Assignment 1 – Machine Learning (Blended Del)

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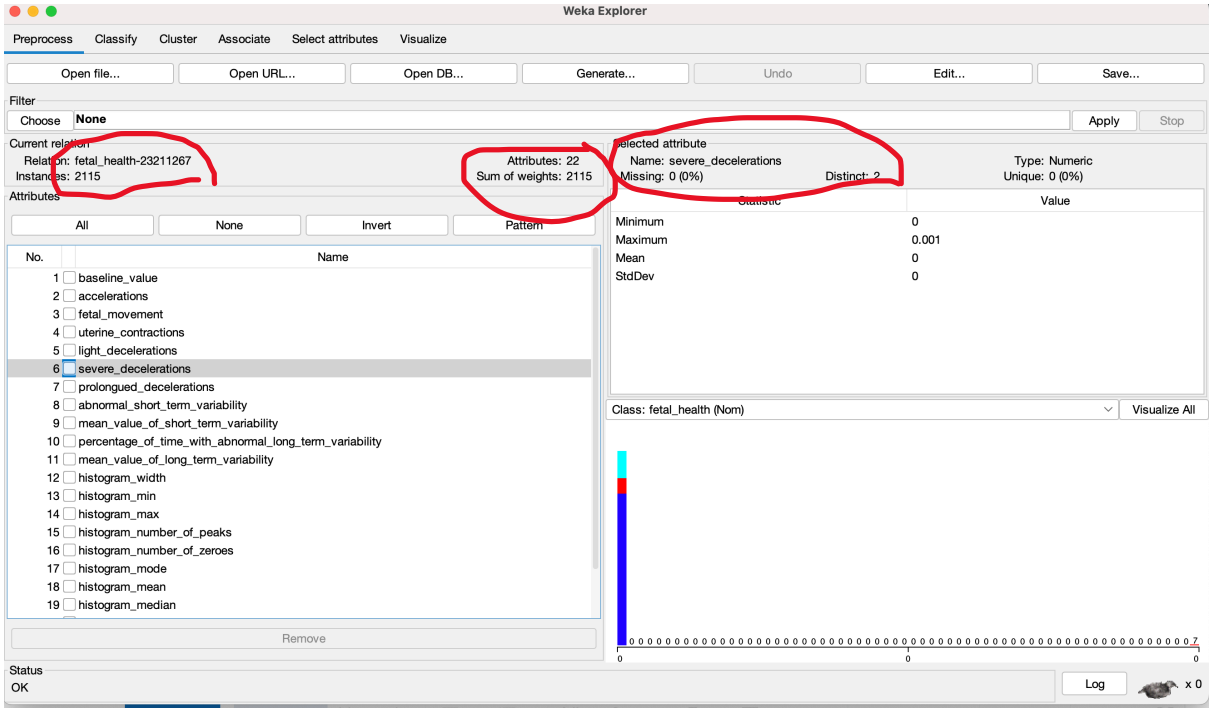
Module Code: COMP47460

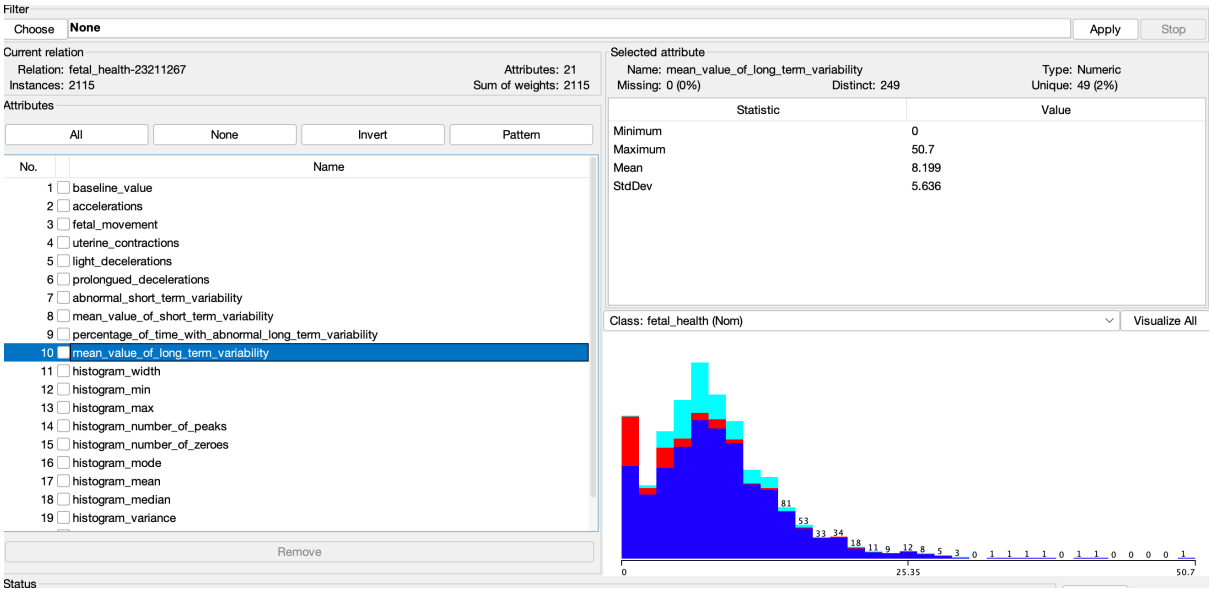
1.1.
Examine the dataset carefully in the Weka Explorer. You should investigate some of the [5] filters in Weka which allow you to normalise and/or clean the dataset as appropriate. Describe the data preparation/cleaning steps you took if any (e.g., Your description may look like "I did min-max normalisation of feature X using the minimum on the feature values in training examples and maximum of feature values over all labelled examples. I manually removed feature Y because …").

- **Note: Please see uploaded python scripts for incremental output csv files and console output outlined below. In addition, I have taken one of the earlier output files and updated with excel functions to ensure code matches manually calculated results.**

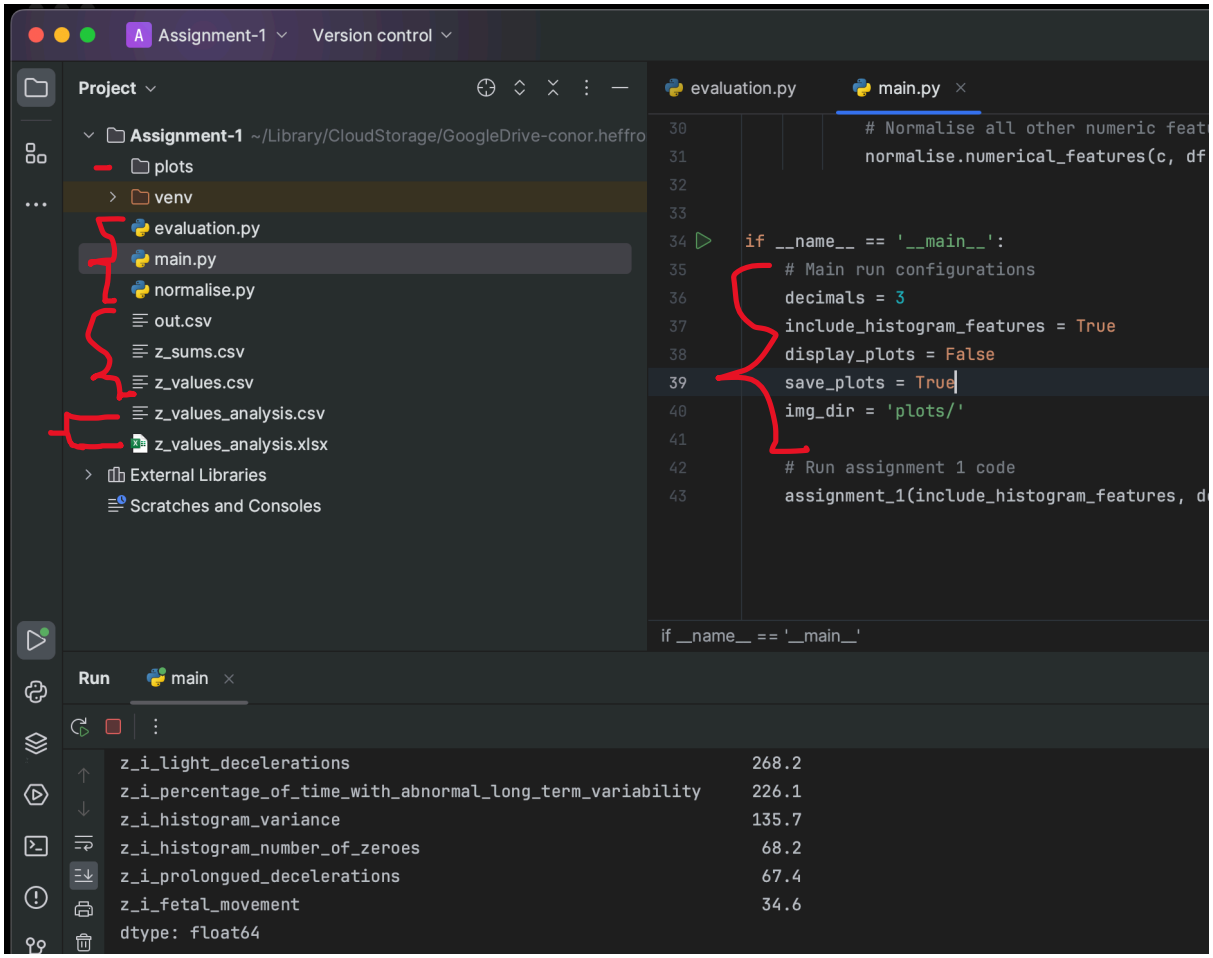
- I loaded the dataset into Weka and exported to csv format.
- There were 2115 records or instances loaded from the *.arff file with 22 attributes or features.
- Straight away I could see 'severe_decelerations' was a very limited feature with only 2 distinct values where a non-zero value only occurs 7 times as noted by the python scripts output below (z sum = 7.0 after normalising to range [0, 1]) so I removed this feature from further analysis in Weka and python script runs.
- I think the histogram features would normally be dropped but some of them appear to be quite varied so this makes for a good data sample.



