# Fetal Birth Weight Estimation during High risk Pregnancies using Machine learning

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## ABSTRACT

The newborn size is an important factor and indicator of infant survival and morbidity and consequently leads to diseases like cardiovascular disease, diabetes, and other disorders. Accurate fetal birth weight estimation is important for both fetuses and mothers. Both LBW (low birth weight, birth weight < 2500g) and HBW (high birth weight, birth weight > 4000g) fetuses and mothers are linked to various health complications like perinatal mortality and so on. The purpose of this study is to determine if we can predict birth weight accurately based on fetal and maternal characteristics routinely from time to time. Linear regression and Random Forest Regressor algorithms are used. The results show that the hybrid model (bagged tree) achieved excellent results concerning the accuracy, and area under the receiving characteristic curve, 0.849 and 0.636, respectively. Early diagnosis of problems related to fetal development ensures chances of an increase in gestation days by timely intervention. Doing so ensures improved fetal weight at birth and should lead to a decrease in neonatal morbidity and mortality rate.

**General Terms**
Morbidity, Mortality, Fetus, Birth weight.

**Keywords**
Machine learning, Support Vector Machine.

## 1. INTRODUCTION

The global existence of infant mortality has increased over the past 2 decades. Numerous investigations have shown that there is a strong association between maternal health and fetal well-being. Early identification of health problems and the utilization of timely intervention benefits monitoring both for the mother and fetus Intrauterine growth restriction (IUGR) is a disorder in which the fetus is smaller in stature as compared to others of the same gestational age. This condition limits the growth of the baby's body parts and the whole of the baby's body. Neonates with IUGR have problems at birth, such as low oxygen level, low Apgar score, and respiratory
difficulties due to meconium aspiration or hypoglycemia. Severe cases can cause long-term growth problems or even death of the neonate. Maternal hypertension is the primary cause of IUGR, there are different types of hypertension during the pregnancy-puerperal

cycle. In this sense, persistent arterial hypertension is, independently responsible for the most severe fetal growth.

## 2. LITERATURE REVIEW

Various papers describing to estimating the fetal weight and methods suggesting the implementation ways as illustrated and discussed here.

Novel fetal weight estimation model which combined SVM based classification with DBM to improve the performance of EFW in all fetal weight ranges by M. Feng, L. Wan, Z. Li, L. et al[1], they solved the imbalanced learning problem by utilizing SMOTE based data augmentation .it was demonstrated from the result that the proposed model outperformed the regression formulas. Their study revealed that DBM is a promising approach for fetal weight estimation, it also proved that classify fetuses into different groups and predict birth weight using different significant parameters are effective.

Use of artificial intelligence techniques ,compared serval ML techniques using a real database of pregnant women who suffered some hypertensive disorder during pregnancy by M. W. L. Moreira et al[2], they made use of artificial intelligence techniques with novel technologies which can reduce the high morbidity and mortality rates worldwide ,especially in developing countries.

Proposed EFSVR by J. Yu, Y. Wang and P. Chen et al[3], to estimate fetal weight estimation for LBW fetuses which dealt with serval problems .Due to the poor quality of ultrasound images and inter -or intra observer variances ultrasound measurement data for the model construction are usually inaccurate .To enhance the robustness of the weight estimation algorithm ,the FSVR is proposed to alleviate the effect of inaccurate data to the model.

Estimated fetal weight errors obtained by using 26 regression equations using SV approach by F. Sereno et al[4], They also estimated fetal weight to be used in clinical management needs adaptation to local conditions of measuring the critical biometric parameters. The generalization and combination of ensembles of neural nets in order to ensure that data variability inherent to the dynamics of the growing fetus phenomena.

Investigated the ability of application of the ANBLIR to predict the risk of low -fetal birth weight basing on the classification of quantitative description of fetal cardiotocographic signals by R. Czabanski, et al[5]. Along with evaluation of different learning methods of the ANBLIR, they examined the influence of the patients data distribution and also the role of the underrepresented abnormal class on the prediction quality. The experiments show that it is better to apply the scheme one single CTG trace assigned to one patient . The obtained results indicate also an increase of the risk of low-fetal birth weight prediction with a decrease of the fetal gestational age .

Proposed a simple and efficient mathematical model based on real data collected over 2years to estimate the delivery weight for low birth weight babies by M Abdollahian and N. Guarantee et al[6] . Only real recorded data were analyzed using multi linear4 regression model to access the impact of serval predicators . The p-value corresponding to individual characteristics are used to establish the most significant reduced model for the prediction .The analysis show that the regression based on only gestation age baby's height and head circumference can explain 60% of the variation in the newborn weight for LBW babies.

