Perinatal health risk predictors using artificial intelligence

Introduction:

Advances in public health and medical care have enabled better pregnancy and birth outcomes. The rates of perinatal health indicators such as maternal mortality and morbidity; fetal, neonatal, and infant mortality; low birthweight; and preterm birth have reduced over time. However, they are still a public health concern, and considerable disparities exist within and between countries. For perinatal researchers who are engaged in unraveling the tangled web of causation for maternal and child health outcomes and for clinicians involved in the care of pregnant women and infants, artificial intelligence offers novel approaches to prediction modeling, diagnosis, early detection, and monitoring in perinatal health. Machine learning, a commonly used artificial intelligence method, has been used to predict preterm birth, birthweight, preeclampsia, mortality, hypertensive disorders, and postpartum depression. Real-time electronic health recording and predictive modeling using artificial intelligence have found early success in fetal monitoring and monitoring of women with gestational diabetes especially in low-resource settings. Artificial intelligence–based methodologies have the potential to improve prenatal diagnosis of birth defects and outcomes in assisted reproductive technology too.

1.2 Purpose

The purpose of using artificial intelligence (AI) for perinatal health risk prediction is to identify women who are at higher risk of experiencing adverse pregnancy outcomes, such as preterm birth, low birth weight, and stillbirth, so that they can receive earlier and more targeted interventions to reduce their risks. By using AI, health care providers can make more accurate predictions of perinatal health risks based on large amounts of data, including demographic information, medical history, and prenatal test results.

The ultimate goal of using AI for perinatal health risk prediction is to improve maternal and infant health outcomes and reduce health disparities. By identifying women who are at high risk of adverse pregnancy outcomes, health care providers can provide targeted interventions and preventive care that can improve the health of mothers and their babies. Additionally, by reducing the number of adverse pregnancy outcomes, AI can help to lower health care costs and reduce the burden on the health care system.

2. LITERATURE SURVEY

2.1 Existing Problem

One of the existing problems with using artificial intelligence (AI) for perinatal health risk prediction is the potential for biased results. AI algorithms are only as good as the data they are trained on, and if the data is biased, then the predictions made by the AI will also be biased. This can lead to disparities in health care, as some groups may be more likely to be misclassified or overlooked as high-risk, leading to inadequate care and negative health outcomes.

Another problem is the lack of standardization in the data used for perinatal health risk prediction. Data can be collected and stored in different formats and from different sources, which can make it difficult to compare results across studies and to ensure that all relevant data is being used. This can result in variations in the accuracy of AI predictions and in the interventions that are offered to high-risk women.

2.2 Proposed Solution

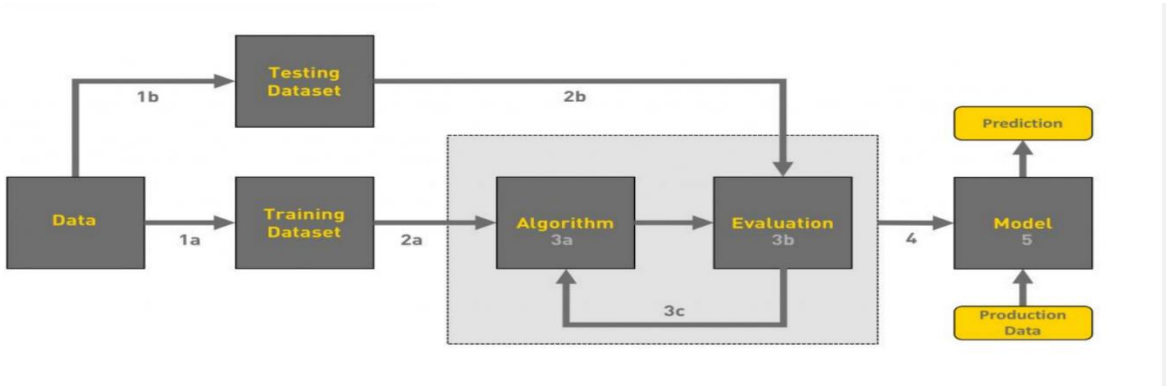
To address the existing problems with using artificial intelligence (AI) for perinatal health risk prediction, several solutions have been proposed:

Addressing data bias: To reduce the risk of biased results, it is important to ensure that the data used to train AI algorithms is diverse and representative of the population it will be used on. This can be achieved by using large, diverse datasets, as well as by using techniques such as data augmentation and synthetic data generation.