‘mean_value_of_long_term_variability’ has the most distinct values at 249 which was something to note.



Then I wrote Python code to clean and normalise the data especially the numerical features.
I then calculated the z value for each and ordered by z sum as the final program output to see the key features from this process.



Note: From top left above marked with red:

- plots output directory
- python scripts,
- incremental output files
- manual excel analysis for comparison
- Main configurations for python run script

Main Program Console Out:

```
--------------------------------------------------
Min of baseline_value is: 106
Max of baseline_value is: 160
Mean of baseline_value is: 133.30070921985816
Median of baseline_value is: 133.0
Standard Deviation of baseline_value is: 9.837149600812499
Zi sum value baseline_value is: 1074.6
--------------------------------------------------
Min of accelerations is: 0.0
Max of accelerations is: 0.019
Mean of accelerations is: 0.0031787234042553194
Median of accelerations is: 0.002
Standard Deviation of accelerations is: 0.003863961682425237
Zi sum value accelerations is: 367.79999999999995
```

Min of fetal_movement is: 0.0
Max of fetal_movement is: 0.481
Mean of fetal_movement is: 0.009526713947990545
Median of fetal_movement is: 0.0
Standard Deviation of fetal_movement is: 0.046782681829283676
Zi sum value fetal_movement is: 34.599999999999994

Min of uterine_contractions is: 0.0
Max of uterine_contractions is: 0.015
Mean of uterine_contractions is: 0.004373049645390071
Median of uterine_contractions is: 0.004
Standard Deviation of uterine_contractions is: 0.002947399462280164
Zi sum value uterine_contractions is: 616.8

Min of light_decelerations is: 0.0
Max of light_decelerations is: 0.015
Mean of light_decelerations is: 0.001888888888888889
Median of light_decelerations is: 0.0
Standard Deviation of light_decelerations is: 0.0029635828830450834
Zi sum value light_decelerations is: 268.20000000000005

~~Min of severe_decelerations is: 0.0~~
~~Max of severe_decelerations is: 0.001~~
~~Mean of severe_decelerations is: 3.309692671394799e-06~~
~~Median of severe_decelerations is: 0.0~~
~~Standard Deviation of severe_decelerations is: 5.744822913623554e-05~~
~~Zi sum value severe_decelerations is: 7.0~~

Min of prolongued_decelerations is: 0.0
Max of prolongued_decelerations is: 0.005
Mean of prolongued_decelerations is: 0.00015933806146572102
Median of prolongued_decelerations is: 0.0
Standard Deviation of prolongued_decelerations is: 0.0005913692853366418
Zi sum value prolongued_decelerations is: 67.4

Min of abnormal_short_term_variability is: 12
Max of abnormal_short_term_variability is: 87
Mean of abnormal_short_term_variability is: 46.95035460992908
Median of abnormal_short_term_variability is: 49.0
Standard Deviation of abnormal_short_term_variability is: 17.162584263361758
Zi sum value abnormal_short_term_variability is: 983.9

Min of mean_value_of_short_term_variability is: 0.2
Max of mean_value_of_short_term_variability is: 7.0
Mean of mean_value_of_short_term_variability is: 1.3339952718676122
Median of mean_value_of_short_term_variability is: 1.2
Standard Deviation of mean_value_of_short_term_variability is: 0.8837077165359826
Zi sum value mean_value_of_short_term_variability is: 345.20000000000005

Min of percentage_of_time_with_abnormal_long_term_variability is: 0

Max of percentage_of_time_with_abnormal_long_term_variability is: 91
Mean of percentage_of_time_with_abnormal_long_term_variability is: 9.823167848699764
Median of percentage_of_time_with_abnormal_long_term_variability is: 0.0
Standard Deviation of percentage_of_time_with_abnormal_long_term_variability is: 18.391154458995572
Zi sum value percentage_of_time_with_abnormal_long_term_variability is: 226.10000000000002

Min of mean_value_of_long_term_variability is: 0.0
Max of mean_value_of_long_term_variability is: 50.7
Mean of mean_value_of_long_term_variability is: 8.19886524822695
Median of mean_value_of_long_term_variability is: 7.4
Standard Deviation of mean_value_of_long_term_variability is: 5.636014802636036
Zi sum value mean_value_of_long_term_variability is: 339.70000000000005

Min of histogram_width is: 3
Max of histogram_width is: 180
Mean of histogram_width is: 70.49267139479906
Median of histogram_width is: 68.0
Standard Deviation of histogram_width is: 38.95078910381832
Zi sum value histogram_width is: 807.9000000000001

Min of histogram_min is: 50
Max of histogram_min is: 159
Mean of histogram_min is: 93.54704491725768
Median of histogram_min is: 93.0
Standard Deviation of histogram_min is: 29.580143601297536
Zi sum value histogram_min is: 844.7

Min of histogram_max is: 122
Max of histogram_max is: 238
Mean of histogram_max is: 164.03971631205673
Median of histogram_max is: 162.0
Standard Deviation of histogram_max is: 17.944182664569215
Zi sum value histogram_max is: 768.3

Min of histogram_number_of_peaks is: 0
Max of histogram_number_of_peaks is: 18
Mean of histogram_number_of_peaks is: 4.069976359338061
Median of histogram_number_of_peaks is: 3.0
Standard Deviation of histogram_number_of_peaks is: 2.947638560550025
Zi sum value histogram_number_of_peaks is: 492.3

Min of histogram_number_of_zeroes is: 0
Max of histogram_number_of_zeroes is: 10
Mean of histogram_number_of_zeroes is: 0.3224586288416076
Median of histogram_number_of_zeroes is: 0.0
Standard Deviation of histogram_number_of_zeroes is: 0.7041179104063311
Zi sum value histogram_number_of_zeroes is: 68.20000000000002

Min of histogram_mode is: 60
Max of histogram_mode is: 187

Mean of histogram_mode is: 137.44586288416076
Median of histogram_mode is: 139.0
Standard Deviation of histogram_mode is: 16.403044334341104
Zi sum value histogram_mode is: 1289.5

Min of histogram_mean is: 73
Max of histogram_mean is: 182
Mean of histogram_mean is: 134.60614657210402
Median of histogram_mean is: 136.0
Standard Deviation of histogram_mean is: 15.617939011476754
Zi sum value histogram_mean is: 1198.4999999999998

Min of histogram_median is: 77
Max of histogram_median is: 186
Mean of histogram_median is: 138.09078014184396
Median of histogram_median is: 139.0
Standard Deviation of histogram_median is: 14.48426821225838
Zi sum value histogram_median is: 1184.8

Min of histogram_variance is: 0
Max of histogram_variance is: 269
Mean of histogram_variance is: 18.846808510638297
Median of histogram_variance is: 7.0
Standard Deviation of histogram_variance is: 29.03532873969992
Zi sum value histogram_variance is: 135.7

Min of histogram_tendency is: -1
Max of histogram_tendency is: 1
Mean of histogram_tendency is: 0.32056737588652484
Median of histogram_tendency is: 0.0
Standard Deviation of histogram_tendency is: 0.6107888873223769
Zi sum value histogram_tendency is: 1396.5
---

z_i_fetal_health	1499.7
z_i_histogram_tendency	**1396.5**
z_i_histogram_mode	**1289.5**
z_i_histogram_mean	**1198.5**
z_i_histogram_median	**1184.8**
z_i_baseline_value	**1074.6**
z_i_abnormal_short_term_variability	**983.9**
z_i_histogram_min	**844.7**
z_i_histogram_width	807.9
z_i_histogram_max	768.3
z_i_uterine_contractions	616.8
z_i_histogram_number_of_peaks	492.3
z_i_accelerations	367.8
z_i_mean_value_of_short_term_variability	345.2
z_i_mean_value_of_long_term_variability	339.7
z_i_light_decelerations	268.2
z_i_percentage_of_time_with_abnormal_long_term_variability	226.1
z_i_histogram_variance	135.7

z_i_histogram_number_of_zeroes 68.2
z_i_prolongued_decelerations 67.4
z_i_fetal_movement 34.6
~~z_i_severe_decelerations 7.0~~
dtype: float64

Process finished with exit code 0

- 'fetal_health' value is the categorical feature that was originally used to classify the data so I have excluded this as a key feature but more like a classifier field.
- The 7 key features thereafter and info are highlighted in yellow.
- The next 3 fields highlighted in orange were non histogram related fields.
- The features with z sum less than 40 are marked in blue. I removed 'severe_decelerations' altogether as I don't think it's even close to the threshold to be very useful. However out of the seven non zero values there were 6 records with the same fetal health classifier assigned but this is probably coincidence as the data sample is too small.