A. M. Phillips, proposed that Estimate of fetal weight by ultrasound within two weeks of delivery in the detection of fetal macrosomia et at[7]. They have discovered that fetal weight can be estimated through ultrasound while detection of fetal macrosomia.

Factors associated with macrosomia among neonates delivered at Debre Markos referral hospital, Northwest Ethiopia, proposed by T.Wondie, et al[8]. Genetic factors and maternal conditions such as obesity or diabeties can cause fetal macrosomia. With this, a baby might have a medical condition

that makes him or her grow faster or larger sometimes it's unknown what causes a baby becomes larger than the average.

Low birth weight and macrosomia in Tigray, Northern Ethiopia: who are the mothers at risk? by H. G. Mengesha et al[9], have described that a fetus larger than 4000grams or 4500 grams is considered as macrosomia. It is associated with increased risk of several complications particularly maternal and/or fetal trauma during birth neonatal hypoglycemia and respiratory problems.

Medical image segmentation based on FCM and level Set algorithm, in software Engineering and Service Science(ICSESS) by S. Qian and G. Weng et al[10]. The results showed the better accuracy in the segmentation and the proposed method had a lower iteration making the computation time less. Finally, the detection of an object shape was to measure and recognize the characteristics of an image.

## 3. METHODOLOGY

- A dataset of Fetal birth weight is taken.
- The dataset is loaded and preprocessed with various machine learning techniques.
- The preprocessed data is divided as training and testing data.
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- The prediction model is built using machine learning algorithms linear regression and random forest regressor.
- The model is trained using training dataset and once the model has been trained successfully it has to be tested .
- The trained model is testing using testing dataset and accuracy is calculated.
- The algorithm which gives the best accuracy is taken as our final prediction model.
- The finalized model is converted into pickle model (binary format data) and saved.
- A front end is developed with the help of flask and HTML.
- Now user will enter the different input parameters to predict fetal birth weight in the front end.
- The user entered parameters are collected at the back end.
- The collected data from user is given as input to our finalized algorithm to predict the fetal birth weight.
- Now classify them based on predicted birth weight as low birth weight if weight <2.5kg, Normal birth weight if ,2.5kg <weight <4.5kg and abnormal birth if weight >4.5kg.
- Finally the predicted birth weight and classified category both output is displayed on the front end.

## 4.SUMMARY ON LITERATURE SURVEY

Here some features, there extraction techniques and classifiers are discussed:

| Paper Title | Author | Technique | Year |
|---|---|---|---|
| To classify fetuses into different groups and predict birth weight using different significant parameters are effective. | M. Feng, Wan et al[1] | Proposed model outperformed the regression formulas. | 2019 |
| Performance assessment of Decision tree based predictive classifiers for risk pregnancy care. | M. W. L. Moreira Et al[2] | ML Techniques, Super vector Machines(SVM), KNN. | 2017 |
| Detection and measurement of fetal abdominal contour in ultrasound images via iterative randomized hough transform. | W. Wang, J. Qin Et al[3] | Hough transform | 2014 |
| The applications of radial basic functions and SVM. | Sereno F et al[4] | Super vector machines. | 2000 |
| Experiments shows which is better to apply the scheme . | R. Czabanski et al[5] | CTG Trace | 2017 |
| Estimate fetal weight by ultrasound within Two weeks. | A. M. Phillips et al[6] | Fetal macrosomia | 2014 |
| Factors associated with macrosomia among neonates at Debre Markos referral hospital. | T. Wondie et al[7] | Detection of fetal macrosomia. | 2014 |
| Low birth weight & Macrosomia. | H. G. Mengesha et al[8] | BMC Pediatrics | 2017 |
| Medical image segmentation. | S. Qian Weng etal[9] | FCM and level set algorithm | 2016 |

## 5. CONCLUSION

Current standards for ultrasound assessment of fetal growth can lead to misclassification of up to 15% of fetuses, considering them SGA(small for gestational age). Growth limitation represents a sign of severe health problem, often resulting from the fetus not receiving enough nutrients or oxygen in the uterus. The understanding of many aspects of fetal growth and pathophysiology of its restriction is still weak. As clinical proposals, several models of ultrasound techniques have been developed. However, an accurate method for the disease diagnosis has not yet been found. It is known that the more initial the growth restriction, the greater the severity. ML techniques represent an essential tool to assist specialists in the early identification of this disturbance.

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