

DIAGNOSTIC CARDIOTOCOGRAPHY (CTG)

WITH MACHINE LEARNING

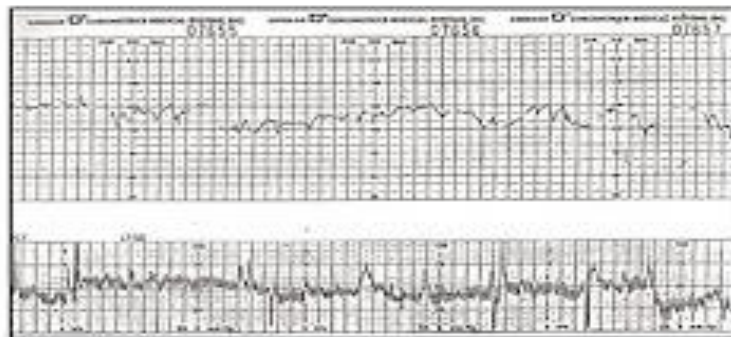
1. A SPEAKER IN THE BACK OF THE MONITOR GIVES AN AUDIBLE REPORT OF EACH FETAL HEART BEAT.



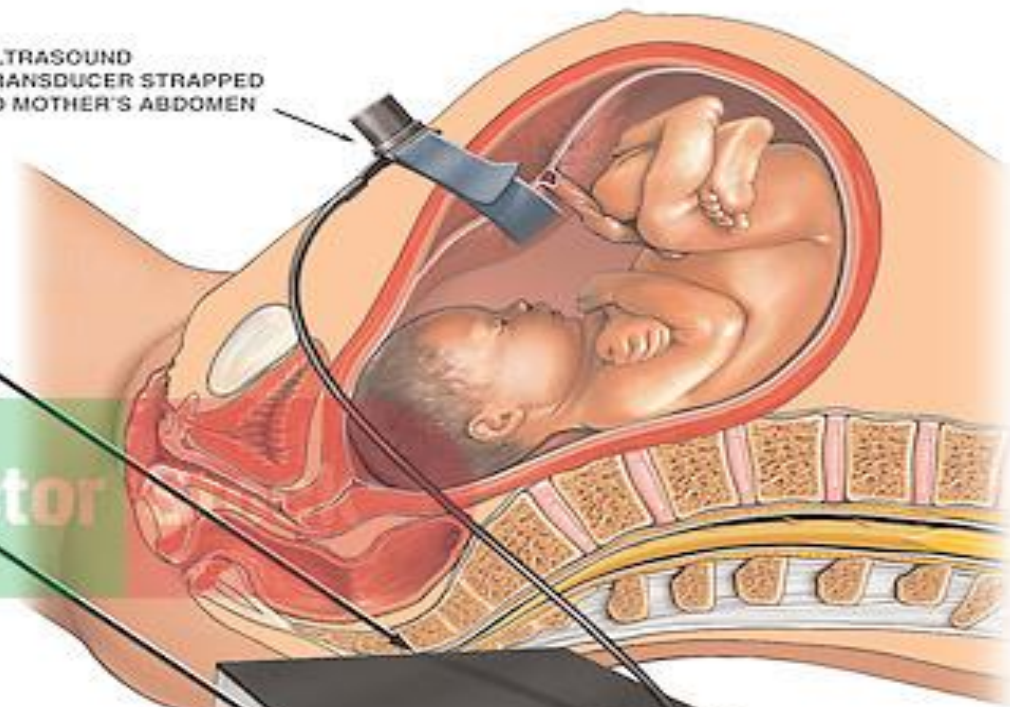
2. A DIGITAL DISPLAY INDICATES THE FETAL HEARTBEAT IN BEATS PER MINUTE.



3. THE FETAL HEARTBEAT AND MATERNAL CONTRACTIONS ARE RECORDED ON A PAPER PRINTOUT.



ULTRASOUND
TRANSDUCER STRAPPED
TO MOTHER'S ABDOMEN



S.No	Predictor Attribute	Attribute Description
1	LB	Baseline value (Medical expert)
2	AC	Baseline value
3	FM	Accelerations
4	UC	Fetal movement
5	DL	Uterine contractions
6	DS	Percentage of time with abnormal short term variability
7	DP	Mean value of short term variability
8	ASTV	Percentage of time with abnormal long term variability
9	MSTV	Mean value of long term variability
10	ALTV	Light decelerations
11	MLTV	Severe decelerations
12	Width	Prolonged decelerations
13	Min	Repetitive decelerations
14	Max	Histogram width
15	Nmax	Low frequency of the histogram
16	Nzeros	High frequency of the histogram
17	Mode	Number of histogram peaks
18	Mean	Number of histogram zeros
19	Median	Histogram mode
20	Variance	Histogram mean
21	Tendency	Histogram median