Output Verified in Excel Worksheet after manually manipulating incremental csv output files:

A	B	H	M	Q	R	S	U	V
fetal_health	z_i_baseline_value	z_i_abnormal_short_term_variability	z_i_histogram_min	z_i_histogram_mode	z_i_histogram_mean	z_i_histogram_median	z_i_histogram_tendency	z_i_fetal_health
Normal	0.5	0.2	0.1	0.7	0.6	0.6	1	0.8
Normal	0.4	0.3	0	0.6	0.6	0.5	0.5	0.8
Suspect	0.6	0.6	0	0.7	0.7	0.7	1	0.5
Suspect	0.4	0.7	0.7	0.6	0.5	0.5	0.5	0.5
Suspect	1	0.6	0.9	0.8	0.9	0.9	0.5	0.5
Normal	0.5	0.6	0.6	0.6	0.7	0.6	0.5	0.8
Suspect	0.7	0.7	0.7	0.7	0.7	0.7	0.5	0.5
Normal	0.6	0.6	0.4	0.8	0.6	0.6	1	0.8
Normal	0.6	0.4	0.5	0.6	0.6	0.6	1	0.8
Normal	0.3	0.1	0.5	0.5	0.5	0.5	0.5	0.8
Normal	0.1	0.7	0.4	0.4	0.4	0.3	0	0.8
Normal	0.6	0.5	0.3	0.7	0.7	0.7	1	0.8
Pathological	0.4	0.7	0.7	0.6	0.5	0.5	0.5	0.2
Normal	0.3	0.6	0.2	0.5	0.4	0.5	0.5	0.8
Normal	0.6	0.2	0.2	0.6	0.6	0.6	1	0.8
Normal	0.7	0.4	0.8	0.7	0.7	0.6	0.5	0.8
Suspect	0.8	0.8	0.8	0.7	0.7	0.7	0	0.5
Suspect	0.6	0.7	0.2	0.7	0.6	0.6	1	0.5
Normal	0.3	0.3	0.3	0.5	0.4	0.4	1	0.8
Normal	0.4	0.2	0.1	0.6	0.5	0.5	0.5	0.8
Normal	0.5	0.3	0.5	0.6	0.6	0.6	0.5	0.8
Normal	0.7	0.3	0.4	0.7	0.7	0.7	1	0.8
Normal	0.4	0.5	0.1	0.6	0.5	0.5	1	0.8
Normal	0.4	0.7	0.1	0.5	0.3	0.5	0.5	0.8
Normal	0.6	0.5	0.2	0.7	0.7	0.6	1	0.8
Normal	0.7	0.6	0.1	0.7	0.6	0.6	1	0.8
Pathological	0.3	0.6	0.2	0.2	0.3	0.3	0.5	0.2
Suspect	0.4	0.7	0.2	0.7	0.6	0.6	1	0.5
Normal	0.8	0.5	0.9	0.8	0.8	0.8	1	0.8
	1074.6	983.9	844.7	1289.5	1198.5	1184.8	1396.5	1499.7

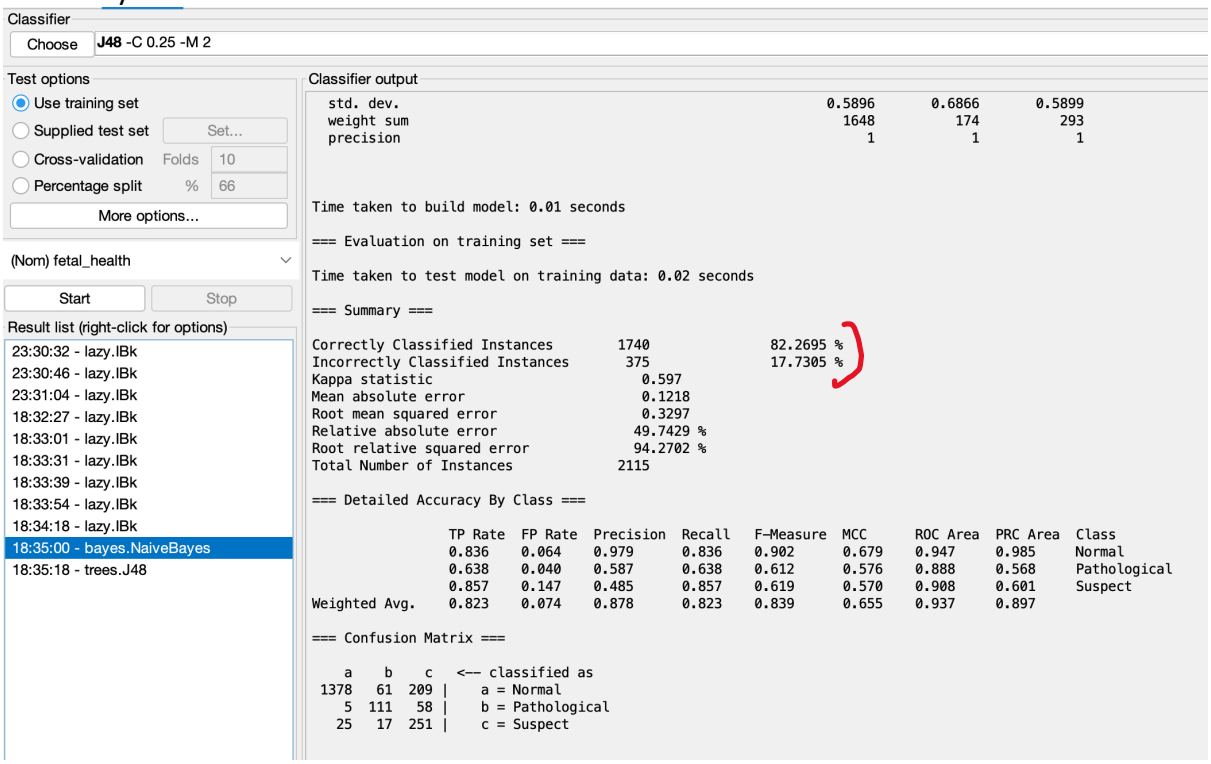
1.2.

Use 3 classifiers [k-NN, Naive Bayes, Decision Tree] we have discussed in the module [20] and compare the accuracy of the Fetal Health predictions. You should choose the accuracy measures, explain your choices, and discuss some reasons for the different accuracy values. What is the optimal value of k for the k-NN classifier?
Do you get better accuracy if you use 1/d weighting? Do the results change if you use k = 3 or k = 5-fold cross-validation?

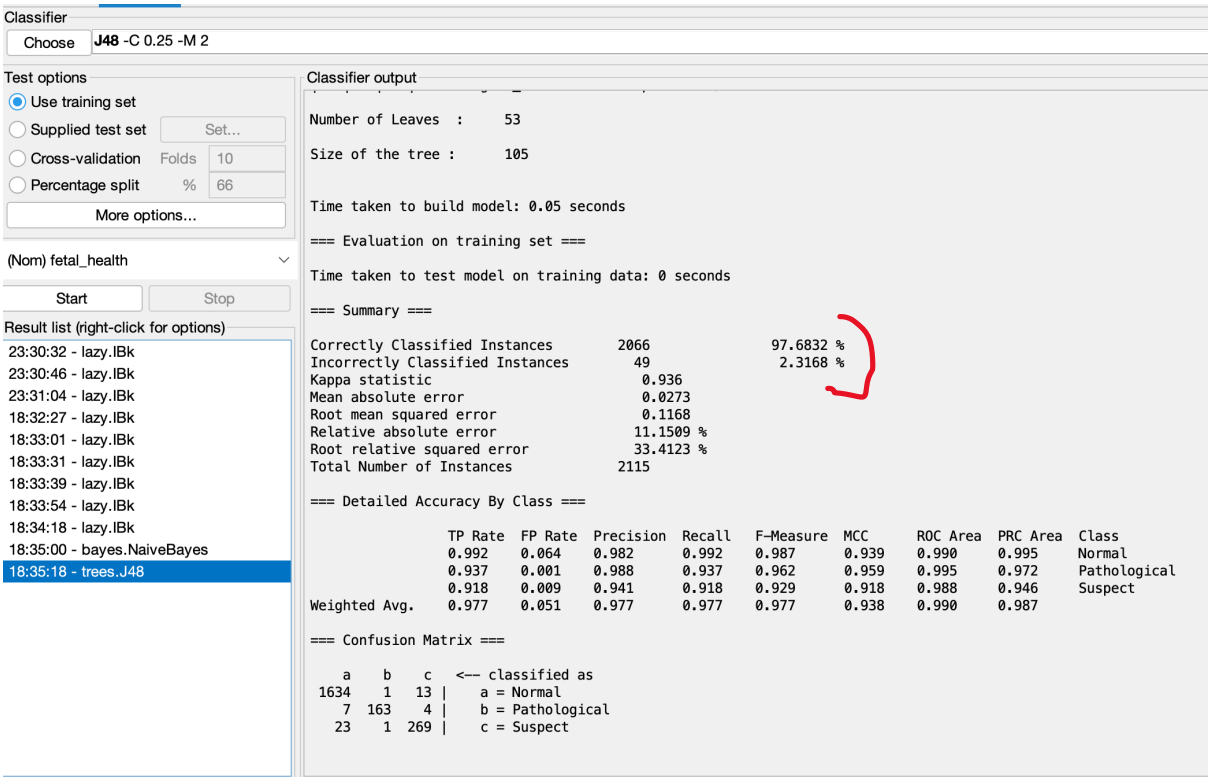
- Naïve Bayes is least accuracte.
- KNN and decision tree are close in accuracy (over 95% so good options).