Standardizing data: Standardizing the data used for perinatal health risk prediction can improve the accuracy and comparability of AI predictions. This can be achieved by establishing standards for data collection, storage, and formatting, as well as by using common data platforms and data dictionaries.

3. THEORITICAL ANALYSIS

3.1 Block Diagram



3.2 Hardware/Software Designing

Software Requirements:

Python

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. It was created by Guido van Rossum , and first released on February 20, 1991. Its high-level built in data structures, combined with dynamic typing and dynamic binding , make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed.

Anaconda Navigator

Anaconda Navigator is a desktop graphical user interface (GUI) included in Anaconda distribution.Navigator allows you to launch common Python programs and easily manage conda packages, environments, and channels without using command-line commands. Navigator can search for packages on Anaconda Cloud or in a local Anaconda Repository.Conda is an open-source, crossplatform, package management system. For this project, we will be using Jupyter notebook and Spyder.

Jupyter Notebook

The Jupyter Notebook App is a server-client application that allows editing and running notebook documents via a web browser. The Jupyter Notebook App can be executed on a local desktop requiring no internet access or can be installed on a remote server and accessed through the internet.

Spyder

Spyder is an open-source cross-platform integrated development environment (IDE) for scientific programming in the Python language. Spyder integrates with a number of prominent packages in the scientific Python stack, including NumPy, SciPy, Matplotlib, pandas, IPython, SymPy and Cython, as well as other open-source software. It is released under the MIT license.

Flask

Flask is a micro web framework written in Python. It is classified as a microframework because it does not require particular tools or libraries. It has no database abstraction layer, form validation, or any other components where pre-existing third-party libraries provide common functions. However, Flask supports extensions that can add application features as if they were implemented in Flask itself.

Hardware Requirements:

Operating System: Windows 7 or above

Processor:Intel Core i5 and above

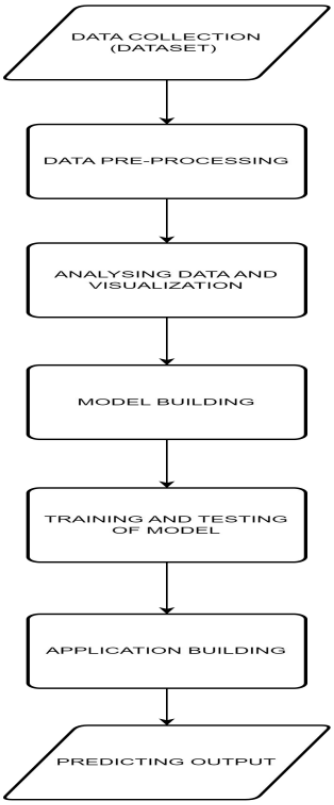
RAM: 4Gb and above

Storage Space Required: 10gb and above

4. EXPERIMENTAL INVESTIGATIONS

The text data need to be organized before proceeding with the project. We will be using PS_20174392719_1491204439457_logs.csv dataset file to fetch the text data of training data. The datas are to be preprocessed in a way such that there is no empty field or outliers.We will create a function that uses the pre-trained model for predicting custom outputs. Then we have to test and train the model. After the model is build, we will be integrating it to a web application build in flask.

5. FLOWCHART



6. RESULT


Perinatal health risk prediction
Age
eg: 35
SystolicBP
eg: 120
DiastolicBP
eg: 60
BS
eg: 6.1
BodyTemp
eg: 98
Predict


Perinatal health risk prediction
Age
eg: 35
SystolicBP
eg: 120
DiastolicBP
eg: 60
BS
eg: 6.1
BodyTemp
eg: 98
Predict
Patient is at Low Risk

7. ADVANTAGES

Improved accuracy: AI algorithms can analyze large amounts of data and identify patterns that may be difficult to detect through traditional methods. This can result in more accurate predictions of perinatal health risks, which can help health care providers to make more informed decisions about the care they provide.