	Normal CTG^a	Suspicious CTG	Pathological CTG
Baseline ^b	110-160 bpm	Lacking at least one of normal characteristics, but with no pathological features	<100 bpm
Variability ^{c,d,j}	5-25 bpm		Reduced/increased variability ^{c,d} ; sinusoidal pattern ^j
Decelerations ^{e,f,g,h,i}	No repetitive* decelerations		Repetitive* late or prolonged decelerations for >30 min (or >20 min if reduced variability); one deceleration >5 min
Interpretation	No hypoxia/acidosis	Low probability of hypoxia/acidosis	High probability of hypoxia/acidosis

❖ THE CTG DATA SET

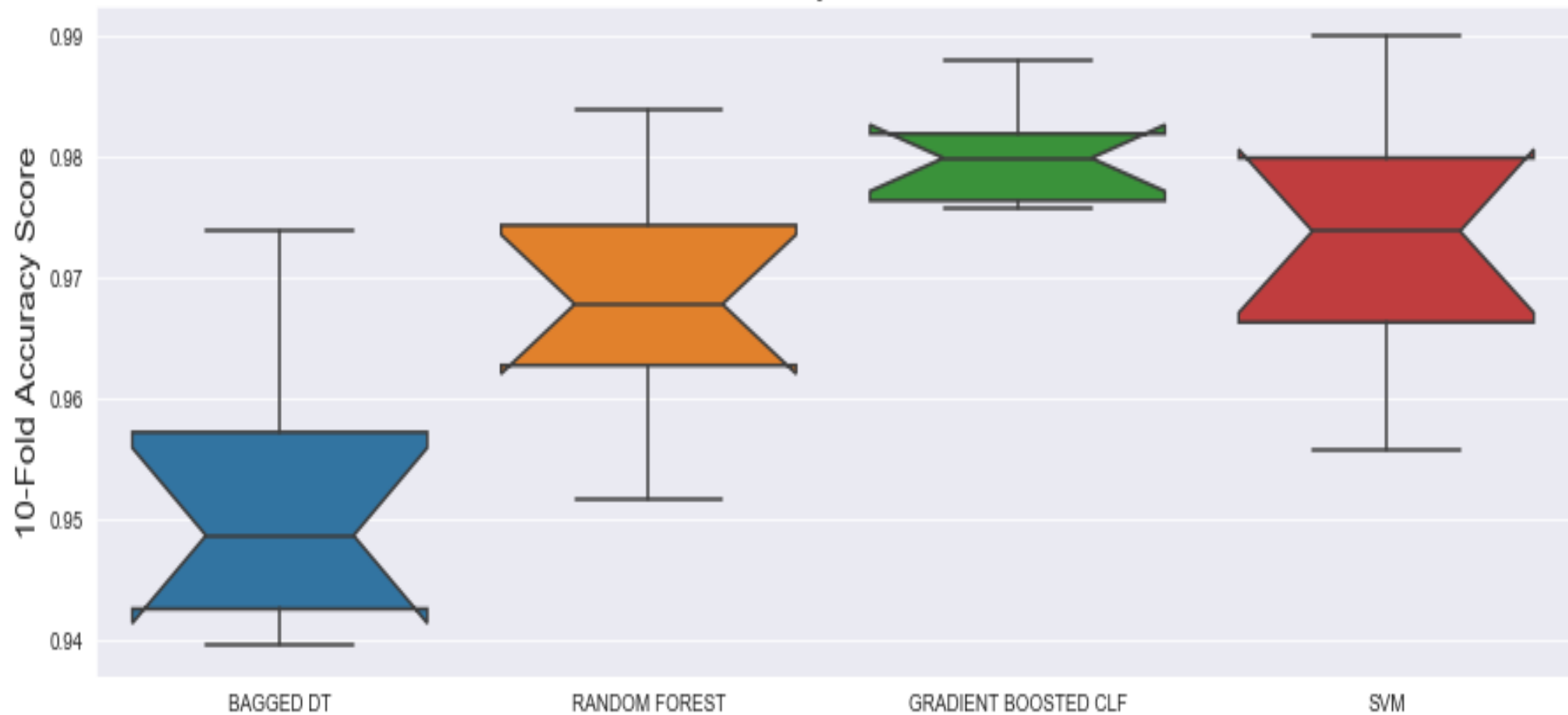
2126 PHYSICIAN SCORED CTG TESTS

1655 NORMAL CASES

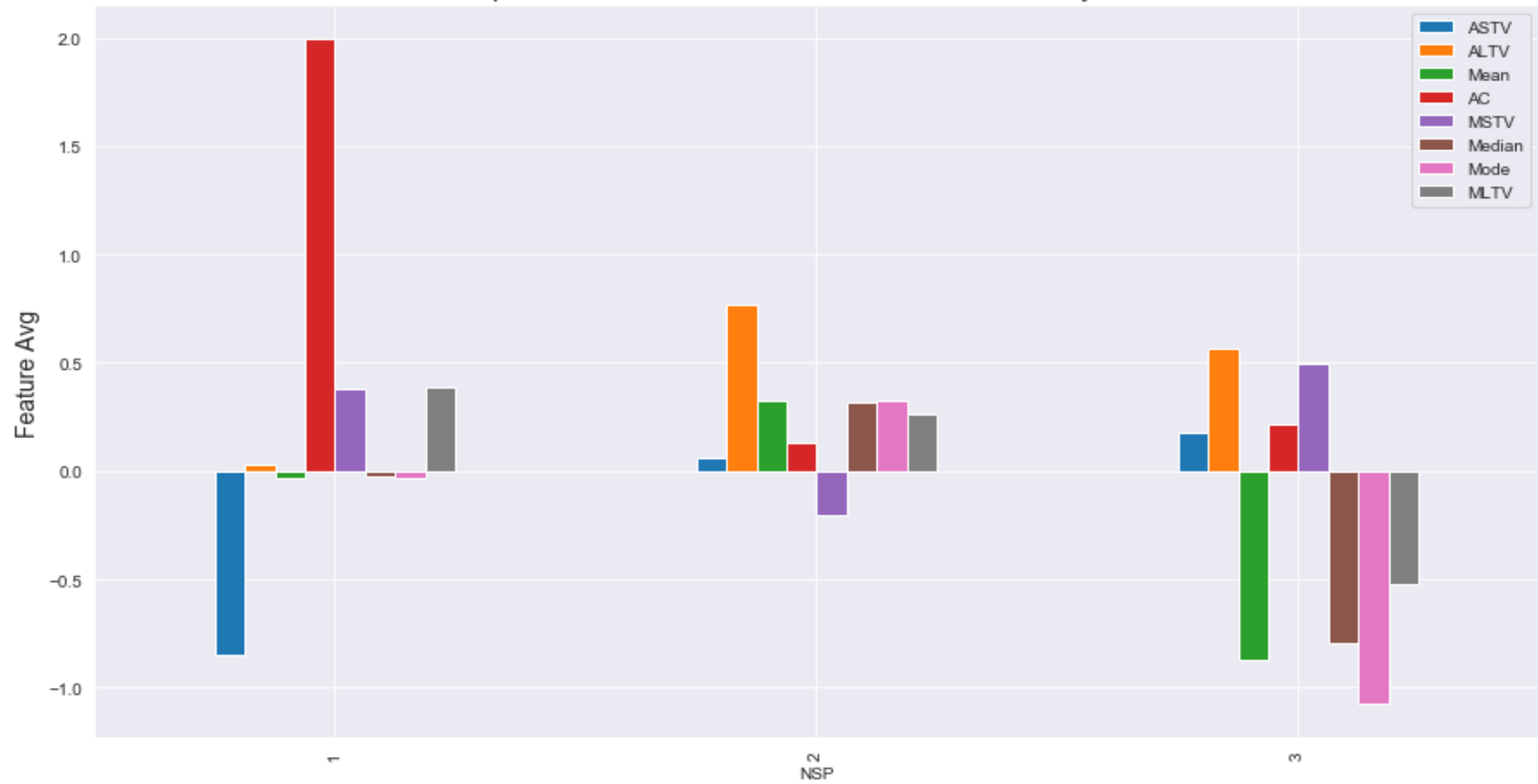
295 (1655) SUSPICIOUS CASES

176 (1655) PATHOLOGICAL CASES

10-Fold CV Accuracy Score 4 Best Models



Top 8 Features From Final Model: Feature Mean by Class



Gradient Boosting Classifier Model Final Model

F1: 10 Fold Gradient Boosting Classifier Cross Validation: 0.9800750517733222

