Fetal Distress Classification Based on Cardiotocography

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Project Planning and Goal Setting:

Poojitha Cherukuri, Vinay Daram, Venkata Surya Mouli Sree Vamsi Mallady, Aravind Reddy Pallreddy, and Madhu Surisetti had a meeting to discuss the project's objectives, timeline, and expected outcomes. They also identified potential challenges and risks and developed a plan to address them.

Data collection:

Poojitha Cherukuri has provided the team with the facts and we used the CTG dataset which is to be had to each person inside the "The College of California Irvine" ML Repository. The dataset carries 21 Columns except for the goal class. using those functions of facts must classify the fame of the fetal nation. The reputation of the fetal kingdom is classed into three states normal, suspect, and pathological. The CTG dataset consists of 2126 observations which of them 1655 are regular, 295 are suspect and 176 are pathological.

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Data pre-processing and visualization:

Venkata Surya Mouli Sree Vamsi Mallady has supplied the information on what Pre-Processing means and making ready facts effectively which allows us to get accurate results. The crucial step in pre-processing is handling missing values, disposing of unwanted functions, and reworking the information within the dataset. in this dataset, we removed the unwanted features and copy columns within the dataset.

Data Visualization is the method of translating records into visible factors like maps or charts. in this take a look at, we visualized the dataset to know approximately the relationship among the 2 capabilities which allows to put off unwanted functions.We visualized the count of each target class which helps whether the classes are imbalanced or not.

And this Feature Scaling for pre-processing the data and It is a technique that is used to standardize the feature values present in the dataset from long range to small.
And for this Feature Selection is for pre-processing the data and It is the process where we select features automatically or manually which helps the model perform well.

Model Building:

Aravind Reddy Pallreddy has contributed to the team in making handling and Training a the model with Machine Learning which helps us the process of ML algorithm are fed up with the learning dataset. We used the deployed model for new data to predict the outcome. And in this, we used the Random Forest algorithm to build the model. And Random Forest is one of the ensemble ML methods. RF set of rules may be used for both class and Regression. In this study, we are using Classification Algorithm because of the dataset in the categorical distribution.

Building a User Interface:

Vinay Dararam has contributed his part in doing the user interface part of the project in which he used the basic HTML and CSS to design the page kind of form where the doctors/users would enter the required data and then after entering this would go to a flask model which comes in the integration step then we would get the results page where we use to display the result, required graphs which would help the doctors what steps need to be done and medication as well.

Integrating :

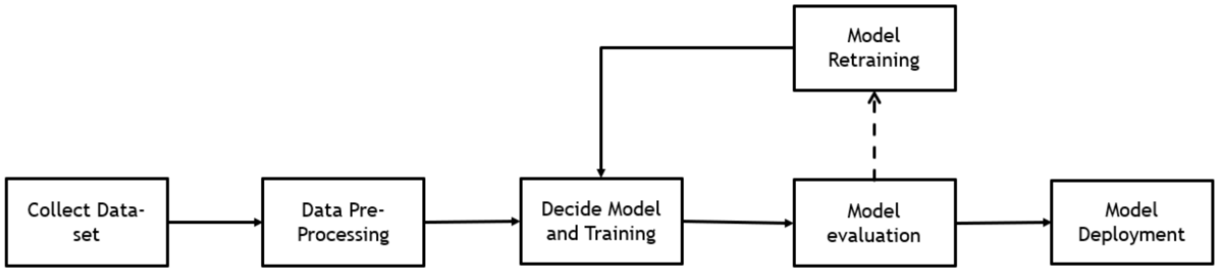
Madhu Surisetti has contributed his part in integrating the model with the user interface and this is been achieved by 2 most imp things libraries called Flask and Pickle which help to handle the web page and then to send the data in bite formates called picking the data and this is an important part in processing and displaying the data.

Abstract:

The fact that kids are the destiny of the sector. So, workers need to ensure that they're born with no complications or disabilities. but unfortunately, some toddlers are born with one or greater complications and certainly one of those is fetus misery. This situation happens because of insufficient oxygen supply and lots of different factors in the mother's womb. This misery will result in a few disorders like neurological malfunctions and every so often it may also lead to demise. Cardiotocography (CTG) is an effective, efficient, and widely used technique to research the fetal heartbeat price (FHR) and uterine contraction of the mom, and so forth. This cardiotocography plays an important position in studying numerous fetal distress conditions (everyday, Suspicious, Pathological) and their possibilities. a complete of 2126 measurements and classifications of fetal coronary heart fee (FHR) sign output had been analyzed to are expecting the numerous fetal misery situations which of them 1655 had been normal, 295 suspicious, and 176 have been pathologic samples that imply the existence of fetal misery. So, need a pc-based approach for reading the effects and observations made at some point of the cardiotocography and predicting the opportunities of fetal misery. To attain this goal, adaptive boosting ensemble mastering Algorithms and diverse different gadget studying algorithms are employed. as a result the usage of device gaining knowledge of the opportunity of fetal misery in Pregnant girls is predicted.

Project Design:

Project Design is the first phase of the project. A Project Design is a strategic combination of features and processes to achieve a goal. Project Design helps a group or team to achieve a goal in the step-by-step process. The below diagram represents the design of the project:



To achieve a result, we need to collect the dataset from the top Repositories like UCI and Kaggle. The dataset needs to be pre-processed to eliminate the anomalies in the data. Next, we will train the model with the dataset by applying different algorithms. Every ML Model needs to be evaluated if the model is not meeting requirements. Need to train again and after meeting requirements, the model should be deployed into Production.

Project Milestones:

1) Design:

Project Design is the first phase of the project. A Project Design is a strategic combination of features and processes to achieve a goal. Project Design helps a group or team to achieve a goal in the step-by-step process. The below diagram represents the design of the project.

2) Data Collection:

In this look at, we used the CTG dataset which is to be had to anyone inside the "The University of California Irvine" ML Repository. The dataset carries 21 Columns with the exception of the target magnificence. The use of these capabilities of facts need to classify the fame of the fetal state. The fame of the fetal kingdom is assessed into 3 states normal, suspect, and pathological. The CTG dataset incorporates 2126 observations which of them 1655 are regular, 295 are suspect and 176 are pathological. these observations suggest the repute of the fetal state. Attributes information is given as:

LB	FHR baseline
AC	Accelerations
FM	Fetal Movements
UC	Uterine Contradictions
DL	Light Decelerations
DS	Severe Decelerations
DP	Prolonged Decelerations

ASTV	Abnormal Short-Term Variability
MSTV	Mean Value of Short-Term Variability
ALTV	Abnormal Long-Term Variability
MLTV	Mean Value of Long-Term Variability
Width	Width of Histogram
Min	Minimum of Histogram
Max	Maximum of Histogram
Nmax	No: of Histogram Peaks
Nzeroes	No: of Histogram Zeroes
Mode	Histogram Mode
Median	Histogram Median
Variance	Histogram Variance
Tendency	Histogram Tendency
NSP	Fetal State (Normal – N, Suspicious – S, Pathological – P)

3) Data Pre-Processing:

Pre-Processing means preparing statistics efficiently which enables us to get accurate results. The crucial step in preprocessing is dealing with missing values, disposing of unwanted features, and transforming the statistics within the dataset. on this dataset, we eliminated the undesirable features and copy columns in the dataset. We didn't find any null values within the facts.

Feature Scaling:

It is a method that is used to standardize the characteristic values present inside the dataset from long variety to small. In this examination, we used the standard Scalar process for feature Scaling. After Standardization, the values will variety from zero to 1. The simple system for Standardization is:

$$Z=(x-\mu)/\sigma \quad (x = \text{Value}, \mu = \text{Mean}, \sigma = \text{Standard Deviation})$$

133.303857	9.840844	106.0	126.000	133.000	140.000	160.000
0.003178	0.003866	0.0	0.000	0.002	0.006	0.019
0.009481	0.046666	0.0	0.000	0.000	0.003	0.481
0.004366	0.002946	0.0	0.002	0.004	0.007	0.015
0.001889	0.002960	0.0	0.000	0.000	0.003	0.015
0.000003	0.000057	0.0	0.000	0.000	0.000	0.001

Before Feature Scaling

1.069490e-15	1.000235	-2.775197	-0.742373	-0.030884	0.680604	2.713428
-6.015884e-17	1.000235	-0.822388	-0.822388	-0.304881	0.730133	4.093929
-1.336863e-17	1.000235	-0.203210	-0.203210	-0.203210	-0.138908	10.106540
-1.336863e-16	1.000235	-1.482465	-0.803434	-0.124404	0.894142	3.610264
-5.347452e-17	1.000235	-0.638438	-0.638438	-0.638438	0.375243	4.429965
6.684315e-18	1.000235	-0.057476	-0.057476	-0.057476	-0.057476	17.398686

