

Exploring Machine Learning Algorithms to Find the Best Features for Predicting Modes of Childbirth

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ABSTRACT

A woman's satisfaction with childbirth may have immediate and long-term effects on her health as well as on the relationship with her newborn child. The mode of baby delivery is genuinely vital to a delivery patient and her infant child. It might be a crucial factor for ensuring the safety of both the mother and the child. During the baby delivery, decision-making within a short time becomes very challenging for the physician. Besides, humans may make wrong decisions selecting the appropriate delivery mode of childbirth. A wrong decision increases the mother's life risk and can also be harmful to the newborn baby's health. Computer-aided decision-making can be an excellent solution to this problem. Considering this scope, we have built a supervised machine learning-based decision-making model to predict the most suitable childbirth mode that will reduce this risk. This work has applied 32 supervised classifier algorithms and 11 training methods on the real childbirth dataset from the Tarail Upazilla Health complex, Kishorganj, Bangladesh. We have also analyzed the result and compared them using various statistical parameters to determine the best-performed model. The quadratic discriminant analysis has shown the highest accuracy of 0.979992 with the F1 score of 0.979962. Using this model to decide the appropriate labor mode may significantly reduce maternal and infant health risks.

Keywords: -Childbirth; labour mode; supervised machine learning; maternal death; infant

I. INTRODUCTION

In baby delivery, we want to make sure that the mother and the child are safe. For this safety, the method of baby delivery is very significant. Usually, the corresponding physician chooses the mode of delivery from two options, includes (i) vaginal birth or (ii) Cesarean area (c-section) birth. So, the patient herself cannot contribute to the decision-making procedure. When a child contains a low-risk pregnancy and is in the head-down position, and the patient is at least 37 weeks pregnant, gynecologists suggest attempting a vaginal birth. In this case, a newborn baby usually gets essential gut bacteria from the mother. Besides, it can help press liquid out of a baby's lungs, decreasing the risk of the baby's breathing problem. This way of birthing also helps for breastfeeding and reduces the baby's risk of asthma and obesity. Additionally, parents will be able to avoid the cost and potential risk of surgery. That is why normal birth is most suitable for both the baby's and the mother's health. On the other hand, there are cases like twins, or the mother has diabetes, high blood weight, HIV, or active herpes, or the baby is not in a head-down position, which compiles the patient to have a c-section delivery. However, it

increases the risk of asthma from the early childhood of the baby. In other instances, including delivering a comparatively larger baby for the maternal pelvis, or if the baby is not in a head-down position, the c-section delivery becomes an essential mode of childbirth. However, many times, physicians are more biased for a csection delivery than a vaginal delivery. The number count of c-sections is increasing day by day, and it got doubled during 1980. Another record says, as of 2015, the cesarean section rate is exceeding by 35.5% than WHO's recommendation [1]. Lately, during the period 2017-2018, the c-section rate in Bangladesh has increased by 51%, and in 2018, 77% of those c-sections were unnecessary [2]. Save the Children, a popular magazine, has recently documented a 51% increment in extraneous c-section delivery in Bangladesh [3]. In addition to that, maternal mortality is also shown and has been a big problem for most South Asian countries. Compared to the developed countries, the maternal mortality rate in Bangladesh is extremely high. In 2017, the maternal mortality rate in the USA was 0.000017 percent [4]. In the same year, this rate was 0.000113 percent in Bangladesh, which is a few times more than in other developed countries. WHO

has reported maternal mortality of 194 per 1000 in Bangladesh. This high maternal death rate can be significantly reduced by selecting the birth mode appropriately. "National Low Birth Weight Survey Bangladesh, 2015" has reported that Maternal mortality and cesarean delivery rates have doubled compared to regular deliveries [5]. It gives us the scope to develop a decision making model to choose the appropriate mode of childbirth.