Recall: 10 Fold Gradient Boosting Classifier Cross Validation: 0.9800614168884275

Precision: 10 Fold Gradient Boosting Classifier Cross Validation: 0.9803919635650793

Accuracy: 10 Fold Gradient Boosting Classifier Cross Validation: 0.9800614168884275

Gradient Boosting Classifier Final Train Scores: 0.9997122302158273

Gradient Boosting Classifier Final Test Scores: 0.9798657718120806

	precision	recall	f1-score	support
1	0.98	0.97	0.97	494
2	0.98	0.97	0.97	486
3	0.99	0.99	0.99	510
micro avg	0.98	0.98	0.98	1490
macro avg	0.98	0.98	0.98	1490
weighted avg	0.98	0.98	0.98	1490

Confusion Matrix

True Class	Predicted Class		
	Normal	Suspect	Pathologic
	Normal	Suspect	Pathologic
Normal	481	9	4
Suspect	12	472	2
Pathologic	0	3	507

DIRECTIONS AND RECOMMENDATIONS

- ❖ VALUABLE DIAGNOSTIC TOOL
- ❖ MINIMIZE COSTS BY REDUCING PHYSICIAN EVALUATION TIME
- ❖ CONTINUE TO ADD MORE DATA. INCREASE PREDICTIVE POWER AND OPTIMIZATION
- ❖ EXPLORE DEEP LEARNING NEURAL NETWORKS

Thank
you