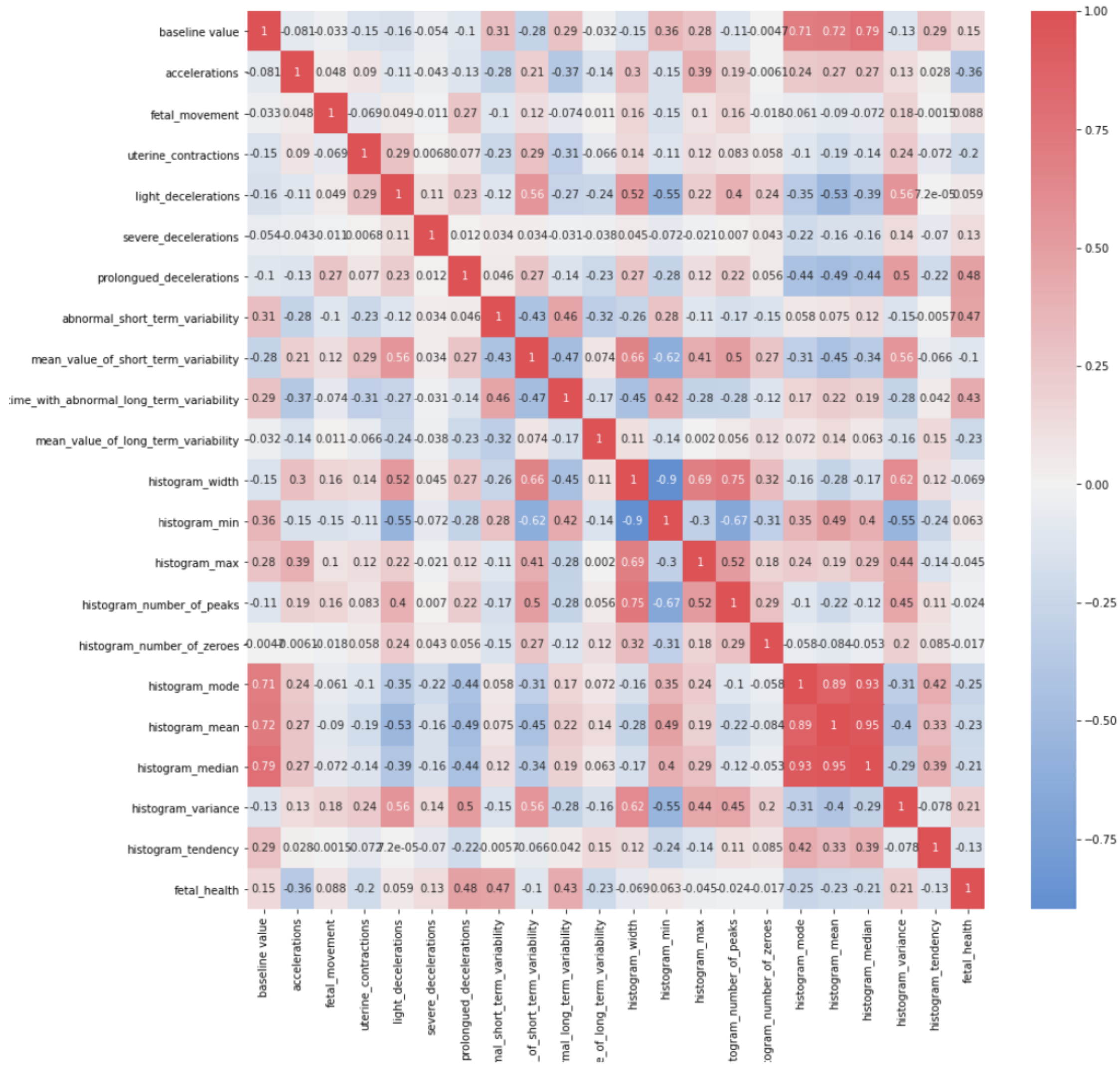
After Feature Scaling

4) Data Visualization:

Data Visualization is the manner of translating statistics into visible factors like maps or charts. in this look, we visualized the dataset to realize about the relationship between the two capabilities which enables to get rid of undesirable capabilities. We visualized the count of each target class which helps whether the classes are imbalanced or not.

Feature Selection:

It is the process where we select features automatically or manually which helps the model perform well. In this study, we used a correlation map that helps to know about the distribution of the data. We didn't find zero correlation for any feature. Every feature has its dependency on others.



5) Data Splitting:

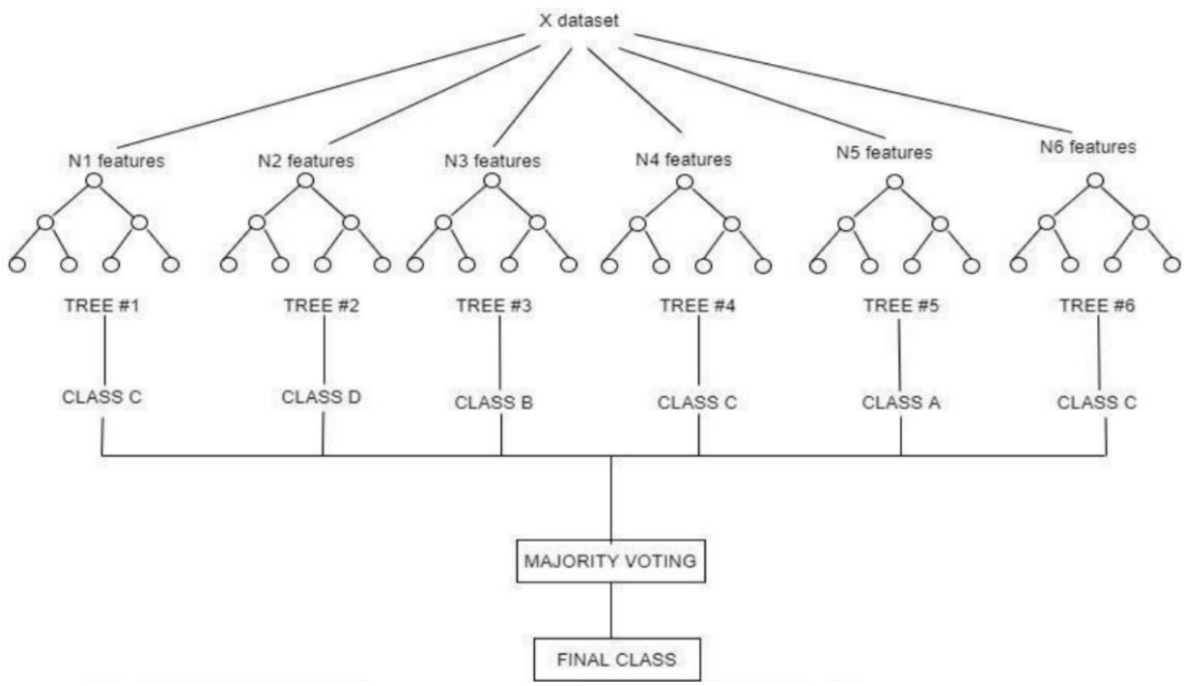
Data splitting is the act of splitting statistics into or more portions. In gadget gaining knowledge of, we are able to divide the dataset into the schooling and testing dataset. One portion which is the training set may be used to expand the predictive model. another component that is the testing set can be used to evaluate the version's performance. We divided the dataset into the education set with 80% of the statistics and 20% of the testing set and splitting is executed based at the 42 random states.

6)Model Training:

Handling and schooling a device studying model is a process in which the ML algorithms are bored to death with the learning dataset. We used the deployed model for new information to predict the outcome. And on this, we used the Random forest set of rules to build the model. And Random forest is one of the ensemble ML methods. RF algorithm can be used for both classification and Regression. In this study, we're the use of classification set of rules because of the dataset in the categorical distribution.

Random Forest:

Random Forest is one of the ensemble ML methods. RF algorithm can be used for both Classification and Regression. In this study, we are using Classification Algorithm because of the dataset in the categorical distribution. We created the trees in the random forest with a depth of 12 and used almost all features available in a dataset with no n_jobs. The estimators chosen for the algorithm are about 150 and decided root of trees with entropy criteria.



The following steps describe the details of building the Random Forest:

- Randomly select some features from the total features. Ensure that selected features should be less than the total features.
- Among the selected features, calculate the best nodes using some procedure called best-split point.
- Again, Split the node (which we got in step-2) into child nodes with the same procedure best split.
- Repeat the first 3 steps until nodes created by the algorithm are reached.
- Then, build the random forest by repeating steps 1 to 4 for random n number times to create decision trees.
- Take the check facts and features and use the selection trees to are expecting the final results and store the outcome in a few variables.
- Calculate the votes for each prediction and consider the majority as the final prediction.