Increased efficiency: By automating the process of perinatal health risk prediction, AI can reduce the time and effort required to make these predictions. This can allow health care providers to focus their time and resources on providing targeted interventions to women who are at high risk of adverse pregnancy outcomes.

Better health outcomes: By identifying women who are at high risk of adverse pregnancy outcomes, AI can help health care providers to provide earlier and more targeted interventions. This can reduce the risk of adverse pregnancy outcomes and improve maternal and infant health outcomes.

Improved equity: By reducing the risk of biased results, AI can help to reduce disparities in health care and improve the health outcomes of disadvantaged populations.

DISADVANTAGES

Data bias: AI algorithms are only as good as the data they are trained on, and if the data is biased, then the predictions made by the AI will also be biased. This can result in disparities in health care and negative health outcomes for certain populations.

Lack of transparency: AI algorithms can be complex and difficult to understand, making it challenging to understand how predictions are being made. This can make it difficult for health care providers to understand the limitations of AI predictions and to make informed decisions about care.

Cost: Implementing AI systems can be expensive, and may require significant investment in technology, infrastructure, and personnel.

Lack of standardization: There is currently a lack of standardization in the data used for perinatal health risk prediction, which can make it difficult to compare results across studies and to ensure that all relevant data is being used.

Potential for incorrect predictions: AI algorithms are not perfect, and there is always the risk of incorrect predictions, which can lead to inappropriate interventions or a failure to provide necessary care.

8. APPLICATIONS

Predicting pre-eclampsia: AI algorithms can analyze maternal demographic, clinical, and laboratory data to predict the risk of pre-eclampsia, a condition that can lead to serious maternal and fetal morbidity and mortality.

Predicting gestational diabetes: AI algorithms can be used to predict the risk of gestational diabetes, a condition that can lead to complications during pregnancy and delivery, as well as an increased risk of long-term health problems for both the mother and the baby.

Predicting preterm birth: AI algorithms can be used to predict the risk of preterm birth, which is associated with a range of short- and long-term health problems for both the mother and the baby.

Predicting adverse pregnancy outcomes: AI algorithms can be used to predict a range of adverse pregnancy outcomes, such as stillbirth, low birth weight, and neonatal death, which can help health care providers to provide earlier and more targeted interventions.

Optimizing prenatal care: AI algorithms can be used to optimize prenatal care by predicting the risks associated with specific interventions and tailoring care to individual women based on their unique needs and risks.

9. CONCLUSION

In conclusion, the use of artificial intelligence (AI) for perinatal health risk prediction has the potential to significantly improve maternal and infant health outcomes by providing earlier and more targeted interventions. However, it is important to carefully consider the limitations and potential biases of AI algorithms and to ensure that they are used in a transparent and ethical manner. Additionally, investment in further research and development is needed to refine AI algorithms and ensure that they are based on robust, high-quality data. Ultimately, the successful integration of AI into perinatal health care will require collaboration between health care providers, researchers, and technology experts to ensure that the benefits of AI are realized while minimizing its potential limitations and risks.

10. FUTURE SCOPE

Integration with wearable technology: Wearable technology such as smartwatches and continuous monitoring devices can provide real-time data on maternal and fetal health, which can be used to improve perinatal health risk predictions.

Big data analytics: The use of big data analytics can provide more comprehensive and accurate data for AI algorithms to analyze, improving the accuracy of perinatal health risk predictions.

Improved accuracy: Continued research and development is likely to lead to improvements in the accuracy of perinatal health risk predictions, enabling earlier and more targeted interventions.

Personalized predictions: AI algorithms can be customized to predict health risks specific to an individual based on their unique demographic, clinical, and lifestyle factors.

Expansion of applications: The use of AI in perinatal health risk prediction may expand to include the prediction of other maternal and fetal health conditions, such as postpartum depression and autism.

Improved data privacy and security: As AI becomes more widely used in health care, it will be important to ensure that sensitive health information is protected and that privacy and security measures are in place.