- Running with k=1, then k=3 and k=5 improved accuracy each time when updating to use 1/distance weighting.

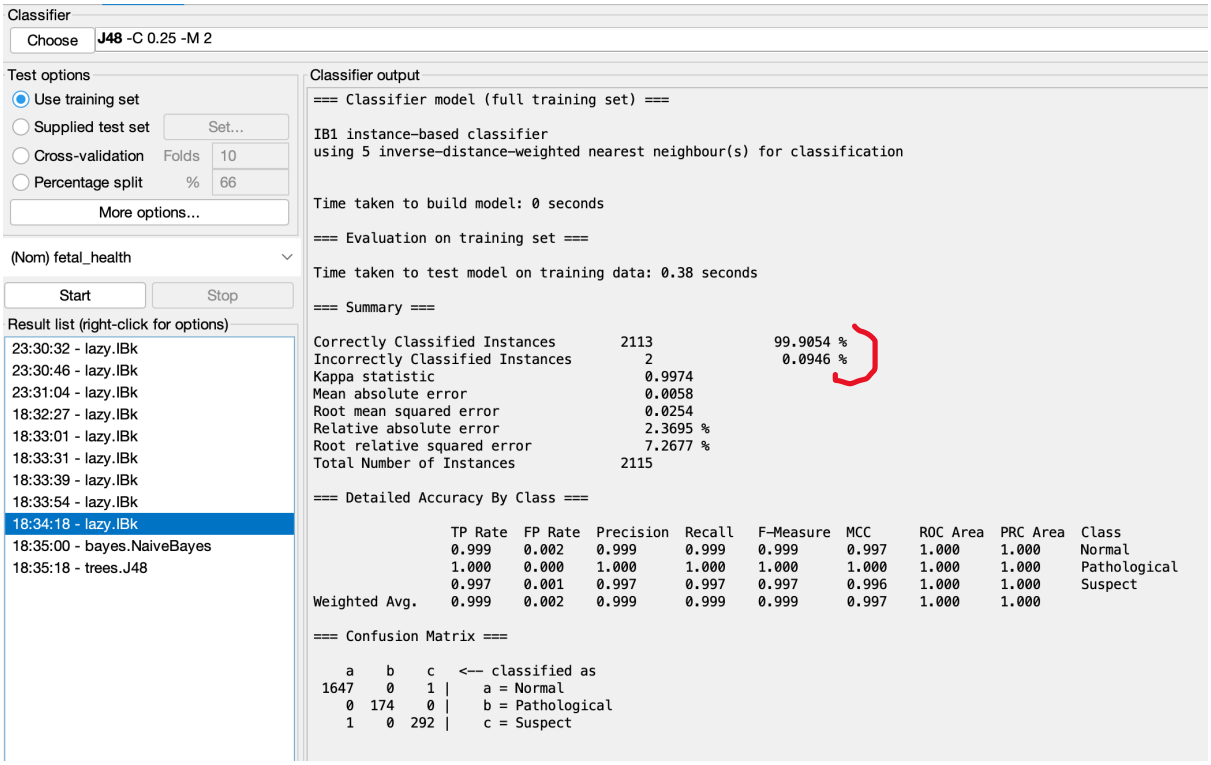
Naive Bayes



Decision Tree



k-NN



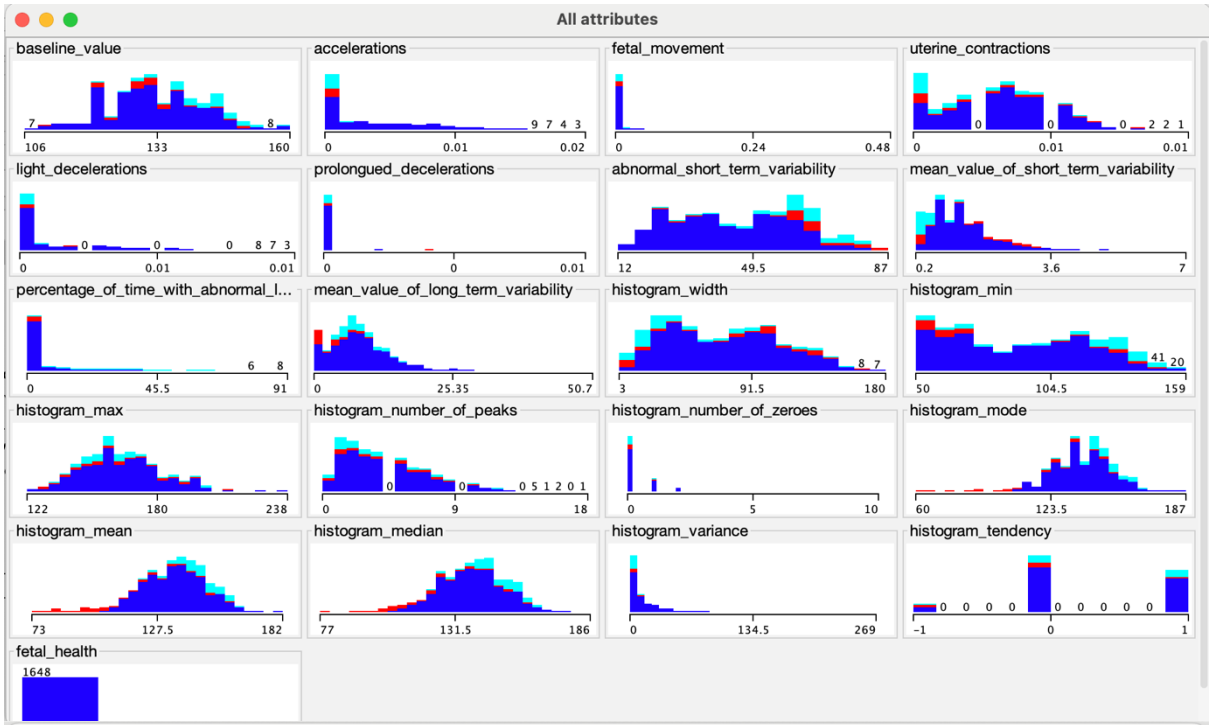
1.3.

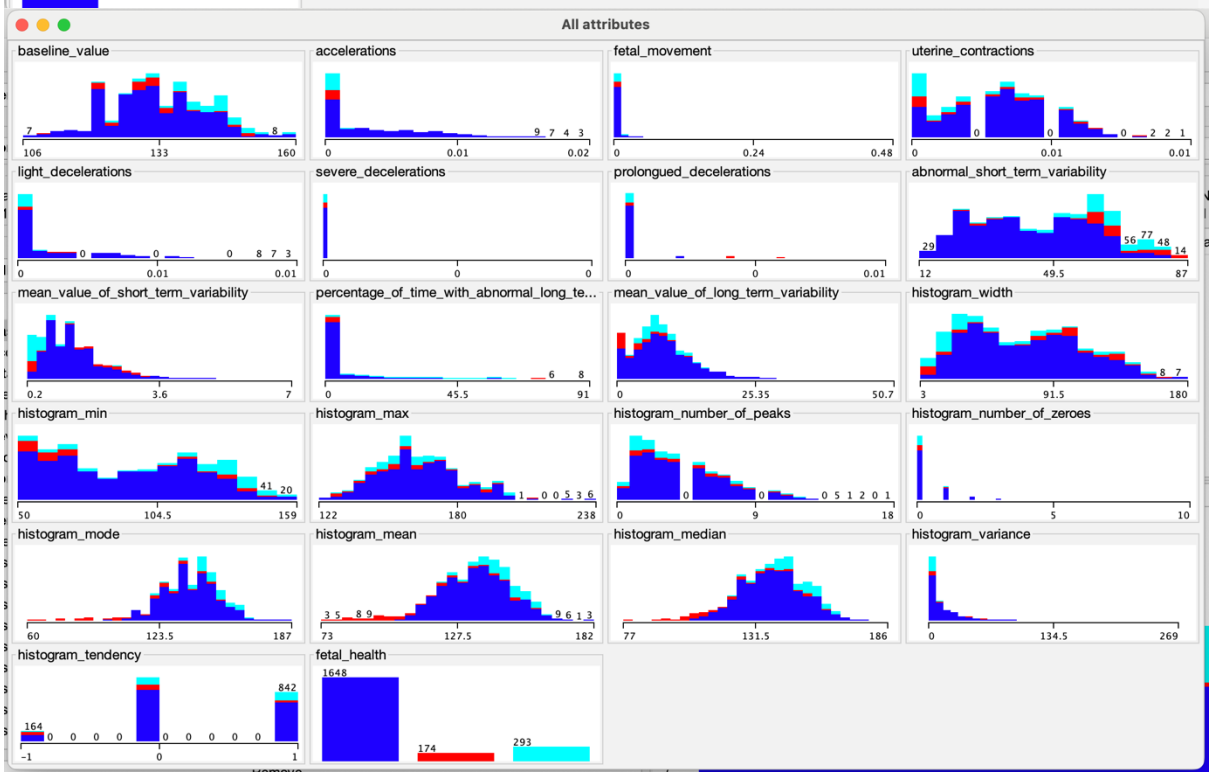
i. Plot the ROC curves for 3 different classification models (use Weka for this). [15]

ii. What do you learn from these ROC curve? Include the AUC in your discussion.

iii. Which classifier/configuration is best suited for this task? Are you satisfied with the performance?