After model creation with the random wooded area by means of using hyperparameters we mentioned and skilled the version with a training dataset and evaluated it with a trying out set. From the beneath confusion matrix, we will see that version is not skilled well with the pathological magnificence state. to conquer this, we need to train the model with some other hyperparameter. to overcome the problem, hyperparameter tuning will be useful to determine the best hyperparameter for the version.

	Predicted(Random Forest)			
Actual		Normal	Suspect	Pathological
	Normal	327	4	2
	Suspect	11	51	2
	Pathological	2	3	24

Performance Evaluation:

Performance Evaluation is the important step in Machine Learning Model. The main aim of the model evaluation to estimate the accuracy of the model on unseen data. There are various types of metrics which we can use them to evaluate the performance of the Machine Learning Model. Performance evaluation will be different for classification as well as regression. In this Study, to evaluate the performance of the classification model we used the confusion matrix. The confusion matrix has the True Positives (TP), True Negatives (TN), False Negatives (FN), False Positives (FP).

	Actually Positive (1)	Actually Negative (0)
Predicted Positive (1)	True Positives (TPs)	False Positives (FPs)
Predicted Negative (0)	False Negatives (FNs)	True Negatives (TNs)

The Performance Evaluation Metrics:
The number of correct predictions made as a ratio of all predictions made is called Accuracy.

$$\textbf{Accuracy} = \frac{TP+TN}{TP+FP+TN+FN}$$

Precision quantifies the no: of positive class predictions that actually belong to positive class.

$$\textbf{Precision} = \frac{TP}{TP+FP}$$

Recall quantifies the no: of positive class predictions made out of all positive example in dataset.

$$\textbf{Recall} = \frac{TP}{TP+FN}$$

F1-Score provides a single score that balances both the precision and recall in one number.

F1_Score = $2 * (precision * recall) / (precision + recall)$

Let's see the evaluation of each algorithm that we have trained for the CTG data.

Random Forest:

In Implementation, we fed up the data to random forest to train the model. Let's see how the performance of the model by using evaluation metrics.

Evaluation Metric	Values
Accuracy	0.9553
Precision	0.92661
Recall	0.91
F1 Score	0.92

The Model Accuracy is about 95~% (approx.) that we achieved by apply the testing data on model. Precision refers to the quality of model. Here, model's precision based on test data is about 93~% (approx.) which means that random forest predicting 93% more relevant results than irrelevant. Recall refers to the quantity of model. Here, model's recall is about 91% (approx.) which means that model is predicting most relevant results. When we are having the class imbalance in the dataset, we prefer precision over recall. When we consider only precision the model is trained well and almost it is giving 92% of the true positives. As higher the precision higher the quality of model.

Repository / Archive:

As mentioned the link which was attached contains the zip file of the project which has a Fetal. ipynb which helps us to run in the cloab or Jupiter notebook and this will help us to understand and visualize the data with the help of random forest algorithm which helps to train the model and from the requirements.txt file which will help us in importing the required libraries into the system and we also have app.py file which will help us in running the model in python which helps us using the web page /UI model of the application and this will run in localhost

Result Analysis:

From the research papers and the documents which we have gone through we came across the things like using of decisions trees and k-nearest nibours and we have observed that it is producing an accuracy of around 80 to 85% so we thought of using random forest and we choose random forest because it an insatiable learning technique in which it takes multiple decision trees and then predict accuracy accordingly and by choosing this we achieved an accuracy of around 94.5% of accuracy.

Source Code:

static/Home.css:

```
@import url(https://fonts.googleapis.com/css?family=Cookie|Raleway:300,700,400);
*{
 box-sizing: border-box;
 font-size: 1em;
 margin: 0;
 padding: 0;
}
body{
 background: url('https://ak.picdn.net/shutterstock/videos/1098595/thumb/1.jpg') center
repeat;
 background-size: cover;
 color: #333;
 font-size: 18px;
 font-family: 'Raleway', sans-serif;
}
#parent
{
   text-align: center;
   width:100%;
}
.container{
 border-radius: 0.5em;
 box-shadow: 0 0 1em 0 rgba(51,51,51,0.25);
 display: block;
 max-width: 700px;
 overflow: hidden;
   background-color:#fff;
   opacity: 0.75;
```

```
 padding: 2em;
 width: 98%;
}
.heading{
   background-color: rgb(
       133, 130, 126
       );
   height: 900px;
}
.heading1{
   background-color:rgb(153, 106, 106);
   height: 350px;
}
form input.submit{
 background: rgba(255,255,255,0.25);
 border: 1px solid #333;
 line-height: 1em;
 padding: 0.5em 0.5em;
 -webkit-transition: all 0.25s;
 transition: all 0.25s;
}
form input.submit:hover,
form input.submit:focus,
form input.submit:active,
form input.submit.loading{
 background: #333;
 color: #fff;
 outline: none;
}
form button.success{
 background: #27ae60;
 border-color: #27ae60;
 color: #fff;
}
@-webkit-keyframes spin{
 from{ transform: rotate(0deg); }
 to{ transform: rotate(360deg); }
}
@keyframes spin{
 from{ transform: rotate(0deg); }
```

```
 to{ transform: rotate(360deg); }
}
form button span.loading-spinner{
 -webkit-animation: spin 0.5s linear infinite;
 animation: spin 0.5s linear infinite;
 border: 2px solid #fff;
 border-top-color: transparent;
 border-radius: 50%;
 display: inline-block;
 height: 1em;
 width: 1em;
}
form label{
 border-bottom: 1px solid #333;
 display: block;
 font-size: 1.25em;
 margin-bottom: 0.5em;
 -webkit-transition: all 0.25s;
 transition: all 0.25s;
}
form label.col-one-half{
 font-size: 2em;
 float: left;
 width: 50%;
   font-family: 'Trebuchet MS';
}
form label.col-one-half:nth-of-type(even){
 border-left: 1px solid #333;
 padding-left: 0.25em;
}
form label.col-one-half1{
 font-size: 2em;
 float: left;
 width: 50%;
   font-family: 'Trebuchet MS';
}
form label.col-one-half1:nth-of-type(odd){
 border-left: 1px solid #333;
 padding-left: 0.25em;
}
```

```css
form label input{
 background: none;
 border: none;
 font-size: x-large;
 line-height: 1em;
 font-weight: 300;
 padding: 0.125em 0.25em;
 width: 100%;
}
form label input:focus{
 outline: none;
}
form label input:-webkit-autofill{
 background-color: transparent !important;
}
form label span.label-text{
 display: block;
 font-size: 0.5em;
 font-weight: bold;
 padding-left: 0.5em;
 text-transform: uppercase;
 -webkit-transition: all 0.25s;
 transition: all 0.25s;
}
form label.checkbox{
 border-bottom: 0;
 text-align: center;
}
form label.checkbox input{
 display: none;
}
form label.checkbox span{
 font-size: 0.5em;
}
form label.checkbox span:before{
 content: '\e157';
 display: inline-block;
 font-family: 'Glyphicons Halflings';
 font-size: 1.125em;
 padding-right: 0.25em;
```

```
 position: relative;
   top: 1px;
}
form label.checkbox input:checked + span:before{content: '\e067';}
form label.invalid{border-color: #c0392b !important;}
form label.invalid span.label-text{color: #c0392b;}
form label.password{position: relative;}
form label.password button.toggle-visibility{
 background: none;
 border: none;
 cursor: pointer;
 font-size: 0.75em;
 line-height: 1em;
 position: absolute;
   top: 50%;
   right: 0.5em;
 text-align: center;
 -webkit-transform: translateY(-50%);
 -ms-transform: translateY(-50%);
 transform: translateY(-50%);
 -webkit-transition: all 0.25s;
 transition: all 0.25s;
}
form label.password button.toggle-visibility:hover,
form label.password button.toggle-visibility:focus,
form label.password button.toggle-visibility:active{
 color: #000;
 outline: none;
}
form label.password button.toggle-visibility span{vertical-align: middle;}
h1{
 font-size: 2em;
 margin: 0 0 0.5em 0;
 text-align: center;
 font-family: 'Cookie', cursive;
}
h1 img{
 height: auto;
 margin: 0 auto;
 max-width: 240px;
```

```
 width: 100%;
}
html{
 font-size: 18px;
 height: 100%;
}
.texte
{
   font-size: 3em;
 font-family: 'Trebuchet MS', cursive;
   color: #fff;
   position: relative;
       top:20%;
       right: 25%;
}
.texte1
{
   font-size: 1.5em;
 font-family: 'Trebuchet MS', cursive;
   color: #000;
   position: relative;
       top:4%;
       right:36.8%;
   font-weight: bold;
}
.texte2
{
   font-size: large;
 font-family: 'Trebuchet MS', cursive;
   color: #fff;
   position: relative;
       top: 8%;
       left: 4%;
   text-align: left;
   line-height: 1.6;
   width: 90%;
}
.texte3
{
   font-size: 1.5em;
```

```
 font-family: 'Trebuchet MS', cursive;
   color: #000;
   position: relative;
       top:4%;
       right:35.4%;
   font-weight: bold;
}
.texte4
{
   font-size: 1.5em;
 font-family: 'Trebuchet MS', cursive;
   color: #000;
   position: relative;
       top:4%;
       right:34.5%;
   font-weight: bold;
}
.texte5
{
   font-size: 1.4em;
 font-family: 'Trebuchet MS', cursive;
   color: #000;
   position: relative;
       top:4%;
       right:38%;
   font-weight: bold;
}
.texte6
{
   font-size: 1.5em;
 font-family: 'Trebuchet MS', cursive;
   color: #000;
   position: relative;
       top:4%;
       right:33.5%;
   font-weight: bold;
}
.texte7
{
   font-size: 1.5em;
```

```
 font-family: 'Trebuchet MS', cursive;
   color: #000;
   position: relative;
       top:6%;
       right:27%;
   font-weight: bold;
}
.texte8
{
 font-size: 1.5em;
 font-family: 'Trebuchet MS', cursive;
   color: #000;
   position: center;
   font-weight: bold;
}
.texte9
{
   font-size: large;
 font-family: 'Trebuchet MS', cursive;
   color: #fff;
   position: relative;
       top: 8%;
   text-align: left;
   line-height: 1.6;
   width: 90%;
}
.texte10
{
   font-size: large;
 font-family: 'Trebuchet MS', cursive;
   color: #fff;
   position: relative;
       top: 4%;
       left: 7%;
   text-align: left;
   line-height: 1.6;
   width: 90%;
}
.text-center{
 text-align: center;
```

```
}
.text-left{
 text-align: left;
   font-size: 2em;
   font-family: 'Cookie', cursive;
}
.header1 {
   overflow: hidden;
   background-color:grey;
   padding: 20px 10px;
 }
  .header1 a {
   float: left;
   color: white;
   text-align: center;
   padding: 12px;
   text-decoration: none;
   font-size: 18px;
   line-height: 25px;
   border-radius: 4px;
 }
  .header1 a.logo {
   font-size: 25px;
   font-weight: bold;
 }
  .header1 a:hover {
   color: black;
 }
  .header1 a.active {
   background-color: dodgerblue;
   color: white;
 }
  .header1-right {
   float: right;
 }
  @media screen and (max-width: 500px) {
   .header1 a {
     float: none;
     display: block;
     text-align: left;
```

```
  }

  .header1-right {
    float: none;
  }
 }
 #parent
 {
    text-align: center;
    width:100%;
 }
 .carousel-item {
   height: 65vh;
   min-height: 350px;
   background: no-repeat center center scroll;
   -webkit-background-size: cover;
   -moz-background-size: cover;
   -o-background-size: cover;
   background-size: cover;
 }
 .site-footer
{
 background-color:#26272b;
 padding:45px 0 20px;
 font-size:15px;
 line-height:24px;
 color:#737373;
}
.site-footer hr
{
 border-top-color:#bbb;
 opacity:0.5
}
.site-footer hr.small
{
 margin:20px 0
}
.site-footer h6
{
 color:#fff;
```

```
 font-size:16px;
 text-transform:uppercase;
 margin-top:5px;
 letter-spacing:2px
}
.site-footer a
{
 color:#737373;
}
.site-footer a:hover
{
 color:#3366cc;
 text-decoration:none;
}
.footer-links
{
 padding-left:0;
 list-style:none
}
.footer-links li
{
 display:block
}
.footer-links a
{
 color:#737373
}
.footer-links a:active,.footer-links a:focus,.footer-links a:hover
{
 color:#3366cc;
 text-decoration:none;
}
.footer-links.inline li
{
 display:inline-block
}
.site-footer .social-icons
{
 text-align:right
}
```

```css
.site-footer .social-icons a
{
 width:40px;
 height:40px;
 line-height:40px;
 margin-left:6px;
 margin-right:0;
 border-radius:100%;
 background-color:#33353d
}
.copyright-text
{
 margin:0
}
@media (max-width:991px)
{
 .site-footer [class^=col-]
 {
   margin-bottom:30px
 }
}
@media (max-width:767px)
{
 .site-footer
 {
   padding-bottom:0
 }
 .site-footer .copyright-text,.site-footer .social-icons
 {
   text-align:center
 }
}
.social-icons
{
 padding-left:0;
 margin-bottom:0;
 list-style:none
}
.social-icons li
{
```

```
 display:inline-block;
 margin-bottom:4px
}
.social-icons li.title
{
 margin-right:15px;
 text-transform:uppercase;
 color:#96a2b2;
 font-weight:700;
 font-size:13px
}
.social-icons a{
 background-color:#eceeef;
 color:#818a91;
 font-size:16px;
 display:inline-block;
 line-height:44px;
 width:44px;
 height:44px;
 text-align:center;
 margin-right:8px;
 border-radius:100%;
 -webkit-transition:all .2s linear;
 -o-transition:all .2s linear;
 transition:all .2s linear
}
.social-icons a:active,.social-icons a:focus,.social-icons a:hover
{
 color:#fff;
 background-color:#29aafe
}
.social-icons.size-sm a
{
 line-height:34px;
 height:34px;
 width:34px;
 font-size:14px
}
.social-icons a.facebook:hover
{
```

```
 background-color:#3b5998
}
.social-icons a.twitter:hover
{
 background-color:#00aced
}
.social-icons a.linkedin:hover
{
 background-color:#007bb6
}
@media (max-width:767px)
{
 .social-icons li.title
 {
   display:block;
   margin-right:0;
   font-weight:600
 }
}
.container2{
 padding-right:15px;
   padding-left:15px;
   margin-right:auto;
   margin-left:auto;
}
ul.abc
{
 list-style-type: square;
 position: relative;
   left: 5%;
}
```

