validated by doctors and midwives.

3.3. Analysis Stages

The analysis stage is the stage for analyzing the data needed for the training and testing stages in Backpropagation, as well as analyzing the needs for building applications, thereby simplifying the application design process. Data analysis carried out includes input data and data transformation. The input data is in the form of examination results of pregnant women who are about to give birth, which include: data on cervical opening, uterine contractions, pulse, blood pressure, temperature and urine, while data transformation is a stage to change the symptom data values into a scale of numbers 0 and 1 so that it can be used for calculations in the training and testing stages of Backpropagation.

3.4.Data Grouping

The data grouping stage is a stage for dividing data into training data and testing data. In the data grouping stage, the training data is 70%, 80%, 90% and test data is 30%, 20%, 10%.

3.5.Detection of Childbirth Normality Using Backpropagation

In the initial stage, the system training process is carried out using existing training data so that it can carry out training in accordance with Backpropagation training[12]. After the training process is carried out, the final weight will be obtained. This final weight will later be used to carry out testing. The process of Backpropagation can be explained as follows[13,14]:

a. Initializing the initial weight with a small random value can be done by selecting a value in the range between 0 and 1. Determine the maximum epoch and learning rate. In this manual calculation example, a maximum epoch of 100 and a learning rate of 0.01 will be used.
b. Enter the training data in the form of input variables (X_1 to X_n) and the target class.
c. The training stage consists of 3 stages, namely the forward propagation stage, backpropagation, and changes in weight and bias with the addition of momentum parameters. Carry out the calculation process at these three stages.
d. Carry out the training process for the maximum number of epochs that have been determined.
e. The final weight obtained from the training process will then be saved for use in the testing stage.

IV. RESULT AND DISCUSSION

Before using the application developed, the user must first carry out training on the training data used. The training menu is a display for carrying out the training process and a display for entering the values of the maximum epoch variables, target error, learning rate, number of hidden layer neurons and momentum. The training display design can be seen in Figure 3 below:

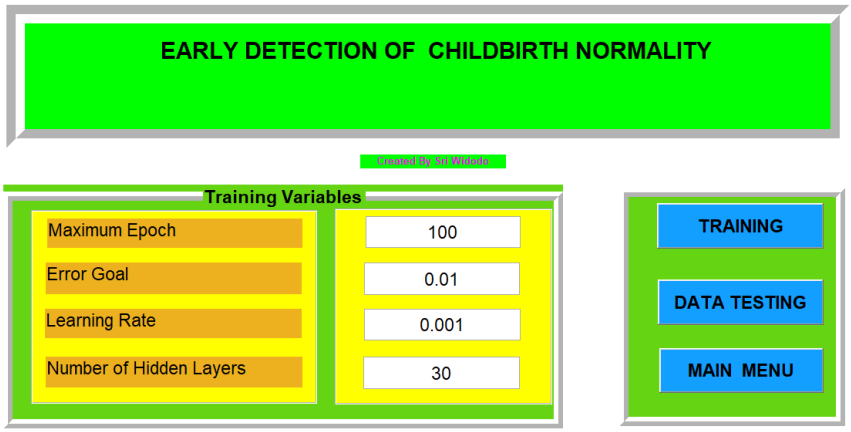

Figure 3: Training Menu

The test display is a display for carrying out the testing process and displays the test data table and test results table and there is a button for carrying out accuracy testing using the confusion matrix. The testing menu can be seen in Figure 4 below:

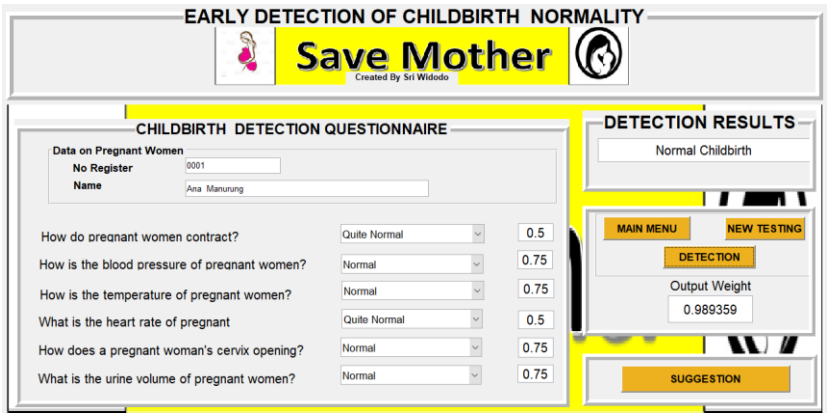

Figure 4: Childbirth detection menu

The application developed is also equipped with graphs to monitor the development of pregnant women, which include graphs of the development of cervical opening, uterine contractions, pulse, blood pressure, temperature and urine. One graphic display of the development of pregnant women is shown in Figure 5.

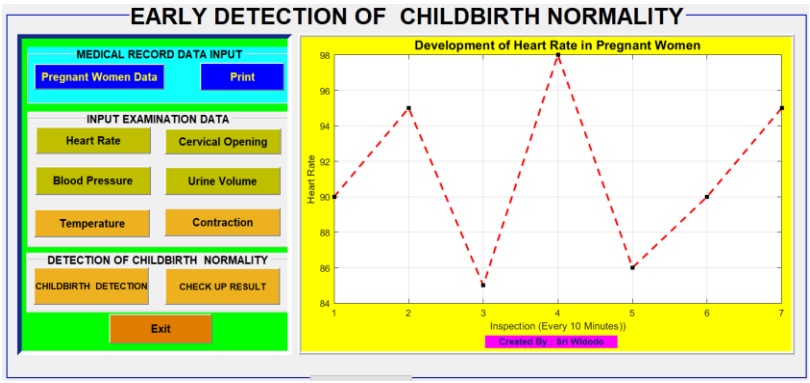

Figure 5. Graph of heart rate development

The parameter to measure the success rate of the model is the accuracy value. Accuracy values can be determined by carrying out tests using testing data. The test was carried out four times. The first to fourth tests used training data of 60:40, 70:30, 80:20 and 90:10 respectively, with a learning rate of 0.001, maximum epoch

100. Target error 0.01 and number of hidden layer neurons 8. The results of the tests carried out were obtained The highest accuracy is 80%, using 80:20 training data.

V. CONCLUSION

The conclusion from the research carried out is that the expert system using the Backpropagation with momentum method can work well with accuracy results of 80% or as many as 16 patients out of 20 patients who have been selected. This can be a means for midwives to see the patient's history of complaints, so that they can provide solutions and appropriate initial treatment to prevent maternal and infant deaths before the birth process. Apart from that, the graphic display of the examination of mothers who are about to give birth makes it easier for midwives to monitor the health development of mothers who are about to give birth, and can make decisions quickly if an emergency occurs in pregnant women.

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