Weka Plots and visualisation notes:


All attributes
baseline_value
accelerations
fetal_movement
uterine_contractions
light_decelerations
prolongued_decelerations
abnormal_short_term_variability
mean_value_of_short_term_variability
percentage_of_time_with_abnormal_l...
mean_value_of_long_term_variability
histogram_width
histogram_min
histogram_max
histogram_number_of_peaks
histogram_number_of_zeroes
histogram_mode
histogram_mean
histogram_median
histogram_variance
histogram_tendency
fetal_health

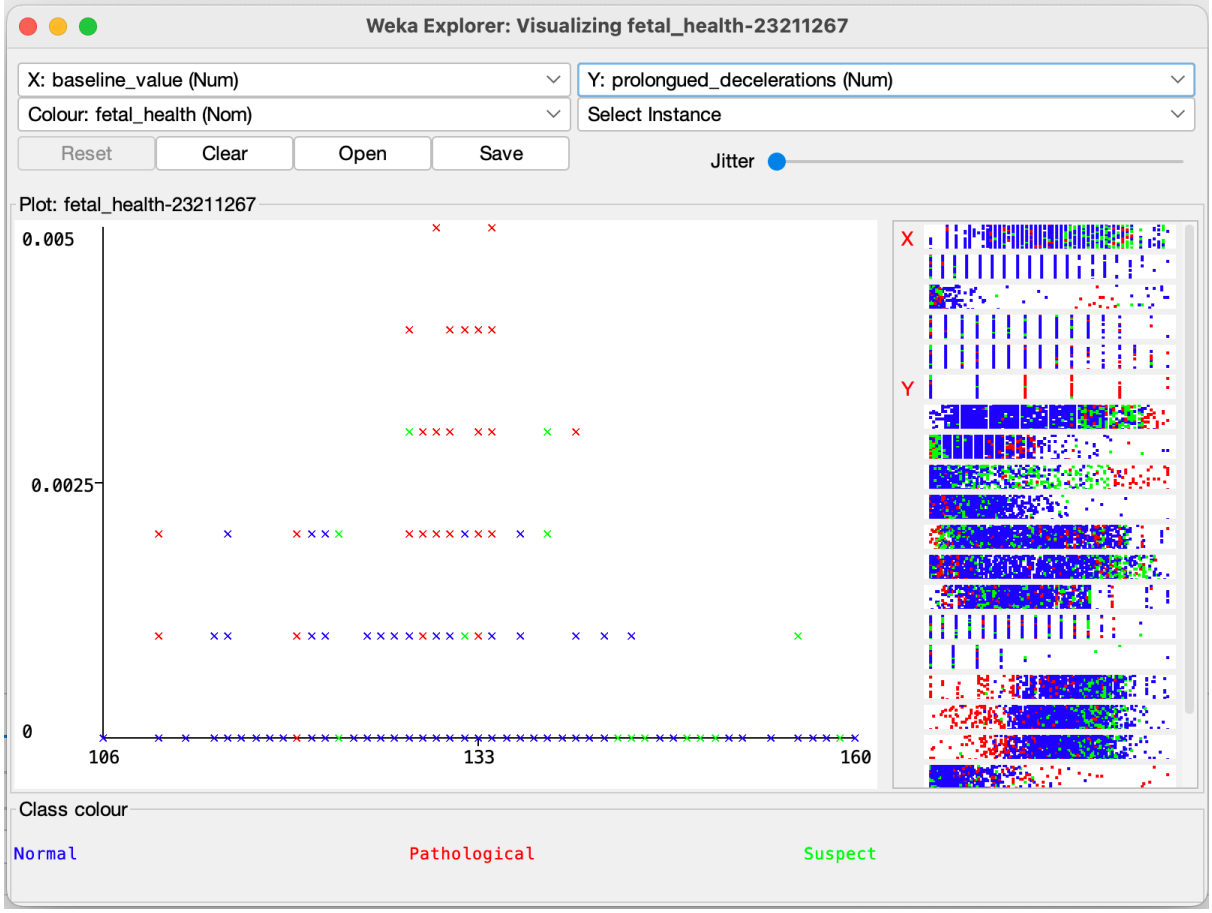

All attributes
baseline_value
accelerations
fetal_movement
uterine_contractions
light_decelerations
severe_decelerations
prolongued_decelerations
abnormal_short_term_variability
mean_value_of_short_term_variability
percentage_of_time_with_abnormal_long_te...
mean_value_of_long_term_variability
histogram_width
histogram_min
histogram_max
histogram_number_of_peaks
histogram_number_of_zeroes
histogram_mode
histogram_mean
histogram_median
histogram_variance
histogram_tendency
fetal_health

Selected attribute

Name: severe_decelerations Type: Numeric

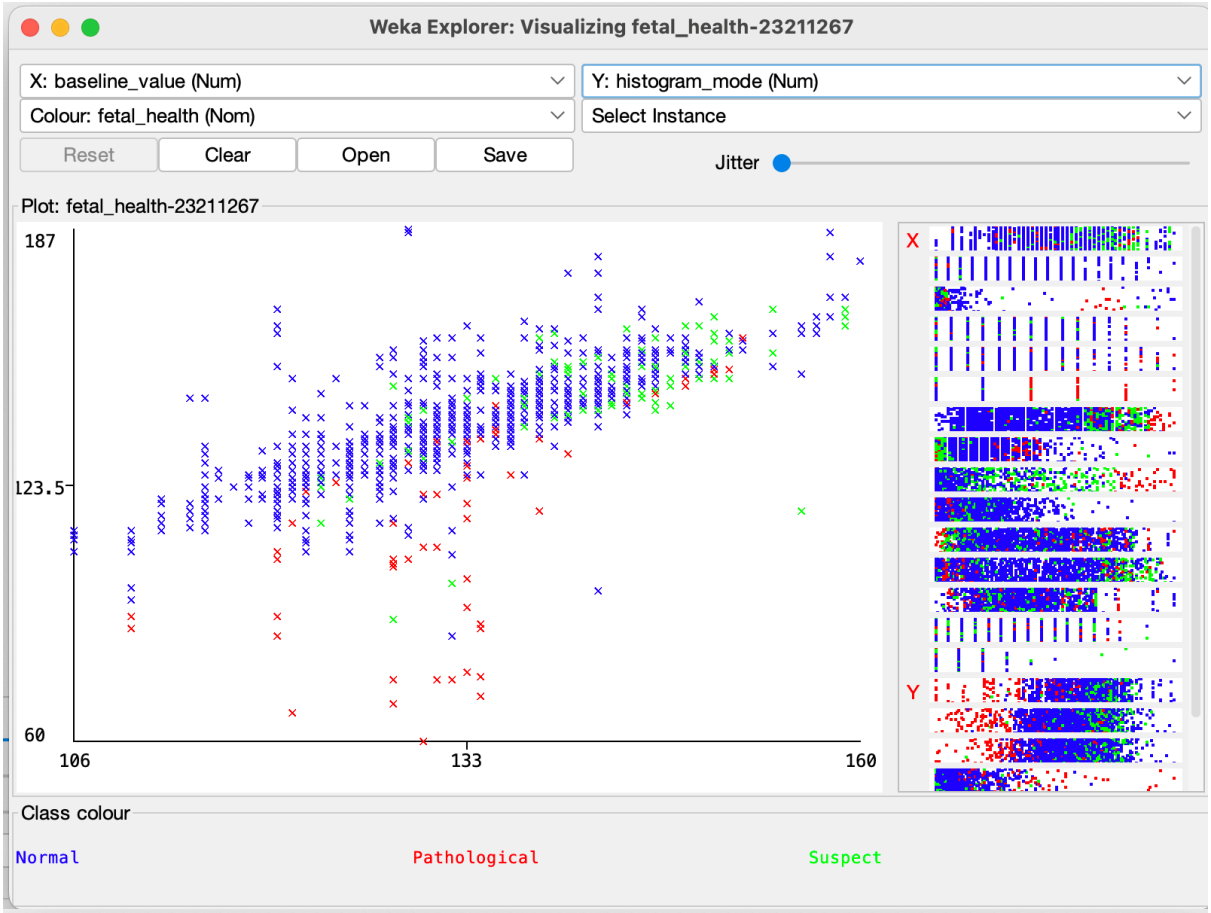
Missing: 0 (0%) Distinct: 2 Unique: 0 (0%)