Both of the processes of childbirth have advantages and disadvantages based on the particular patient's situation. However, the gynecologist decides the birth mode considering the mother's biological factors, including counting, age, ANC, para, partograph, AMTSL, blood circulation, birth weight, BP, PNC-1 presentation, cervix(OS), membrane, and so on. This research proposed a scientific method to decide childbirth mode considering the mother's present situation and earlier records.

The following points denote the main contributions of this research paper:

- We have proposed a computerized method of decisionmaking for selecting the appropriate mode of childbirth.
- Since this process is computerized and machine learning-based, it will be less error-prone.
- We have used 32 different classifier algorithms to make the decision more accurate and reliable.
- This model can analyze and use such big data for decision-making that it is merely impossible for a human being to analyze.

II. LITERATURE SURVEY

A lot of research is being done in the machine learning domain for biomedical decision-making. Mboya IB et al. have proposed a machine learning-based method that can predict perinatal death using supervised machine learning algorithms [6]. ML-based model is also being used for predicting a lot of factors of childbirth. For example, Abraham, Abin, et al. described a new technique for gathering various information from EHRs in order to predict singleton preterm birth by applying various machine learning models [7]. Recently, Islam, Muhammad Nazrul, et al. has presented research regarding childbirth mode

with two-fold findings: first, the potential highlights for deciding the method of labor, and second, machine learning algorithms for anticipating the suitable way of labor (vaginal birth, crisis cesarean, cesarean birth) [8]. Kowsher, M. et al. has reported good accuracy in applying machine learning-based recommendation system to predict the most appropriate childbirth mode [9].

Khan, Nafiz Imtiaz, et al. have a similar test to anticipate whether the cesarean area is essential with the assistance of information mining and subsequently expand the mother and infant's security during and after labor by staying away from a pointless cesarean segment [10]. Besides, Fu, Yuanqing, et al. had described a model to recognize early life hazard factors for youth overweight/stoutness among preterm babies and decided to take care of practices that could alter the distinguished danger factors [11]. Other researchers also have applied machine learning models to classify various biomedical factors and hence to conclude the adverse effect of c-section delivery. For instance, Siddiqui, Mohammad Khubeb, et al. described that machine learning classifiers could use EEG information and identify seizures alongside uncovering applicable reasonable examples without trading off execution [12]. In addition, Soh, Yan Xi, et al. had explained the relationships among sociodemographic and medicine factors, the concern of parturition, psychosocial wellbeing, and childbirth self-efficacy employing a structural equation modeling approach [3]. csection delivery may have a postbirth adverse health effect on a mother. Chen, Yanfang, et al. showed the relationship between conveyance and post-traumatic stress problems that yielded conflicting outcomes. This examination is expected to research the relationship between conveyance and post-traumatic stress in an associate of Chinese ladies with a high pace of cesarean conveyance [14].

Zhang, Yiye, et al. propose a machine learning structure for PPD hazard expectation utilizing information extricated from electronic wellbeing records (EHRs) [15]. Later on, Lipschuetz, Michal, et al. presented to decide the customized forecast of vaginal birth after cesarean conveyance utilizing 30 an AI calculation that might help patient-doctor dynamic and 31 increment paces of preliminaries of work [16]. Also, Serçekuş, Pınar, Okan Vardar, and

Sevgi Özkan proposed to recognize and think about the dread of labor and related to variables among pregnant ladies and their accomplices [17]. Onchonga, David et al. described a new investigating ladies' experience from maternity specialists drove incorporated pre-birth preparing and its effect on the dread of labor [18]. After that, Liu, Ligue, et al. proposed an expectation model of undeveloped improvement by using machine learning algorithms dependent on authentic case information. In this way, specialists can make more exact ideas on the quantity of patient subsequent meet-ups and give choice help to moderately unpracticed specialists in clinical practice [19]. On the other hand, Lindblad Wollmann, Charlotte, et al. described the predicting vaginal birth in ladies with one earlier cesarean and no vaginal conveyances utilizing machine learning strategies [20]. Unlike their works, we showed and analyzed various methodology of supervised classifiers based on a real dataset of childbirth to figure out the best model to predict the suitable mode of delivery.