templates/home.html:

```
<html>
   <head>
       <meta charset="UTF-8">
       <title>Fetala Distress Classification</title>
       <meta name="viewport" content="width=device-width, initial-scale=1">
```

```
      <link rel='stylesheet'
href='https://maxcdn.bootstrapcdn.com/bootstrap/3.3.5/css/bootstrap.min.css'>
      <link rel="stylesheet" href="/static/home.css">
      <link rel="stylesheet"
href="https://cdnjs.cloudflare.com/ajax/libs/meyer-reset/2.0/reset.min.css">
      <script
src="https://cdnjs.cloudflare.com/ajax/libs/prefixfree/1.0.7/prefixfree.min.js"></script>
   </head>
   <body>
      <div id=parent>

         <div>
            <div class="header1">
              <a href="#default" class="logo" style="font-family: 'Trebuchet MS';
font-size:xx-large;">Fetal Distress Classification Using Cardiotocography</a>
              <div class="header1-right">
                <a href="https://gamecontent391.000webhostapp.com/Quote/stg.pdf"
target="_blank" style="font-family: 'Lucida Sans', 'Lucida Sans Regular', 'Lucida
Grande', 'Lucida Sans Unicode', Geneva, Verdana, sans-serif;">More Info</a>
              </div>
            </div>
            <div class="heading">
                    <h2 class="texte1">What is Fetal Distress?</h2></br>
                    <p class="texte10">Fetal distress refers to signs before and during
childbirth indicating that the fetus is not well. It typically occurs when the fetus has not
been receiving enough oxygen and when the pregnancy lasts too long.
                    </p></br>
                    <h2 class="texte3">What is Cardiotocography?</h2></br>
                    <p class="texte10">Cardiotocography (CTG) is a technical means of
recording the fetal heartbeat and the uterine contractions during pregnancy. The
machine used to perform the monitoring is called a cardiotocograph, more commonly
known as an electronic fetal monitor (EFM).
                    </p></br>
                    <h2 class="texte4">What are inputs to be given?</h2></br>
                    <p class="texte10">The outputs which are coming from
Cardiotocography Machine of one Person.Those Outputs should be the inputs for this
Software and they should be in integer or decimal format.
                    </p><br>
                    <h2 class="texte5">How Does this Work?</h2></br>
```

```
                    <p class="texte10">This is computer-based approach for analyses the
results and observations made during the cardiotocography and predicts the
possibilities of the fetal distress to be occurred. This Software is designed using
adaptive boosting ensemble learning Algorithms and various other machine learning
algorithms which predicts the status of Distress
                    </p><br>
                    <h2 class="texte6">Different types of Fetal Distress</h2></br>
                    <dl class="texte10" style="color:blanchedalmond">
                        <dt>-Normal</dt>
                        <dt>-Suspecious</dt>
                        <dt>-Pathological</dt>
                    </dl><br>
                    <h2 class="texte6">Different Acronym & Expansion</h2></br>
                    <dl class="texte10" style="color:blanchedalmond">
                        <dt>ASTV : Abnormal Short Term Variability</dt>
                        <dt>MSTV: Mean Value of Short Term Variability</dt>
                        <dt>ALTV : Abnormal Long Term Variability</dt>
                        <dt>MLTV: Mean Value of Long Term Variability</dt>
                    </dl><br>
                    <p class="texte10">The Form in below which is used to give inputs and
get fetal distress as Output
                    </p><br>
                </div >
            </div>
        </br>
            <div>
                <div class="container">
                    <header>
                        <h1>
                            <a href="#">
                                <img src="/static/2.png" alt="Authentic Collection">
                            </a>
                        </h1>
                    </header></br>
                    <form class="registration-form" action="{{ url_for('predict')}}"
method="POST">
                        <h1 class="text-left">Basic Inputs</h1></br></br>
                        <label class="col-one-half">
                            <span class="label-text">BaseLine Value</span><br>
                            <input type="text" name="baseline_value" required>
```

```
      </label>
      <label class="col-one-half">
        <span class="label-text">Accelerations</span><br>
        <input type="text" name="accelerations" required>
      </label>
      <label class="col-one-half">
        <span class="label-text">Fetal Movement</span><br>
        <input type="text" name="fetal_movement" required>
      </label>
      <label class="col-one-half">
        <span class="label-text">Uterine Contractions</span><br>
        <input type="text" name="uterine_contractions" required>
      </label></br>
      <h1 class="text-left">Decelerations Inputs</h1></br></br>
      <label class="col-one-half">
        <span class="label-text">Light Decelerations</span><br>
        <input type="text" name="light_decelerations" required>
      </label>
      <label class="col-one-half">
        <span class="label-text">Severe_Decelerations</span><br>
        <input type="text" name="severe_decelerations" required>
      </label>
      <label >
        <span class="label-text" style="font-family: 'Trebuchet MS'; font-size:
0.8em;">Prolongued Decelerations</span><br>
        <input type="text" name="prolongued_decelerations" required>
      </label></br>


      <h1 class="text-left">Variability Inputs</h1></br></br>
      <label class="col-one-half1">
        <span class="label-text">ASTV</span><br>
        <input type="text" name="ASTV" required>
      </label>
      <label class="col-one-half1">
        <span class="label-text">MSTV</span><br>
        <input type="text" name="MSTV" required>
      </label>
      <label class="col-one-half1">
        <span class="label-text">ALTV</span><br>
```

```
    <input type="text" name="ALTV" required>
</label>
<label class="col-one-half1">
    <span class="label-text">MLTV</span><br>
    <input type="text" name="MLTV" required>
</label></br>
<h1 class="text-left">Histogram Inputs</h1></br></br>
<label class="col-one-half1">
    <span class="label-text">width</span><br>
    <input type="text" name="width" required>
</label>
<label class="col-one-half1">
    <span class="label-text">min</span><br>
    <input type="text" name="min" required>
</label>
<label class="col-one-half1">
    <span class="label-text">max</span><br>
    <input type="text" name="max" required>
</label>
<label class="col-one-half1">
    <span class="label-text">no:of peaks</span><br>
    <input type="text" name="no_of_peaks" required>
</label>
<label class="col-one-half1">
    <span class="label-text">no:of zeros</span><br>
    <input type="text" name="no_of_zeros" required>
</label>
<label class="col-one-half1">
    <span class="label-text">mode</span><br>
    <input type="text" name="mode" required>
</label>
<label class="col-one-half1">
    <span class="label-text">mean</span><br>
    <input type="text" name="mean" required>
</label>
<label class="col-one-half1">
    <span class="label-text">median</span><br>
    <input type="text" name="median" required>
</label>
<label class="col-one-half1">
```

```
                    <span class="label-text">variance</span><br>
                    <input type="text" name="variance" required>
                </label>
                <label class="col-one-half1">
                    <span class="label-text">tendency</span><br>
                    <input type="text" name="tendency" required>
                </label>



                <div class="text-center">
                    <input type="submit" class="submit" style="font-family: 'Trebuchet
MS';">
                </div>
            </form>
        </div>
    </div> </br></br>
    <div>
            <!-- Site footer -->
  <footer class="site-footer">
      <div class="container2">
        <div class="row">
          <div class="col-sm-12 col-md-6">
            <h6>About</h6>
            <p class="text-justify">This Software Allows Doctors/Persons to analyse the
Cardiotocography Data and get Prediction of Fetal Distress. This Software is mainly
decide to save time for Doctors like Gynaecologist and this is user friendly one can
easily understand and they can check their status of Fetal Distress and it gives the tips
and further steps to be taken by the person if any Problem in Fetal.</p>
          </div>


           <div class="col-xs-6 col-md-3">
            <h6>Contact Us</h6>
            <ul class="footer-links">
              <li><a href="https://www.facebook.com/alleshivasai"
target="_blank">Facebook</a></li>
              <li><a href="https://www.instagram.com/shivasai_alle/"
target="_blank">Instagram</a></li>
```

```
              <li><a href="https://www.linkedin.com/in/shiva-sai-alle-764b2a1ab/"
target="_blank">Linkedin</a></li>
              <li><a href="https://www.youtube.com/channel/UCfthEj3oCLiFakXtSzhZ7Dw"
target="_blank">Youtube</a></li>
            </ul>
          </div>
            <div class="col-xs-6 col-md-3">
              <h6>Quick Links</h6>
              <ul class="footer-links">
                <li><a href="https://gamecontent391.000webhostapp.com/Quote/stg.pdf"
target="_blank">More Info</a></li>
              </ul>
            </div>

          </div>
          <div class="col-md-8 col-sm-6 col-xs-12">
              <p class="copyright-text">Copyright &copy; 2021 All Rights Reserved by
           <a href="#">Alle Shiva Sai</a>.
              </p>
            </div>

        </div><br>
   </footer>

      </div>
           </div>
      <script
src='https://cdnjs.cloudflare.com/ajax/libs/jquery/2.1.3/jquery.min.js'></script>
<script
src='https://maxcdn.bootstrapcdn.com/bootstrap/3.3.4/js/bootstrap.min.js'></script>
<script
src='https://cdnjs.cloudflare.com/ajax/libs/jquery.touchswipe/1.6.4/jquery.touchSwipe.mi
n.js'></script>
   </body>
</html>
```