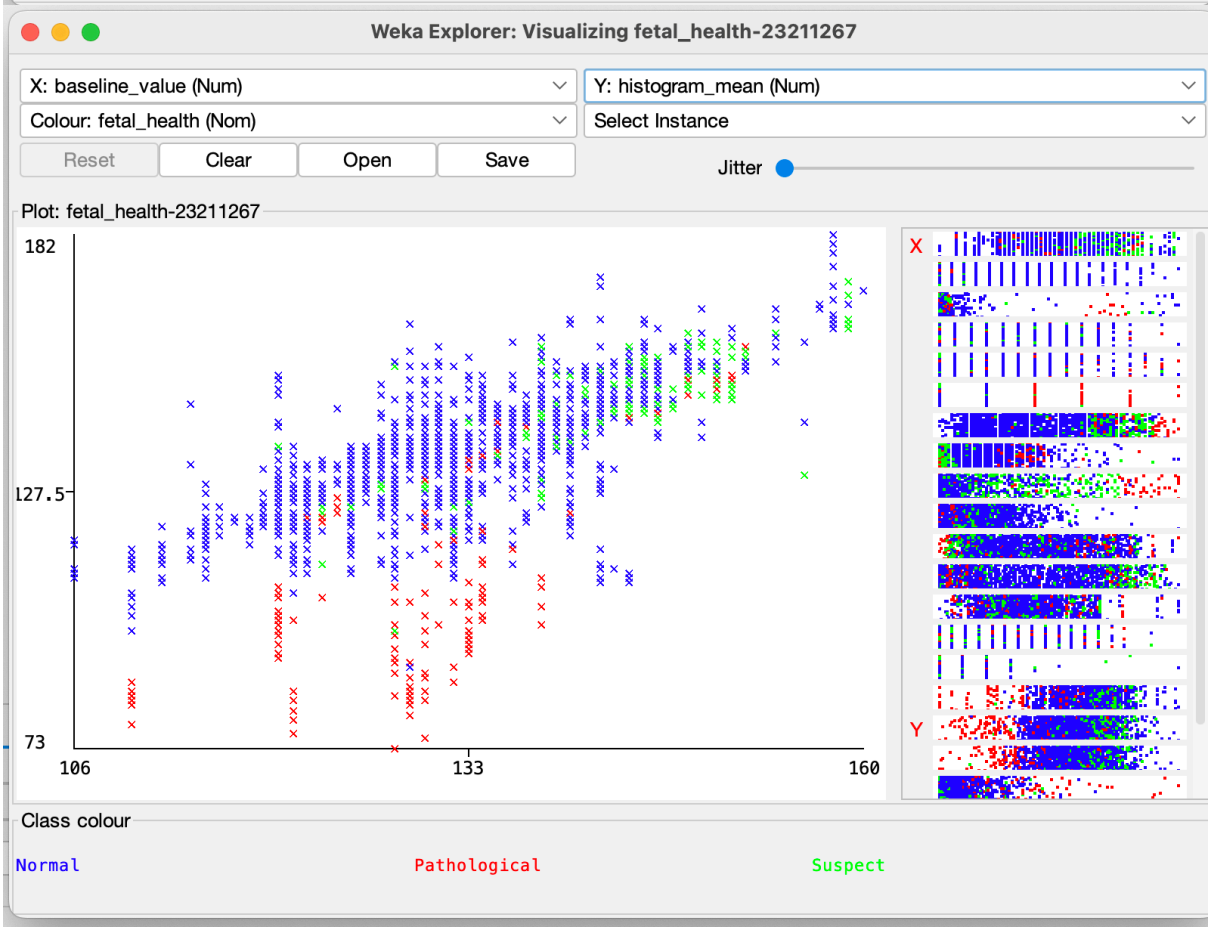
Statistic	Value
Minimum	0
Maximum	0.001
Mean	0
StdDev	0

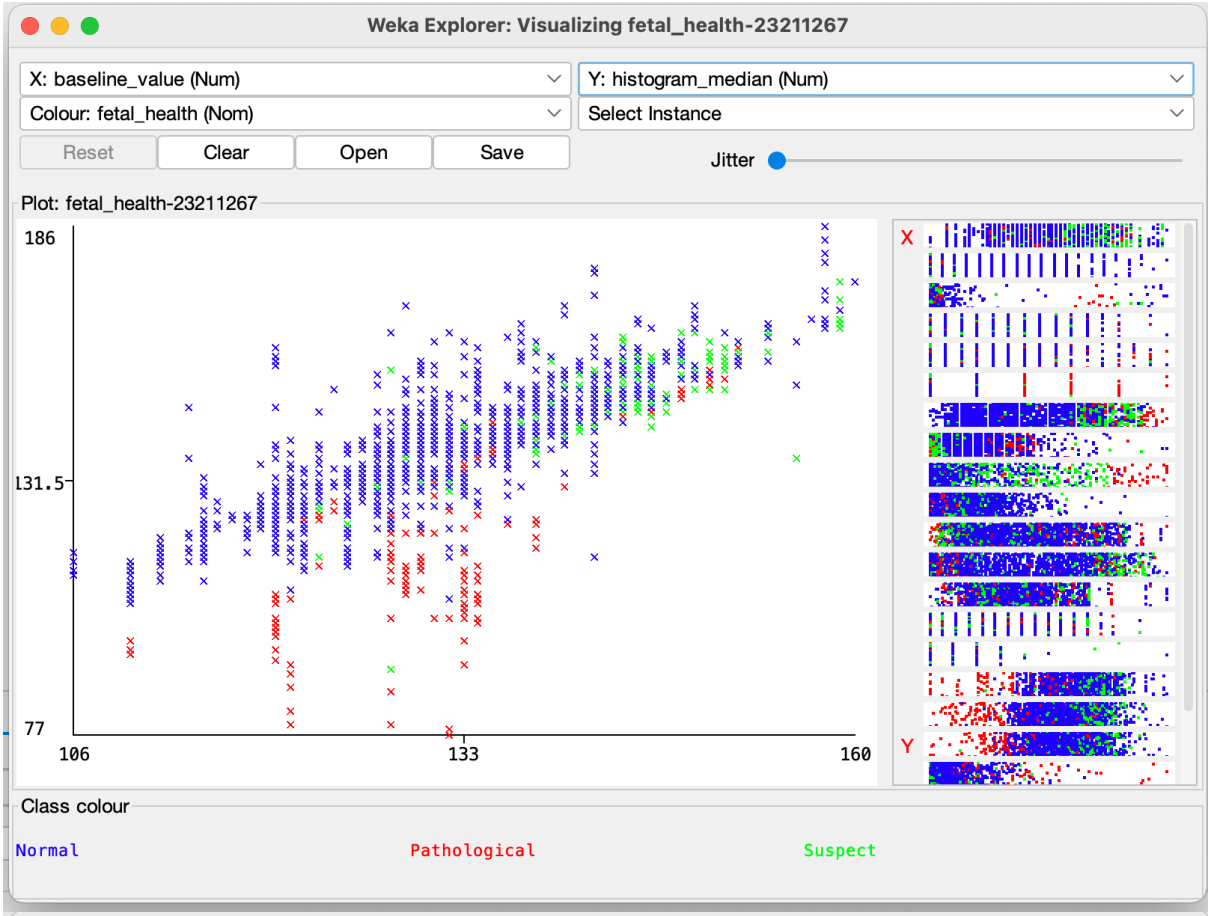



Weka Explorer: Visualizing fetal_health-23211267
X: baseline_value (Num)
Y: abnormal_short_term_variability (Num)
Colour: fetal_health (Nom)
Select Instance
Reset
Clear
Open
Save
Jitter
Plot: fetal_health-23211267
87
19.5
12
106
133
160
X
Y
Class colour
Normal
Pathological
Suspect


Weka Explorer: Visualizing fetal_health-23211267
X: baseline_value (Num)
Y: percentage_of_time_with_abnormal_long_term_variability (...
Colour: fetal_health (Nom)
Select Instance
Reset
Clear
Open
Save
Jitter
Plot: fetal_health-23211267
91
45.5
0
106
133
160
X
Y
Class colour
Normal
Pathological
Suspect


Weka Explorer: Visualizing fetal_health-23211267
X: baseline_value (Num)
Y: histogram_mode (Num)
Colour: fetal_health (Nom)
Select Instance
Reset
Clear
Open
Save
Jitter
Plot: fetal_health-23211267
187
123.5
60
106
133
160
X
Y
Class colour
Normal
Pathological
Suspect


Weka Explorer: Visualizing fetal_health-23211267
X: baseline_value (Num)
Y: histogram_mean (Num)
Colour: fetal_health (Nom)
Select Instance
Reset
Clear
Open
Save
Jitter
Plot: fetal_health-23211267
182
127.5
73
106
133
160
X
Y
Class colour
Normal
Pathological
Suspect


Weka Explorer: Visualizing fetal_health-23211267
X: baseline_value (Num)
Y: histogram_median (Num)
Colour: fetal_health (Nom)
Select Instance
Reset
Clear
Open
Save
Jitter
Plot: fetal_health-23211267
186
131.5
77
106
133
160
X
Y
Class colour
Normal
Pathological
Suspect


Weka Explorer: Visualizing fetal_health-23211267
X: baseline_value (Num)
Y: histogram_variance (Num)
Colour: fetal_health (Nom)
Select Instance
Reset
Clear
Open
Save
Jitter
Plot: fetal_health-23211267
269
134.5
0
106
133
160
X
Y
Class colour
Normal
Pathological
Suspect

1.4.