11. BIBLOGRAPHY

https://www.researchgate.net/publication/354937786_Online_Transaction_Fraud_Detection_System_Based_on_Machine_Learning

https://thecleverprogrammer.com/2022/02/22/online-payments-fraud- detection-with-machine-learning/

12. APPENDIX

A. SOURCE CODE

APP.PY

```
from flask import Flask, render_template,request
import pickle

model=pickle.load(open("model_randomforest.pkl","rb"))
app=Flask(_name_)

@app.route('/')
def loadpage():
    return render_template('about.html')

@app.route('/predict')
def predict():
    return render_template('index.html')

@app.route('/y_predict', methods=['POST'])
def prediction():

    Age=request.form["Age"]
    SystolicBP=request.form["SystolicBP"]
    DiastolicBP=request.form["DiastolicBP"]
    BS=request.form["BS"]
    BodyTemp=request.form["BodyTemp"]

    p=[[float(Age),float(SystolicBP),float(DiastolicBP),float(BS),float(BodyTemp)]]
    prediction=model.predict(p)

    if (prediction == ['High risk']):
```

```
        text= "Patient is at High Risk"
    elif (prediction == ['Mid risk']):
        text= "Patient is at Mid Risk"
    else:
        text="Patient is at Low Risk"

    return render_template("index.html",prediction_test=text)



if _name=='main_':
    app.run(debug=False)
```

INDEX.HTML

```
<html>

<head>

<style>
body{
background-size: cover;
background-image:
url('https://c1.wallpaperflare.com/preview/937/818/491/stethoscope-doctor-md-
medical-health-hospital.jpg');
}

</style>

</head>

<body>
```

```
<!-- Main input for receiving Quary for our ML -->
<form action= "/y_predict" method="post">

<h3> Maternal Health Risk Prediction </h3>

<p> Age </p>
<p><input type="text" name="Age" placeholder="eg: 35" required="required" /></p>
<p> SystolicBP </p>
<p><input type="text" name="SystolicBP" placeholder="eg: 120" required="required"
/></p>
<p> DiastolicBP </p>
<p><input type="text" name="DiastolicBP" placeholder="eg: 60" required="required"
/></p>
<p> BS </p>
<p><input type="text" name="BS" placeholder="eg: 6.1" required="required" /></p>
<p> BodyTemp </p>
<p><input type="text" name="BodyTemp" placeholder="eg: 98" required="required"
/></p>


<a><button type="submit">Predict</button></a>

</form>

<p> <b> {{prediction_test}} </b> </p>
</body>
</html>
```

ABOUT.HTML

```
<!DOCTYPE html>
<html>
<head>
  <title> Perinatal health risk predictor Home page</title>
  <link rel="stylesheet" type="text/css" href="static/css/style.css">



  <link rel="preconnect" href="https://fonts.googleapis.com">
  <link rel="preconnect" href="https://fonts.gstatic.com" crossorigin>
  <link
href="https://fonts.googleapis.com/css2?family=Josefin+Sans:ital,wght@0,100;0
  ,200;0,300;0,400;0,500;0,600;0,700;1,100;1,200;1,300;1,400;1,500;1,600;1,700&displa
  y=swap" rel="stylesheet">


</head>
<body>
  <section class="about">
    <div class="main">
      <img src="static/img/about.png">
      <div class="about-text">
        <h3> Perinatal health risk predictor</h3>
        <h5> Purpose & Model</h5>
        <p>  Advances in public health and medical care have enabled better pregnancy
and birth outcomes. The rates of perinatal health indicators such as maternal mortality
and morbidity; fetal, neonatal, and infant mortality; low birthweight; and preterm birth
have reduced over time. However, they are still a public health concern, and
considerable disparities exist within and between countries. So this website is built to
predict the Risk level of the pregnancy and birth outcomes </p>
        <p>  Here in this project I have used different classification algorithms like:
Decision tree, Randomforest, KNN, Naive byes, Ada boost, Bagging classifier, SVM,
Logistic Regression and used GridSearchCV to check the best performing
classifier.Hence created a classification model using RandomForestClassifier and we are
```

```
trying to predict the Risk level of the patient. The 3 Risk levels are: Low,Mid and High
</p>
      <p> To predict the Risk level of the patient please click on the below button </p>
      <a href="/predict"><button type="button">Predict</button></a>
    </div>
  </div>
 </section>

</body>
</html>
```