Reduce risks during birth with machine learning

Childbirth can be associated with happiness and love, but also stress and uncertainty. Most infants live, but some suffer from long term injuries, or even pass away. This raises the question, what can be done further to make childbirth more safe and prevent long term injuries as well as deaths.

Mechanic stress is one risk during birth. It is applied to the fetus during uterine contraction. This stress affects the brain and/or the umbilical cord, and can lead to hypoxia which is lack of oxygen supply. Another risk is metabolic stress which is when the gas exchange is reduced due to weak circulation in the placenta during a contraction, i.e., less nutrients and oxygen is transferred to the fetus. A fetus has resilience to deal with stress applied during birth, however, if the resilience is comprised, or unusually high, the fetus can suffer from long term consequences such as brain injuries or even cause death.

Cardiotocography, CTG, is a biophysical monitoring method that is used during childbirth. It registers the fetal heart rate, FHR, and the uterine contractions. This method is used to find deviating patterns which can indicate that the fetus is exposed to hypoxia. A problem with CTG is that deviating patterns can occur even when there is no present danger, yielding unnecessary actions such as cesarean sections. Interpretation is difficult and requires much experience within the field.

A possible solution to this problem could be using artificial intelligence, AI. For that we needed to extract features from the CTG that could imply that the fetus was at risk, and alert clinicians to take action. The patterns were used as features in machine learning techniques, to see if AI could distinguish more information than the human eye. Machine learning models got to predict if the infant's Apgar Score would be good or bad. Apgar Score is the sum of the parameters: breathing, heart rate, skin colour, muscle tone, and response to stimulation. If the infant has any indication of low oxygen supply during birth the Apgar Score would be bad and there should have been patterns in the CTG to indicates this. These patterns could be used as features and possibly be an aid in interpretation of the CTG.

Based on the gestational age, length of pregnancy, the births were split into two cases. Case 1 consisted of all births before day 259 and case 2 of all births after day 258. Eight different features were extracted using the FHR signal. The gestational age was used as a feature to provide a benchmark to compare with when adding new features. The extracted features proved to be unsuccessful in adding new information that could imply that the fetus was at risk. It was concluded that using the gestational age as a feature did not provide any further information and furthermore there is a need for better features.

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