III. PROPOSED SYSTEM

Usually, the choice of the mode of delivery is that of the medical professional in charge. A maternal

IV. ADVANTAGES OF PROPOSED SYSTEM

- To explore and prioritize the features that are most essential for predicting modes of childbirth
- To explore machine learning techniques and develop several frameworks, based on different machine learning algorithms, for predicting modes of delivery with reasonable accuracy using a minimum number of features.

healthcare application to assist doctors in predicting a mode of delivery that is compatible with the characteristics of the mother would be helpful in reducing childbirth complications. Few studies have considered the prediction of pregnancy outcomes and modes of delivery, and even fewer clinical decision-support systems have been developed in accordance with such research; for example, Pereira and colleagues conducted a study to design data mining classification models to predict types of delivery using obstetric risk factors in real time.

Usman and coworkers conducted a study based on ultrasound technology and developed an Android application called "Intrapartum," which allows medical professionals to estimate the likelihood of a normal delivery. Other studies are reviewed in this system. Further research and investigation are required to explore

The features that are crucial for predicting modes of delivery and to identify supporting features that can increase the accuracy of such predictions. Similarly, studies should determine which algorithms or techniques can provide greater accuracy for considering a specific group of features, since analyzing all the features of a pregnancy is rarely feasible or possible during childbirth.

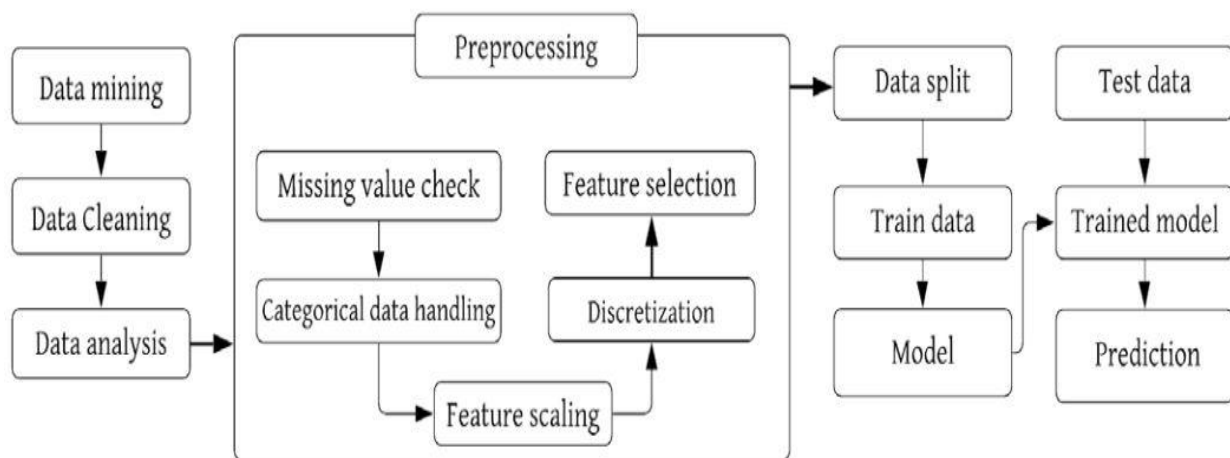


Fig1 Architecture

RESULTS



Fig 2. User Login

The screenshot shows an Excel spreadsheet with the following data:

	A	B	C	D	E	F	G	H
1	David	5	2020	1st Mond	2'0"	Boy Born with Left biggerfoot and Right dominant hand and born with emergency birth		
2	Lars	10	2021	3rd Tuesd	2'1"	Boy Born with vaginal birth and Left dominant hand		
3	Zach	12	2019	2nd Satur	2'0"	Boy Born with cesarean birth and Right dominant hand		
4	Josh	1	2018	1st Tuesd	2'1"	Boy Born with vacuum extraction and his father told that Introducing our bouncing baby boy		
5	Lang	2	2020	1st Mond	2'1"	Boy Born with vaginal birth and Left biggerfoot and mother told that Our little man has arrived		
6	Scotty	3	2019	1st Friday	2'1"	Boy Born with emergency birth and father told that There a new king of the house! Please welcom		
7	Edward	2	2018	1st Thurs	2'2"	Boy Born with forceps delivery and Right dominant hand		
8	Caitlin	6	2020	4th Sunda	1'11"	Girl Born with cesarean birth and Left biggerfoot and Right dominant hand		
9	Eleanor	5	2017	2nd Friday	1'11"	Girl Born with vacuum extraction and Right dominant leg		
10	Damon	9	2019	2nd Mond	1'10"	Boy Born with vaginal birth and with Right biggerfoot and Left dominant hand		
11	Mark	9	2020	4th Friday	2'3"	Boy Born with forceps delivery and doctor told that That is going to be one lucky baby		
12	Ray	3	2021	3rd Wedn	2'0"	Boy Born with vaginal birth and chief doctor told that May your boy baby be blessed with good health,love and laughter		
13	Cal	8	2017	1st Wedn	2'2"	Boy Born with cesarean birth and Left biggerfoot and Right dominant hand		
14	Cam	3	2018	3rd Thurs	2'3"	Boy Born with vacuum extraction and doctor told that Now is the time to enjoy your baby's little feet and baby smell		
15	Julie	11	2016	3rd Mond	2'2"	Girl Born with vaginal birth and mother told that Congratulations to proud new parents		
16	Kate	4	2015	3rd Thurs	1'11"	Girl Born with vacuum extraction and parents told that We are really excited that your baby has arrived safe and sound		
17	Caroline	12	2016	2nd Wedr	2'0"	Girl Born with vacuum extraction and child father told that Thank you for taking such good care of my child and my wife		
18	Maggie	3	2017	2nd Tuesd	2'0"	Girl Born with cesarean birth and Right dominant hand		
19	Lee	6	2020	4th Sunda	2'2"	Girl Born with forceps delivery and father wishes that Thank you for your care during my pregnancy and for the safe delivery of our baby		
20	Heather	3	2019	2nd Thurs	2'1"	Girl Born with cesarean birth and Left biggerfoot and Right dominant hand		
21	Andy	6	2019	3rd Saturd	2'0"	Boy Born with vaginal birth and doctor wishes that You are Going to Be a Great Mother		