This dataset has many features. Carefully identify the most discriminating features to [20] predict Fetal Health.

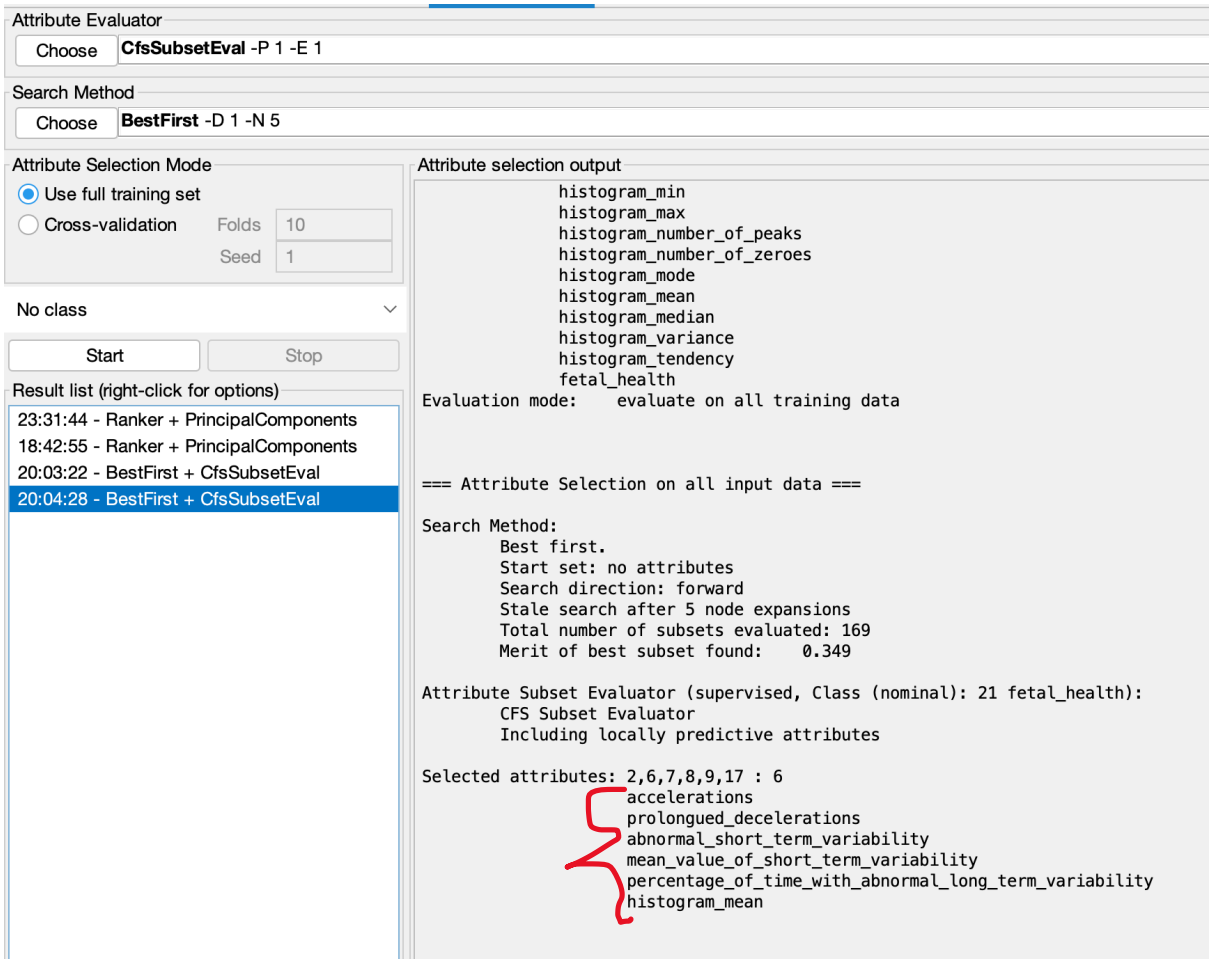
Top 14 features after normalisation of numerical features (top 6 non histogram features in bold / red)

1. histogram_tendency
2. histogram_mode
3. histogram_mean
4. histogram_median
5. **baseline_value**
6. **abnormal_short_term_variability**
7. histogram_min
8. histogram_width
9. histogram_max
10. **uterine_contractions**
11. histogram_number_of_peaks
12. **accelerations**
13. **mean_value_of_short_term_variability**
14. **mean_value_of_long_term_variability**

1.5.

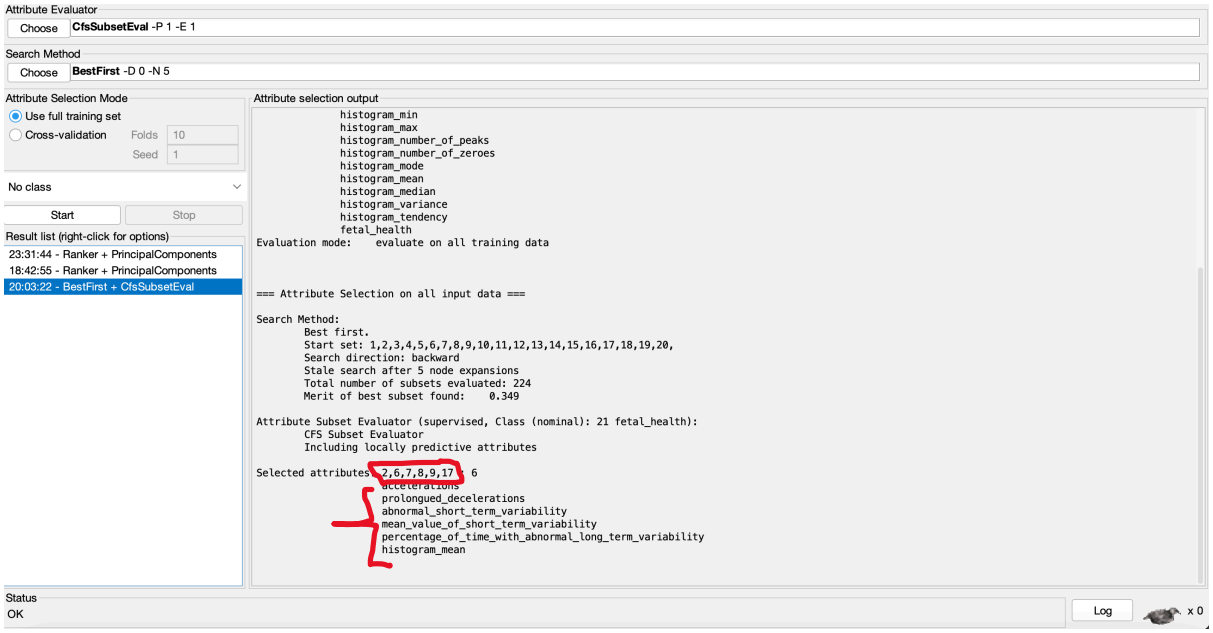
Use the following methods in Weka to find the top 5 features:

- **Wrapper + forward search**



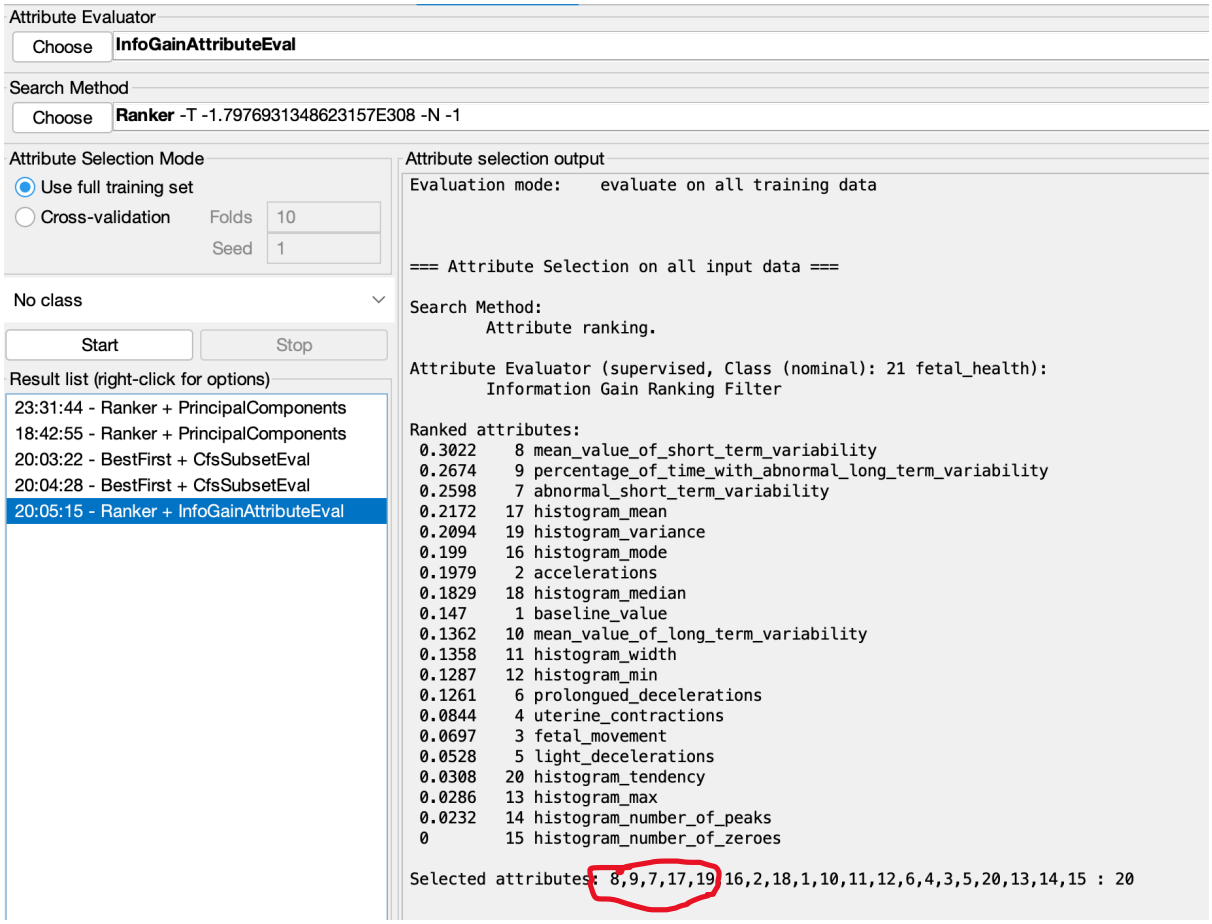
1. accelerations
2. prolonged_decelerations
3. abnormal_short_term_variability
4. mean_value_of_short_term_variability
5. percentage_of_time_with_abnormal_long_term_variability
6. ~~histogram_mean~~