templates/test.html:

```
<html>
   <head>
```

```
        <meta charset="UTF-8">
        <title>Fetal Distress Classification</title>
        <meta name="viewport" content="width=device-width, initial-scale=1">
        <link rel='stylesheet'
href='https://maxcdn.bootstrapcdn.com/bootstrap/3.3.5/css/bootstrap.min.css'>
        <link rel="stylesheet" href="/static/home.css">
        <link rel="stylesheet"
href="https://cdnjs.cloudflare.com/ajax/libs/meyer-reset/2.0/reset.min.css">
        <script
src="https://cdnjs.cloudflare.com/ajax/libs/prefixfree/1.0.7/prefixfree.min.js"></script>
        <script
src="https://cdnjs.cloudflare.com/ajax/libs/Chart.js/2.4.0/Chart.min.js"></script>
    </head>
    <body>
        <div id=parent>

            <div>
                <div class="header1">
                  <a href="#default" class="logo" style="font-family: 'Trebuchet MS';
font-size:xx-large;">Fetal Distress Classification Using Cardiotocography</a>
                  <div class="header1-right">
                    <a href="https://gamecontent391.000webhostapp.com/Quote/stg.pdf"
target="_blank" style="font-family: 'Lucida Sans', 'Lucida Sans Regular', 'Lucida
Grande', 'Lucida Sans Unicode', Geneva, Verdana, sans-serif;">More Info</a>
                  </div>
               </div>
            </div><br>
            <div class="container" style="font-size: x-large;">
                <div>
                    <label><h2 class='texte8'>Status of Fetal Distress</h2></label>
                </div>
                <br>
                <div>
                    {% if prediction==1.0 %}
                    <h2 class="texte2" style="color:rgb(0, 255, 0); font-size:
x-large;">Normal.<br> Please be cool</h2>
                    {% elif prediction==2.0 %}
                    <h2 class="texte2" style="color:orange; font-size:
x-large;">Suspecious.<br> Be careful! Chances of Distress</h2>
                    {% elif prediction==3.0 %}
```

```
                <h2 class="texte2" style="color:rgb(255, 0, 0); font-size:
x-large;">Pathological.<br>Need an Emergency Treatment</h2>
                {% else %}
                <h2 class="texte2" style="color:rgb(0, 192, 226); font-size: x-large;">Some
thing went wrong. PLease check once</h2>
                {% endif %}

            </div>
        </div><br>
        <div class="container" style="font-size: x-large;">
            <div>

                <label><h2 class='texte8'>Analysis of Fetal Distress</h2></label>
            </div>
            <br>
            <div>
                {% if prediction==1.0 %}
                <p class="texte2" style="color:rgb(0, 255, 0); font-size: 0.8em;">
                  The Fetal Heart rate is 110-160 bpm and variability is betweeen 5 to 25
bpm.
                  The decelerations are non repetive and there are atleast 2 accelerations in
20 minutes of CTG
                  The Uterine Contradictions are also normal. So we can conclude that there
is no fetal distress and it is normal.
                </p>
                {% elif prediction==2.0 %}
                <p class="texte2" style="color:orange; font-size: 0.8em;">

                  The fetal heart rate it is 100bpm to 110bpm or greater than 160 bpm. The
variability is greater than 25 bpm or less than 5 bpm for 40 min and also having
decelerations like early deceleration variable or single prolonged decelerations and
absence of accelerations. The Uterine contractions are 5 and it is somewhat suspicious.
Thus we can conclude that 50% chance of occurring fetal distress in future.
                </p>
                {% elif prediction==3.0 %}
                <p class="texte2" style="color:red; font-size: 0.8em;">

                  The fetal heart rate is below 100 bpm and a pattern of variable is
sinusoidal and greater than 25 bpm or less than 5 bpm for 90 minutes. The
decelerations are greater than 3 minutes and they are late decelerations and prolonged
```

```
deceleration and no accelerations are present. The uterine contractions are greater than
5 and it is dangerous. Thus we can conclude that that fatal is in severe condition need
an emergency support.
                </p>
                {% else %}
                <p class="texte2" style="color:rgb(255, 0, 0); font-size: x-large;">Got Some
Error</p>
                {% endif %}

            </div>
        </div><br>

        <div class="container" style="font-size: x-large;">
          <div>
            <label><h2 class='texte8'>Graphs</h2></label>
          </div><br>
          <div>
            <div style="height: 300;">
              <canvas id='linechart5' width="600" height="300"></canvas>
              <script>
                var ctx = document.getElementById("linechart5").getContext("2d");
                var linechart = new Chart(ctx,{
                    type:"line",
                    data: {
                        labels: {{ labels5 | safe }},
                        datasets: [
                            {
                                data:{{ values5 | safe }},
                                fill:false,
                                borderColor: "rgb(75,192,192)",
                                lineTension:0.1,
                                backgroundColor:[
                            'rgba(255, 99, 132, 0.6)',
                            'rgba(54, 162, 235, 0.6)',
                            'rgba(255, 206, 86, 0.6)',
                            'rgba(75, 192, 192, 0.6)',
                            'rgba(153, 102, 255, 0.6)',
                            'rgba(255, 159, 64, 0.6)'
                            ],
```

```
            }
          ],

        },
        options:{
          responsive: false,
          legend: {display: false},
          scales: {
                yAxes: [{
                  ticks: {
                    beginAtZero: true,
                    min: 0
                  }
                }],
                xAxes: [{
                  barPercentage: 0.6,
                  maxBarThickness: 5 ,
                  minBarLength: 10,
                }]
          },
          title:{
            display:true,
            text:'Basic Important Readings',
            fontSize:15
          }
        }
      });

  </script>
  </div><br>
<div style="height: 300;">
  <canvas id='linechart1' width="600" height="300"></canvas>
  <script>
      var ctx = document.getElementById("linechart1").getContext("2d");
      var linechart = new Chart(ctx,{
        type:"line",
        data: {
          labels: {{ labels1 | safe }},
          datasets: [
            {
```

```
                data:{{ values1 | safe }},
                fill:false,
                borderColor: "rgb(75,192,192)",
                lineTension:0.1,
                backgroundColor:[
            'rgba(255, 99, 132, 0.6)',
            'rgba(54, 162, 235, 0.6)',
            'rgba(255, 206, 86, 0.6)',
            'rgba(75, 192, 192, 0.6)',
            'rgba(153, 102, 255, 0.6)',
            'rgba(255, 159, 64, 0.6)'
            ],

            }
        ],

    },
    options:{
        responsive: false,
        legend: {display: false},
        scales: {
                yAxes: [{
                    ticks: {
                        beginAtZero: true,
                        min: 0
                    }
                }],
                xAxes: [{
                    barPercentage: 0.6,
                    maxBarThickness: 5 ,
                    minBarLength: 10,
                }]
        },
        title:{
            display:true,
            text:'Decelerations Readings',
            fontSize:15
        }
    }
});
```

```
</script>
</div><br>
<div style="height: 300;">
 <canvas id='linechart2' width="600" height="300"></canvas>
 <script>
   var ctx = document.getElementById("linechart2").getContext("2d");
   var linechart = new Chart(ctx,{
     type:"line",
     data: {
       labels: {{ labels2 | safe }},
       datasets: [
         {
           data:{{ values2 | safe }},
           fill:false,
           borderColor: "rgb(75,192,192)",
           lineTension:0.1,
           backgroundColor:[
         'rgba(255, 99, 132, 0.6)',
         'rgba(54, 162, 235, 0.6)',
         'rgba(255, 206, 86, 0.6)',
         'rgba(75, 192, 192, 0.6)',
         'rgba(153, 102, 255, 0.6)',
         'rgba(255, 159, 64, 0.6)'
         ],

         }
       ],

     },
     options:{
       responsive: false,
       legend: {display: false},
       scales: {
           yAxes: [{
             ticks: {
               beginAtZero: true,
               min: 0
             }
           }],
```

```
                    xAxes: [{
                        barPercentage: 0.6,
                        maxBarThickness: 5 ,
                        minBarLength: 10,
                    }]
                },
                title:{
                    display:true,
                    text:'Variability Readings',
                    fontSize:15
                }
            }
        });

    </script>
    </div> <br>
    <div>
      <h3 class="texte2" style="color:rgb(0, 0, 0); font-size:small;"> ASTV :
Abnormal Short Term Variability      MSTV: Mean Value of Short
Term Variability</h3>
      <h3 class="texte2" style="color:rgb(0, 0, 0); font-size:small;"> ALTV :
Abnormal Long Term Variability         MLTV: Mean Value of
Long Term Variability</h3>
    </div><br>
    <div style="height: 300;">
      <canvas id='linechart3' width="600" height="300"></canvas>
      <script>
        var ctx = document.getElementById("linechart3").getContext("2d");
        var linechart = new Chart(ctx,{
            type:"bar",
            data: {
                labels: {{ labels3 | safe }},
                datasets: [
                    {
                        data:{{ values3 | safe }},
                        fill:false,
                        borderColor: "rgb(75,192,192)",
                        lineTension:0.1,
                        backgroundColor:[
                    'rgba(255, 99, 132, 1)',
```

```
            'rgba(54, 162, 235, 1)',
            'rgba(255, 206, 86, 1)',
            'rgba(75, 192, 192, 1)',
            'rgba(153, 102, 255, 1)',
            'rgba(255, 159, 64, 1)',
            'rgba(242, 64, 255, 1)'
            ],

            }
          ],

        },
        options:{
          responsive: false,
          legend: {display: false},
          scales: {
                yAxes: [{
                    ticks: {
                        beginAtZero: true,
                        min: 0
                    }
                }],
                xAxes: [{
                    barPercentage: 0.6,
                    maxBarThickness: 5 ,
                    minBarLength: 10,
                }]
          },
          title:{
            display:true,
            text:'Histogram Readings',
            fontSize:15
          }
        }
      });

</script>
</div> <br>
<div style="height: 400;">
 <canvas id='linechart4' width="600" height="400"></canvas>
```

```
        <script>
          var ctx = document.getElementById("linechart4").getContext("2d");
          var linechart = new Chart(ctx,{
            type:"polarArea",
            data: {
              labels: {{ labels4 | safe }},
              datasets: [
                {
                  data:{{ values4 | safe }},
                  fill:false,
                  borderColor: "rgb(75,192,192)",
                  lineTension:0.1,
                  backgroundColor:[
                'rgba(255, 99, 132, 1)',
                'rgba(54, 162, 235, 1)',
                'rgba(255, 206, 86, 1)',
                'rgba(75, 192, 192, 1)',
                'rgba(153, 102, 255, 1)',
                'rgba(255, 159, 64, 1)',
                'rgba(242, 64, 255, 1)'
                ],

                }
              ],

            },
            options:{
              responsive: false,
              legend: {display: true},
              title:{
                display:true,
                text:'Output Comparison',
                fontSize:15
              }
            }
          });

        </script>
        </div>
    </div>
```

```
    </div><br>
    <div class="container" style="font-size: x-large;">
     <div>
       <label><h2 class='texte8'>Further Steps to be taken</h2></label>
     </div>
     <br>
     <div>
       {% if prediction==1.0 %}
       <p class="texte2" style="color:rgb(0, 255, 0); font-size: 0.8em;">
         <ul class="texte2" style="color:rgb(0, 255, 0); font-size: 0.8em;">
           <ul class="abc">
           <li>No intervention necessary to improve fetal oxygenation state</li>
           <li>Continue CTG for extra few minutes</li>
         </ul>
         </ul>
       </p>
       {% elif prediction==2.0 %}
       <p class="texte2" style="color:orange; font-size: 0.8em;">
       <ul class="texte2" style="color:orange; font-size: 0.8em;">
       <ul class="abc">
         <li>Correct any underlying causes such as hypotension or uterine
hyperstimulation</li>
         <li>Start one or more conservative measures</li>
         <li>Inform an obstetrician or a senior midwife</li>
         <li>Document a plan for reviewing the whole clinical picture and the CTG
findings</li>
         <li>Action to correct reversible causes if identified, close monitoring or
additional methods to evaluate fetal oxygenation</li>
       </ul>
       </ul>
       </p>
       {% elif prediction==3.0 %}
       <p class="texte2" style="color:red; font-size: 0.8em;">

         <ul class="texte2" style="color:red; font-size: 0.8em;">
           <ul class="abc">
             <li>Obtain a review by an obstetrician and a senior midwife</li>
             <li>Exclude acute events (e.g. cord prolapse, suspected placental
abruption, or suspected uterine rupture)</li>
```

```
                <li>Correct any underlying causes, such as hypotension or uterine
hyperstimulation</li>
                <li>Start one or more conservative measures</li>
                <li>If the CTG trace is still pathological after implementing conservative
measures then offer digital fetal scalp stimulation and document the outcome
                </li>
                <li>If the cardiotocograph trace is still pathological after fetal scalp
stimulation consider fetal blood sampling and expediting the birth</li>
                <li>If the CTG trace is still pathological then make preparations for an
urgent birth and expedite the birth if the acute bradycardia persists for 9 min</li>
              </ul>
              </ul>
          </p>
          {% else %}
          <p class="texte2" style="color:rgb(255, 0, 0); font-size: x-large;">Got Some
Error</p>
          {% endif %}

        </div>
    </div><br>
    <div class="container" style="font-size: x-large;">
      <div>
        <label><h2 class='texte8'>Recommended Medicines</h2></label>
      </div>
      <br>
      <div>
        {% if prediction==1.0 %}
        <h2 class="texte2" style="color:rgb(0, 255, 0); font-size: x-large;">No Need to
take extra Medicines<br> Follow basic Medicine which contains:</h2>
        <ul class="texte2" style="color:rgb(0, 255, 0); font-size: 0.7em;">
          <ul class="abc">
          <li>Folic Acid</li>
          <li>Iron</li>
          <li>Calcium</li>
          <li>Anti-hypertensive drug</li>
          <li>Diuretics</li>
        </ul>
        </ul>
        {% elif prediction==2.0 %}
```

```
        <h2 class="texte2" style="color:orange; font-size: x-large;">As condition is Suspecious below medicines are recommended<br><h3 class="texte2" style="color:orange; font-size:medium;">(Note: Please Use Medicine Based on the Patient condition)</h3></h2>
        <ul class="texte2" style="color:rgb(0, 0, 0); font-size: 0.8em;">
          <ul class="abc">
            <li><h3 class="texte9" style="color:rgb(0, 0, 0); font-size:large;">Tocolytics: </h3><h3 class="texte9" style="color:orange; font-size:large;">Drug that relax the uterus are thought to improve the blood circulation round the placenta and uterus.</h3></li>
            <li><h3 class="texte9" style="color:rgb(0, 0, 0); font-size:large;">Amiodarone: </h3><h3 class="texte9" style="color:orange; font-size:large;">This drug has been described favorably which helps to treat normal fetal problems and it's not most effective so one can use easily</h3></li>
            <li><h3 class="texte9" style="color:rgb(0, 0, 0); font-size:large;">terbutaline: </h3><h3 class="texte9" style="color:orange; font-size:large;">This drug to stop or slow the contractions which are more high and helps when the patient labour is not right to deliver</h3></li>
            <li><h3 class="texte9" style="color:rgb(0, 0, 0); font-size:large;">Digoxin: </h3><h3 class="texte9" style="color:orange; font-size:large;">This drug is the most common drug used to treat FT. After digoxin, sotalol seems to be the most promising agent, specifically in atrial flutter and nonhydropic supraventricular tachycardia (SVT)</h3></li>

          </ul>
          </ul>
        {% elif prediction==3.0 %}
        <h2 class="texte2" style="color:rgb(255, 0, 0); font-size: x-large;">As condition is Serious below medicines are recommended<br><h3 class="texte2" style="color:rgb(255, 0, 0); font-size:medium;">(Note: Please Use Medicine Based on the Patient condition)</h3></h2>
        <ul class="texte2" style="color:rgb(0, 0, 0); font-size: 0.8em;">
          <ul class="abc">
            <li><h3 class="texte9" style="color:rgb(0, 0, 0); font-size:large;">Tocolytics: </h3><h3 class="texte9" style="color:rgb(255, 0, 0); font-size:large;">Drug that relax the uterus are thought to improve the blood circulation round the placenta and uterus.</h3></li>
            <li><h3 class="texte9" style="color:rgb(0, 0, 0); font-size:large;">Amiodarone: </h3><h3 class="texte9" style="color:rgb(255, 0, 0); font-size:large;">This drug has been described favorably which helps to treat normal fetal problems and it's not most effective so one can use easily</h3></li>
```

```
            <li><h3 class="texte9" style="color:rgb(0, 0, 0); font-size:large;">terbutaline:
</h3><h3 class="texte9" style="color:rgb(255, 0, 0); font-size:large;">This drug to stop
or slow the contractions which are more high and helps when the patient labour is not
right to deliver</h3></li>
            <li><h3 class="texte9" style="color:rgb(0, 0, 0); font-size:large;">Digoxin:
</h3><h3 class="texte9" style="color:rgb(255, 0, 0); font-size:large;">This drug is the
most common drug used to treat FT. After digoxin, sotalol seems to be the most
promising agent, specifically in atrial flutter and nonhydropic supraventricular
tachycardia (SVT)</h3></li>
            <li><h3 class="texte9" style="color:rgb(0, 0, 0);
font-size:large;">Amnioinfusion: </h3><h3 class="texte9" style="color:rgb(255, 0, 0);
font-size:large;">The insertion of this drug fluid into the amniotic cavity to alleviate
compression of the umbilical cord</h3></li>
            <li><h3 class="texte9" style="color:rgb(0, 0, 0); font-size:large;">Flecainide:
</h3><h3 class="texte9" style="color:rgb(255, 0, 0); font-size:large;">This drug is a very
effective drug in the treatment of fetal SVT, although concerns about possible
pro-arrhythmic effects have limited its use</h3></li>
            <li><h3 class="texte9" style="color:rgb(0, 0, 0); font-size:large;">oxytocin:(try
not to use this drug) </h3><h3 class="texte9" style="color:rgb(255, 0, 0);
font-size:large;">This drug that makes the uterus contract more frequently and more
forcefully which leads to immediate deliver</h3></li>
          </ul>
          </ul>
         {% else %}
         <h2 class="texte2" style="color:rgb(0, 192, 226); font-size: x-large;">Some thing
went wrong. PLease check once</h2>
         {% endif %}

      </div>
   </div><br>
         <div>
           <button type="button" class="btn btn-light btn-lg"
onclick="window.print()">Print</button>
         </div>
         <div>
            <!-- Site footer -->
<footer class="site-footer">
 <div class="container2">
   <div class="row">
     <div class="col-sm-12 col-md-6">
```

```
       <h6>About</h6>
       <p class="text-justify">This Software Allows Doctors/Persons to analyse the
Cardiotocography Data and get Prediction of Fetal Distress. This Software is mainly
decide to save time for Doctors like Gynaecologist and this is user friendly one can
easily understand and they can check their status of Fetal Distress and it gives the tips
and further steps to be taken by the person if any Problem in Fetal.</p>
     </div>



     <div class="col-xs-6 col-md-3">
       <h6>Contact Us</h6>
       <ul class="footer-links">
         <li><a href="https://www.facebook.com/alleshivasai"
target="_blank">Facebook</a></li>
         <li><a href="https://www.instagram.com/shivasai_alle/"
target="_blank">Instagram</a></li>
         <li><a href="https://www.linkedin.com/in/shiva-sai-alle-764b2a1ab/"
target="_blank">Linkedin</a></li>
         <li><a href="https://www.youtube.com/channel/UCfthEj3oCLiFakXtSzhZ7Dw"
target="_blank">Youtube</a></li>
       </ul>
     </div>
       <div class="col-xs-6 col-md-3">
         <h6>Quick Links</h6>
         <ul class="footer-links">
           <li><a href="https://gamecontent391.000webhostapp.com/Quote/stg.pdf"
target="_blank">More Info</a></li>
         </ul>
       </div>

     </div>
     <div class="col-md-8 col-sm-6 col-xs-12">
         <p class="copyright-text">Copyright &copy; 2021 All Rights Reserved by
      <a href="#">Alle Shiva Sai</a>.
         </p>
       </div>

   </div><br>
</footer>
```

```
 </div>
       </div>
   </body>
</html>
```