Fig 3. Child Dataset Details

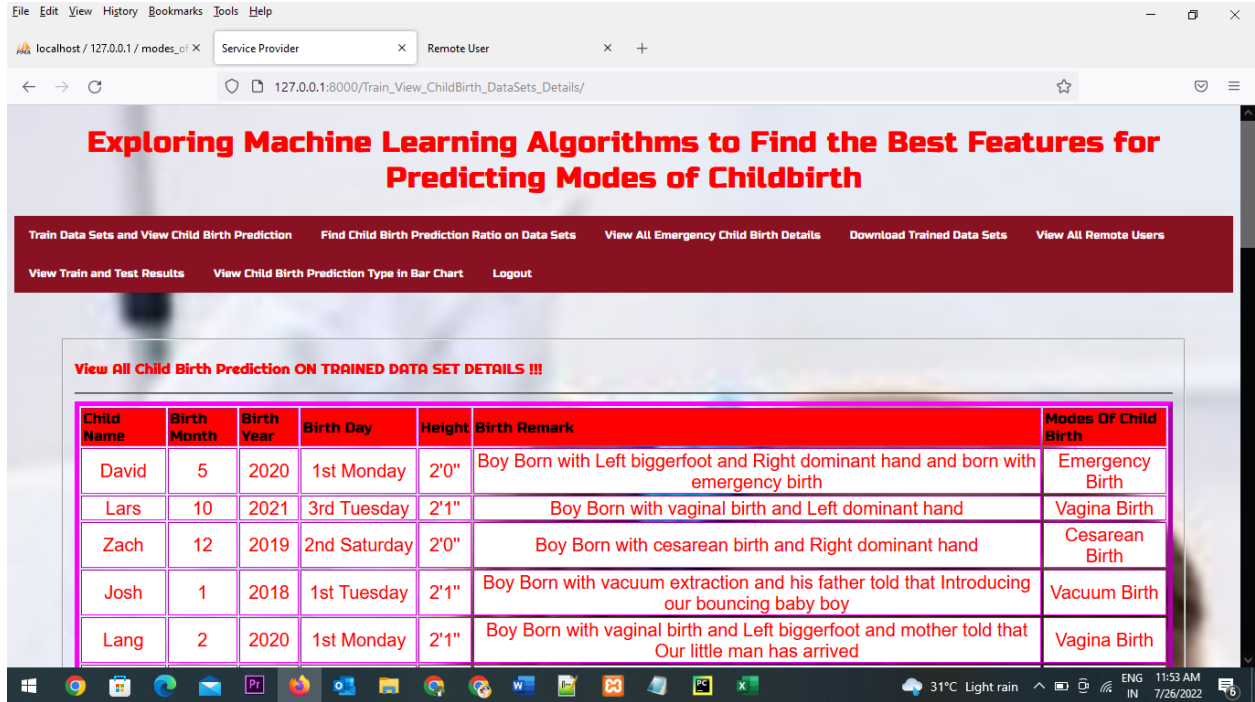


Fig 4. Dataset Details after training

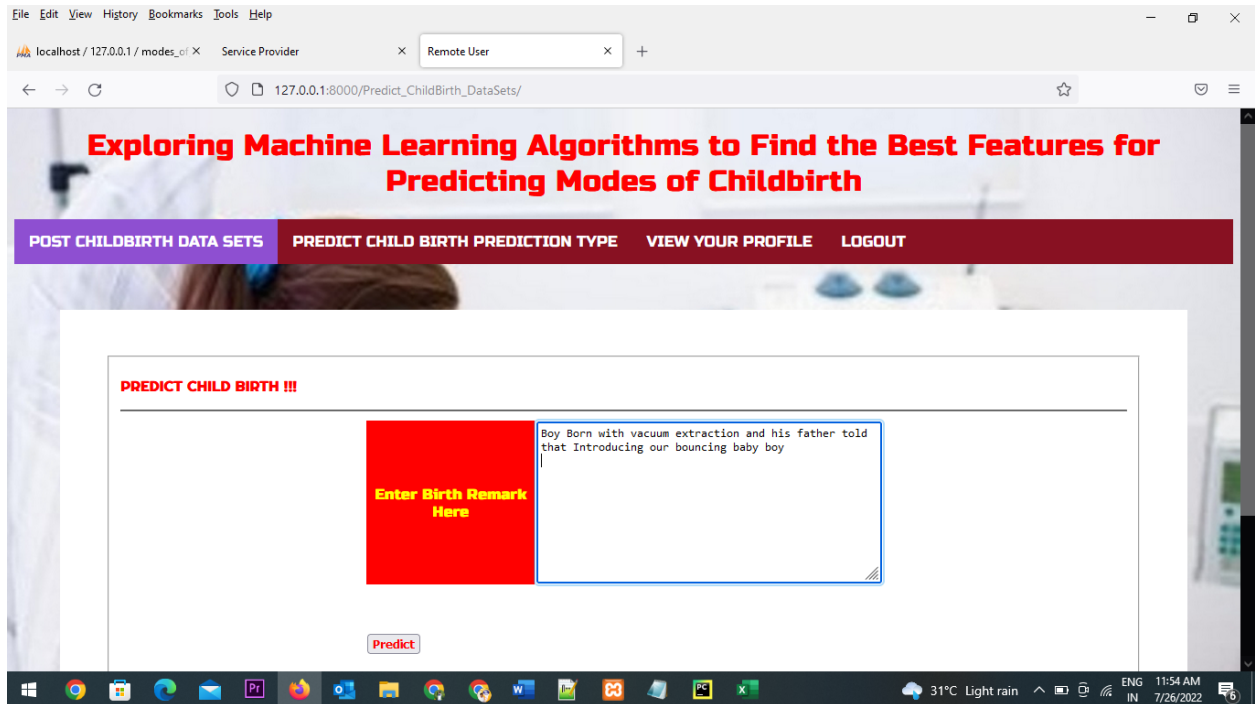


Fig 5. Enter Details For Prediction

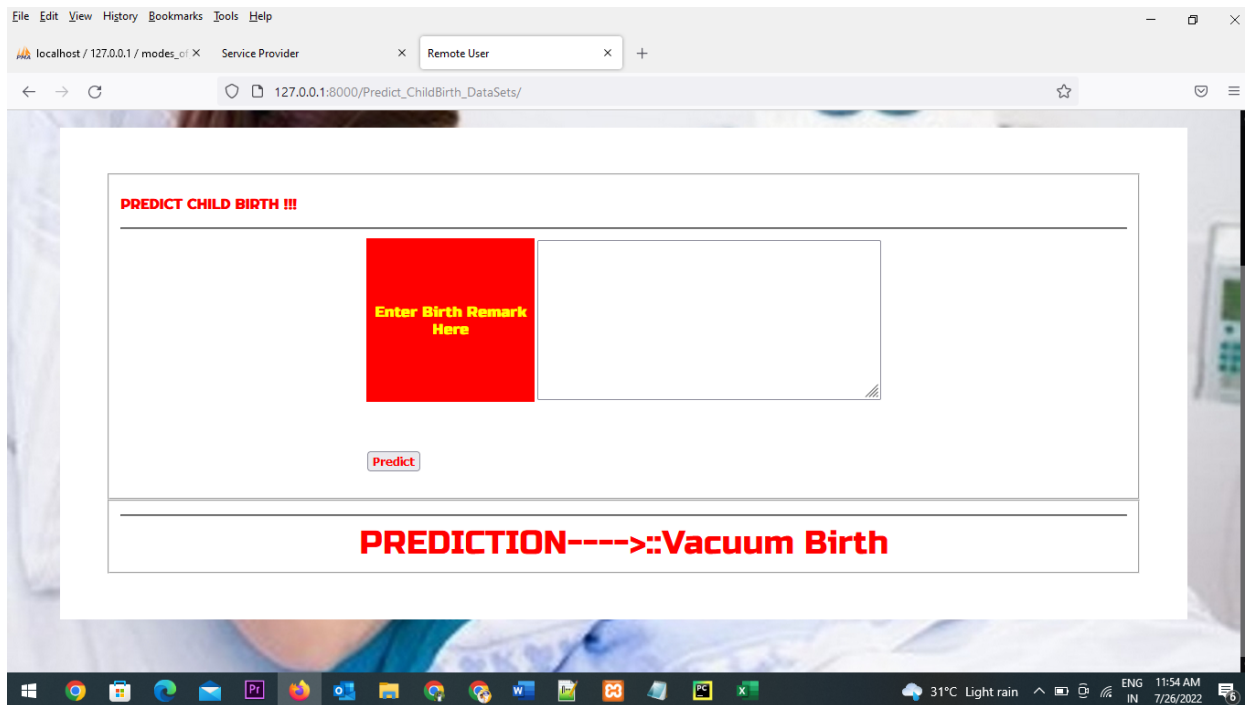


Fig 6. Prediction Type

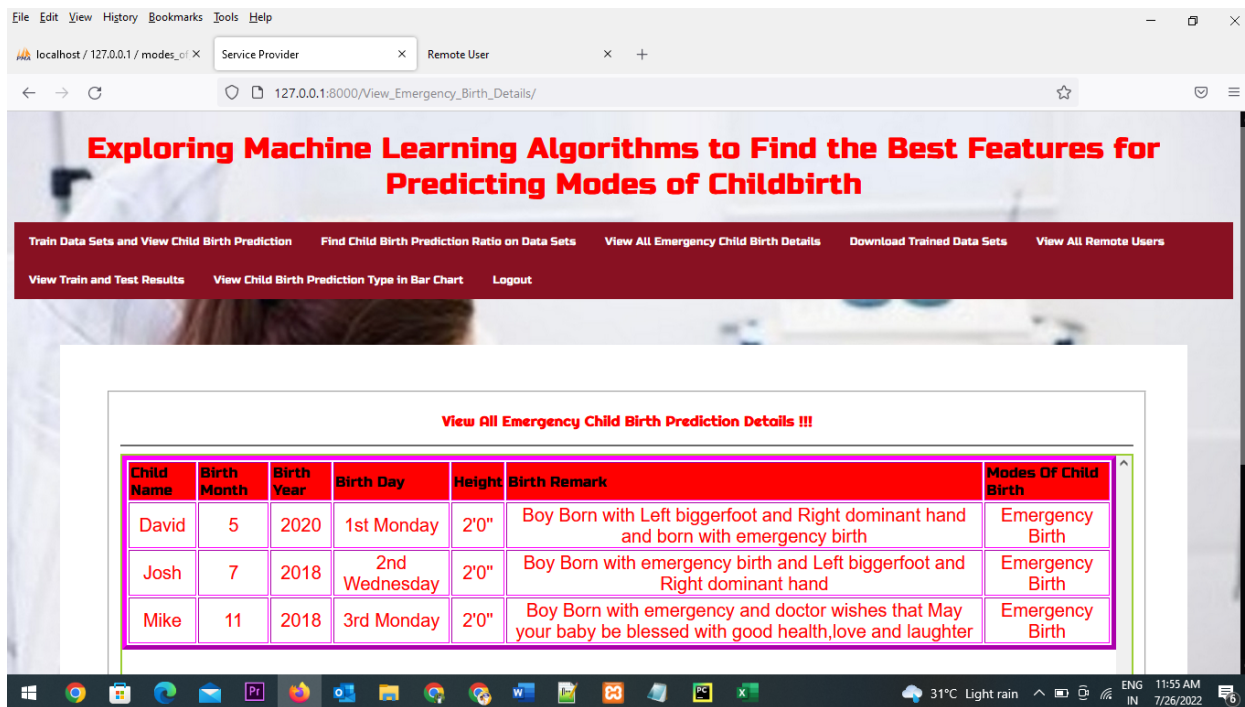


Fig 7. Emergency Child Birth Details

V. CONCLUSION

Selection of the best baby delivery methods is crucial for protecting both the mother and the newborn baby. But it still remains to explore the best sets of features when making this decision in a computerized way. That's why we try to leverage AI to recognize the best mode of baby delivery. Nowadays, machine learning, deep learning, and other computerized computation models are ubiquitously being used in medical decision-making. Here, we have used machine learning-based binary classification algorithms for decision-making between two methods of childbirth. This model will assist the doctor in making a more accurate decision within a very short time. This machine-learning-aided decision will not replace the necessity of the doctors for decision-making. Instead, it will help the physician to gain a deeper insight into the patient's information available. The way of decision-making using this model is very computerized and less likely to have an error. The dataset we have used in this project is not very robust. In the future, we want to add much more observation to our dataset and make this model much more general. We believe a large set of data will produce better accuracy and less overfitting. Besides, we will implement a more in-depth learning-based classification to expand the investigation and make the top choice for record-breaking performance. After childbirth, we plan to implement this system to predict other real-life biomedical factors in advance. In addition, the data can be collected during the whole nine months of the mother's pregnancy. In the future, we plan to make a GUI of this model available to physicians, who can use it as like medical device for decision making.

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