

FETAL ARC

Predicting Fetal Health, and
Birth-Weight of fetus using
Machine Learning

Simran | MT21146 | Group: 28

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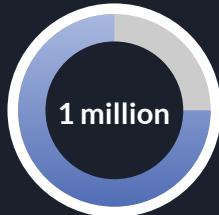
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PROBLEM STATEMENT

- Pregnancy - Beautiful Phase
- Healthy pregnancy → Healthy Baby
- Fetal health is crucial.
- Stats by WHO



Babies
which die



- Hours of Birth
- Premature Birth
- Complications during delivery



Women die
(during/ post
delivery)



PROBLEM STATEMENT (FETAL HEALTH)

- CTG - Cardiotocography (third trimester/during delivery)
- Mother (uterine contractions)
 - baseline (no pain), pain intensity, time duration of contraction, time gap between two contractions.
- Fetus (heart beat)
 - baseline (no uterine contraction), variability (denoting happy state), acceleration (speed up in heart beat above 15 beats wrt baseline within 15 seconds during fetal movements), deceleration (decrease in heart beat below 15 beats wrt baseline during uterine contraction)
- CLASSIFICATION PROBLEM
- Fetal Health → NORMAL
 - parameters are within desired range
- Fetal Health → SUSPECT
 - one of the parameter is abnormal | fetal tests
- Fetal Health → PATHOLOGICAL
 - more than one parameters are abnormal | contingency plan
- ML algorithms assist and support doctors.



(BIRTH WEIGHT)

- Complications/ Premature delivery
- Risk during delivery
- Mortality rate within one year
- Diseases in adulthood - Somewhat related
- No direct method - doctor's experience
- ML algorithms - prediction
- Regression problem (predicted weight) - focus
- Classification (low weight/ normal weight/ overweight)

DATASET AND ANALYSIS/ PREPROCESSING

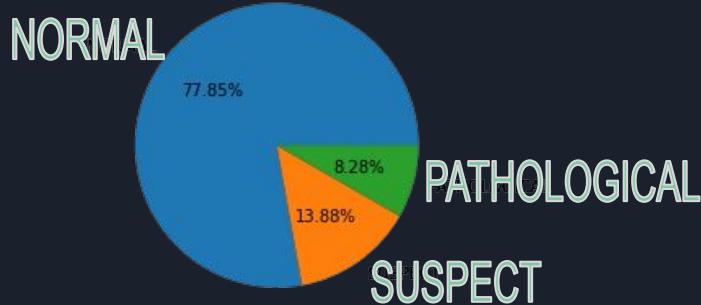
FETAL HEALTH → <https://www.kaggle.com/andrewmvd/fetal-health-classification>

BIRTH WEIGHT → <people.reed.edu/~jones/141/Bwt.dat>

FETAL HEALTH CLASSIFICATION

Overall the conclusions from the dataset are:

- The no. of features are now reduced to 19 (after EDA).
- There is class imbalance.
- Standard Scaling is applied on dataset.



BIRTH WEIGHT PREDICTION

Insights about data.

- First born child has a little lower birth weight as compared to child born after first child.
- As gestational age increases then birth weight also increases.
- Having baby after 42 age and before 20 years of age is risky.
- Usually mothers who smoke have lower weight babies.
- Tall mothers give birth to babies with weight on little higher side.



WEBSITE LINK

<https://fetalhealth-simran.herokuapp.com/>



Final Model and Comparison with Baseline Systems & Results (Fetal Health Classification)

Final Prediction:
Through Majority Voting

Base Models	Parameters
SVC	class_weight="balanced" OVO kernel="rbf"
RandomForest	n_estimators=65 class_weight="balanced" criterion="gini" min_samples_leaf=15
DecisionTree	max_depth=7 min_samples_split=10
Adaboost	n_estimators=40 learning_rate=1.5 base_estimator=DTC



Final Model and Comparison with Baseline Systems & Results (Fetal Health Classification)

M1: Mode (Baseline 1)

M2: Logistic Regression (Baseline 2)

M3: Final Model

TRAINING SET RESULTS

CLASS	Recall Score (M1)	Recall Score (M2)	Recall Score (M3)
NORMAL	1.000000	0.959909	0.931921
SUSPECT	0.000000	0.816327	0.965986
PATHOLOGICAL	0.000000	0.683983	0.956710
MACRO RECALL	0.333333	0.820073	0.951539



Final Model and Comparison with Baseline Systems & Results (Fetal Health Classification)

M1: Mode (Baseline 1)

M2: Logistic Regression (Baseline 2)

M3: Final Model

TESTING SET RESULTS

CLASS	Recall Score (M1)	Recall Score (M2)	Recall Score (M3)
NORMAL	1.000000	0.927928	0.912913
SUSPECT	0.000000	0.689655	0.931034
PATHOLOGICAL	0.000000	0.656250	0.921875
MACRO RECALL	0.333333	0.757944	0.921941

Final Model and Comparison with Baseline Systems & Results (Birth Weight Prediction)

Base Models	Parameters
RandomForest	n_estimators=4 max_depth=4 criterion="squared_error" random_state=8
Adaboost	n_estimators=11 learning_rate=1.2 loss="exponential"

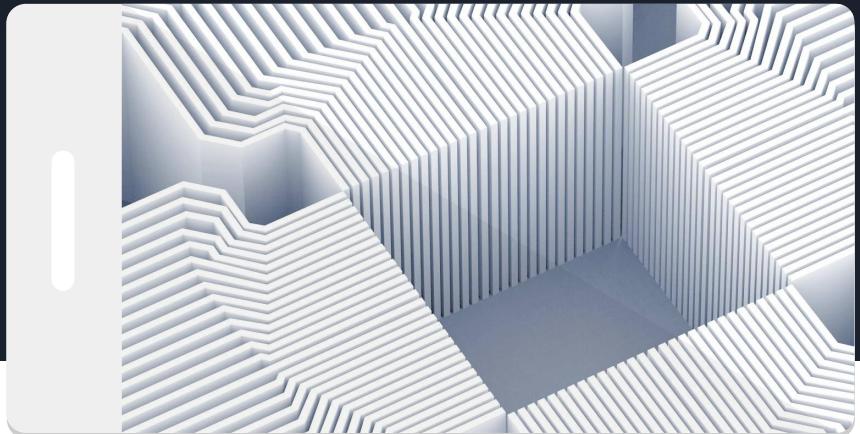
Base Estimator in Adaboost Regressor:
DecisionTreeRegressor(
criterion="absolute error",
max_depth=3, random_state=1)

RMSE (ROOT MEAN SQUARE ERROR)		
MODELS	Train Set	Test Set
MEAN	0.517	0.532
KNN	0.399	0.506
FINAL MODEL	0.421	0.441

Final Prediction = 5/6 * Adaboost Regressor Prediction +
1/6 * RandomForest Regressor Prediction

CONCLUSION

- Potential one stop solution to fetal care.
- Birth Weight prediction module is better than previous work → can be deployed end to end
- Fetal health classification → recall score is good but not good enough to be deployed → cost of life of both baby & mother
- Need for more work
- Work done can provide direction to research in this area.



Thank you!

ANY QUESTIONS??