app.py

```
from flask import Flask,render_template,request
import numpy as np
import pickle
import pandas as pd
from sklearn.svm import SVC
from sklearn.preprocessing import StandardScaler
from sklearn import preprocessing
from sklearn.ensemble import RandomForestClassifier
app = Flask(__name__)
model = pickle.load(open('modelrf.pkl', 'rb'))
scaler = pickle.load(open('scaler.pkl', 'rb'))
@app.route('/')
def index():
   return render_template('home.html')
@app.route('/predict',methods=['POST'])
def predict():
   features = [float(x) for x in request.form.values()]
   data = features
   final_features = [np.array(features)]
   final_features = scaler.transform(final_features)
   prediction = model.predict(final_features)
   labels = ['Baseline Value', 'Accelerations', 'Fetal Movement',
      'Uterine Contractions', 'Light Decelerations', 'Severe Decelerations',
      'Prolongued Decelerations', 'ASTV',
      'MSTV',
      'ALTV',
      'MLTV', 'Width',
      'Min', 'Max', 'No: of peaks',
      'No: of zeros', 'Mode', 'Mean',
      'Median', 'Variance', 'Tendency',
      'Fetal Status']
   data1 = data[4:7]
```

```
    labels1 = labels[4:7]
    data2 = data[7:11]
    labels2 = labels[7:11]
    data31 = data[11:14]
    data32 = data[16:20]
    data3 = data31+data32
    labels31 = labels[11:14]
    labels32 = labels[16:20]
    labels3 = labels31 + labels32
    data5 = data[1:4]
    labels5 = labels[1:4]
    data41 = [100,110,160]
    data41.append(data[0])
    data4 = data41
    labels41 = ['Pathological','Suspecious','Normal','Fetal Heartrate']
    labels4 = labels41

    return
render_template("test.html",values1=data1,labels1=labels1,values2=data2,labels2=labels2,values3=data3,labels3=labels3,values4=data4,labels4=labels4,values5=data5,labels5=labels5,prediction=prediction[0])

if __name__ == '__main__':
    app.run()
```