- **Wrapper + backwards search**



1. accelerations
2. prolonged_decelerations
3. abnormal_short_term_variability
4. mean_value_of_short_term_variability
5. percentage_of_time_with_abnormal_long_term_variability
6. ~~histogram_mean~~

- **Information Gain Discuss the differences in the selected sets of features.**



1. mean_value_of_short_term_variability
2. percentage_of_time_with_abnormal_long_term_variability
3. abnormal_short_term_variability
4. histogram_mean
5. histogram_variance
~~6. histogram_mode~~

1.6.

Evaluate the performance of the [Decision Tree, Naive Bayes, k-NN] classifiers with the [20] top 5 features selected in the previous part. Comment on the differences you observe in the performance.

Wrapper search forward and backward produce the same top 5 fields.
IG produces are different and more accurate top 5 feature list for what I have compared to up to this point.

1.7.

Use Weka to extract the top 2 Principal Components. Evaluate the performance of the [20] [Decision Tree, Naive Bayes, k-NN] classifiers with these principal components and comment on any differences with previous methods. Visualise the principal components (you can add a screenshot of Weka) and comment on how they match with your expectations, having run various models and feature selections.

Attribute Evaluator

Choose **PrincipalComponents** -R 0.95 -A 5

Search Method

Choose **Ranker** -T -1.7976931348623157E308 -N -1

Attribute Selection Mode

Use full training set

Cross-validation Folds 10

Seed 1

No class

Start Stop

Result list (right-click for options)

23:31:44 - Ranker + PrincipalComponents

18:42:55 - Ranker + PrincipalComponents

Attribute selection output

```
 0.1479  0.2207 -0.2218 -0.0752  0.1721 -0.1571  0.2773 -0.0366 -0.1082  0.2141  0.4857  0.3181  0.3588  0.0277 abnormal_short_term_variability
-0.309  -0.1303 -0.0366  0.0047  0.0415  0.1265 -0.0813  0.0469 -0.0152  0.0423 -0.3185 -0.1879  0.1363 -0.4679 mean_value_of_short_term_variability
 0.2183  0.2166 -0.1782  0.0919  0.0868 -0.0759  0.1106 -0.0563  0.1269  0.2018  0.0116 -0.6978 -0.2304  0.2021 percentage_of_time_with_abnormal_long_term_va
 0.0094 -0.145   0.1348  0.4977 -0.2854  0.3057 -0.195  -0.1934 -0.4165  0.1013  0.0881 -0.0789  0.2433  0.0985 mean_value_of_long_term_variability
-0.3007 -0.223  -0.2133  0.0967 -0.0453 -0.0188  0.1735  0.0233 -0.1261  0.0559  0.09   -0.0049  0.0572  0.0751 histogram_width
 0.321   0.1212  0.0977 -0.272  -0.0064  0.2183 -0.1451 -0.0413  0.1077  0.054  -0.0745 -0.0031 -0.0543 -0.0724 histogram_min
-0.1236 -0.2844 -0.302  -0.2384 -0.1088  0.3191  0.1374 -0.0176 -0.0962  0.2105  0.0725 -0.0157  0.0347  0.0436 histogram_max
-0.2376 -0.1757 -0.2246  0.1402 -0.0565 -0.0274  0.2232  0.0763 -0.0086  0.0966  0.3267 -0.1115 -0.5289 -0.2173 histogram_number_of_peaks
-0.1165 -0.0986 -0.1027  0.271   0.1924  0.2552 -0.0264 -0.5381  0.6557 -0.1795  0.144   0.0934  0.0723  0.0361 histogram_number_of_zeroes
 0.2599 -0.3206 -0.1485 -0.0537  0.0521 -0.0616 -0.105   0.004   0.0009  0.0124 -0.0393 -0.0303 -0.0828 -0.0637 histogram_mode
 0.3048 -0.2899 -0.1088 -0.0673 -0.0543  0.0222 -0.0462 -0.0796 -0.0109 -0.0399 -0.029  -0.0491 -0.0036  0.0604 histogram_mean
 0.2738 -0.3173 -0.1822 -0.0903  0.032  -0.0252 -0.07   -0.0484 -0.0145  0.0197 -0.0395 -0.0089  0.0206 -0.0078 histogram_median
-0.28   -0.0212 -0.2405 -0.15    0.0518  0.0011 -0.1253  0.024  -0.0506 -0.089  -0.2126 -0.088   0.1     0.7334 histogram_variance
 0.0725 -0.1966 -0.1043  0.3847  0.2137 -0.5861 -0.1685  0.0233 -0.1116 -0.3048 -0.0118 -0.0128  0.0379 -0.0199 histogram_tendency
-0.073  -0.2937  0.4128 -0.0935  0.0747 -0.1584  0.0014 -0.1078  0.0495  0.2862  0.0565  0.124  -0.186   0.1805 fetal_health=Normal
-0.1119  0.3033 -0.2378 -0.153  -0.0528 -0.159  -0.0804 -0.463  -0.213  -0.0241 -0.0459 -0.2584  0.2065 -0.2538 fetal_health=Pathological
 0.1767  0.1114 -0.3065  0.234  -0.0476  0.3166  0.0623  0.4977  0.11   -0.3245 -0.0314  0.0566  0.059  -0.0149 fetal_health=Suspect

Ranked attributes:
 0.7263   1 0.321histogram_min-0.309mean_value_of_short_term_variability+0.305histogram_mean-0.301histogram_width-0.28histogram_variance...
 0.5584   2 -0.321histogram_mode-0.317histogram_median-0.303accelerations+0.303fetal_health=Pathological-0.294fetal_health=Normal...
 0.4383   3 0.413fetal_health=Normal-0.348baseline_value-0.307fetal_health=Suspect-0.302histogram_max-0.262abnormal_short_term_variability...
 0.3694   4 0.498mean_value_of_long_term_variability+0.385histogram_tendency-0.371accelerations-0.272histogram_min+0.271histogram_number_of_zeroes...
 0.316    5 -0.564fetal_movement+0.426light_decelerations+0.403uterine_contractions-0.285mean_value_of_long_term_variability+0.214histogram_tendency...
 0.2701   6 -0.586histogram_tendency+0.319histogram_max+0.317fetal_health=Suspect+0.306mean_value_of_long_term_variability-0.276fetal_movement...
 0.2283   7 -0.468uterine_contractions-0.435fetal_movement+0.327accelerations+0.277abnormal_short_term_variability-0.276prolongued_decelerations...
 0.1907   8 -0.538histogram_number_of_zeroes+0.498fetal_health=Suspect-0.463fetal_health=Pathological+0.223fetal_movement+0.222light_decelerations...
 0.1578   9 0.656histogram_number_of_zeroes+0.428fetal_movement-0.417mean_value_of_long_term_variability-0.213fetal_health=Pathological+0.151light_deceleratio
 0.1293  10 -0.423accelerations-0.325fetal_health=Suspect+0.321light_decelerations-0.305histogram_tendency-0.29prolongued_decelerations...
 0.1041  11 0.554uterine_contractions+0.486abnormal_short_term_variability+0.327histogram_number_of_peaks-0.319mean_value_of_short_term_variability-0.284light
 0.0806  12 -0.698percentage_of_time_with_abnormal_long_term_variability+0.323prolongued_decelerations+0.318abnormal_short_term_variability-0.269uterine_conti
 0.0622  13 -0.529histogram_number_of_peaks-0.453prolongued_decelerations+0.359abnormal_short_term_variability+0.273accelerations+0.243mean_value_of_long_ter
 0.0464  14 0.733histogram_variance-0.468mean_value_of_short_term_variability-0.254fetal_health=Pathological-0.217histogram_number_of_peaks+0.202percentage_o

Selected attributes: 1,2,3,4,5,6,7,8,9,10,11,12,13,14 : 14
```

Status

OK

Log x 0