model.py

```
import numpy as np
import pandas as pd
from sklearn.preprocessing import StandardScaler
from sklearn import preprocessing
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.ensemble import ExtraTreesClassifier
from sklearn.ensemble import StackingClassifier
from sklearn.model_selection import cross_val_score
from sklearn.metrics import precision_score, recall_score, confusion_matrix,
classification_report, accuracy_score, f1_score
import pickle
df = pd.read_csv("fetal_health.csv")
X=df.drop(["fetal_health"],axis=1)
```

```
y=df["fetal_health"]
col_names = list(X.columns)
scaler = preprocessing.StandardScaler()
X_df= scaler.fit_transform(X)
X_df = pd.DataFrame(X_df, columns=col_names)
X_train, X_test, y_train,y_test = train_test_split(X_df,y,test_size=0.2,random_state=42)
from sklearn.ensemble import RandomForestClassifier
rf = RandomForestClassifier()
rf.fit(X_train, y_train)
from sklearn.metrics import precision_score, recall_score, confusion_matrix,
classification_report, accuracy_score, f1_score
pred_rf = rf.predict(X_test)
accuracy = accuracy_score(y_test, pred_rf)
print(accuracy)
pickle.dump(rf, open('modelrf.pkl', 'wb'))
pickle.dump(scaler, open('scaler.pkl', 'wb'))
model = pickle.load(open('modelrf.pkl', 'rb'))
print(model)
```

Fetal.ipynd

```
import numpy as np
import pandas as pd
df = pd.read_csv("fetal_health.csv")
df.head()
df.describe().T
import seaborn as sns
colours=["#f7b2b0","#8f7198", "#003f5c"]
sns.countplot(data= df, x="fetal_health",palette=colours)
import matplotlib.pyplot as plt
plt.figure(figsize=(15,15))
cmap = sns.diverging_palette(250, 10, s=80, l=55, n=9, as_cmap=True)
sns.heatmap(df.corr(),annot=True, cmap=cmap, center=0)
sns.lmplot(data =df,x="accelerations",y="fetal_movement",palette=colours,
hue="fetal_health",legend_out=False)
plt.show()
sns.lmplot(data =df,x="prolongued_decelerations",y="fetal_movement",palette=colours,
hue="fetal_health",legend_out=False)
plt.show()
```

```
sns.lmplot(data
=df,x="abnormal_short_term_variability",y="fetal_movement",palette=colours,
hue="fetal_health",legend_out=False)
plt.show()
sns.lmplot(data
=df,x="mean_value_of_long_term_variability",y="fetal_movement",palette=colours,
hue="fetal_health",legend_out=False)
plt.show()
shades =["#f7b2b0","#c98ea6","#8f7198","#50587f", "#003f5c"]
plt.figure(figsize=(20,10))
sns.boxenplot(data = df,palette = shades)
plt.xticks(rotation=90)
plt.show()
X=df.drop(["fetal_health"],axis=1)
y=df["fetal_health"]
from sklearn.preprocessing import StandardScaler
col_names = list(X.columns)
from sklearn import preprocessing
scaler = preprocessing.StandardScaler()
X_df= scaler.fit_transform(X)
X_df = pd.DataFrame(X_df, columns=col_names)
X_df.describe().T
plt.figure(figsize=(20,10))
sns.boxenplot(data = X_df,palette = shades)
plt.xticks(rotation=90)
plt.show()
from sklearn.model_selection import train_test_split
X_train, X_test, y_train,y_test = train_test_split(X_df,y,test_size=0.3,random_state=42)
from sklearn.ensemble import RandomForestClassifier
rf = RandomForestClassifier()
rf.fit(X_train, y_train)
from sklearn.metrics import precision_score, recall_score, confusion_matrix,
classification_report, accuracy_score, f1_score
pred_rf = rf.predict(X_test)
accuracy = accuracy_score(y_test, pred_rf)
print(accuracy)
from sklearn.model_selection import GridSearchCV
from sklearn.model_selection import cross_val_score
parameters = {
  'n_estimators': [100,150, 200,500,700,900],
```

```
  'max_features': ['auto', 'sqrt', 'log2'],
  'max_depth' : [4,6,8,12,14,16],
  'criterion' :['gini', 'entropy'],
  'n_jobs':[-1,1,None]
}
#Fitting the trainingset to find parameters with best accuracy
CV_rfc = GridSearchCV(estimator=RandomForestClassifier(), param_grid=parameters,
cv= 5)
RF_model = RandomForestClassifier(criterion= 'entropy',
max_depth= 12,
max_features= 'auto',
n_estimators= 150,
n_jobs= None)
RF_model.fit(X_train, y_train)
#Testing the Model on test set
predictions=RF_model.predict(X_test)
acccuracy= accuracy_score(y_test,predictions)
acccuracy
acccuracy = accuracy_score(y_test, predictions)
recall = recall_score(y_test, predictions, average="weighted")
precision = precision_score(y_test, predictions, average="weighted")
f1_score = f1_score(y_test, predictions, average="micro")
print("********* Random Forest Results *********")
print("Accuracy : ", acccuracy)
print("Recall : ", recall)
print("Precision : ", precision)
print("F1 Score : ", f1_score)
rf2 = RandomForestClassifier(criterion="gini", n_estimators = 100, min_samples_leaf=1,
min_samples_split=2, random_state=42)
rf2.fit(X_train, y_train)
predictions2=rf2.predict(X_test)
acccuracy= accuracy_score(y_test,predictions2)
acccuracy
confusion_matrix(y_test, predictions)
confusion_matrix(y_test, predictions2)
```

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