

The Final Pitch

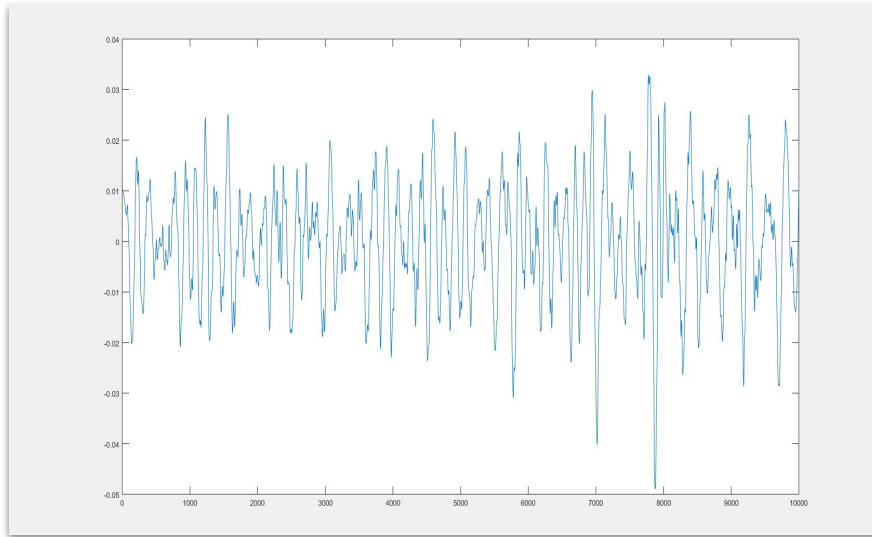
Group 11: Null hypothesis

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Feature Engineering

Raw Data analysis :
Preprocessing



Principal Features Extracted :

FREQ_ESTIMATE : x,y,z

Mean_distance_peaks : x,y,z

RMS_data : x,y,z

Pxx_Corr : xy, yz, zx

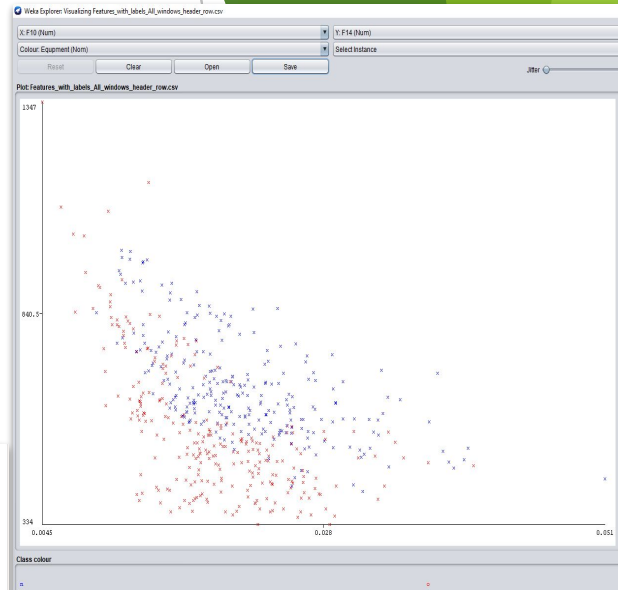
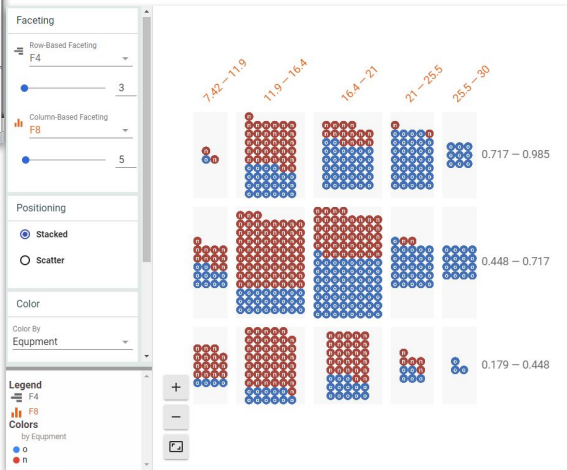
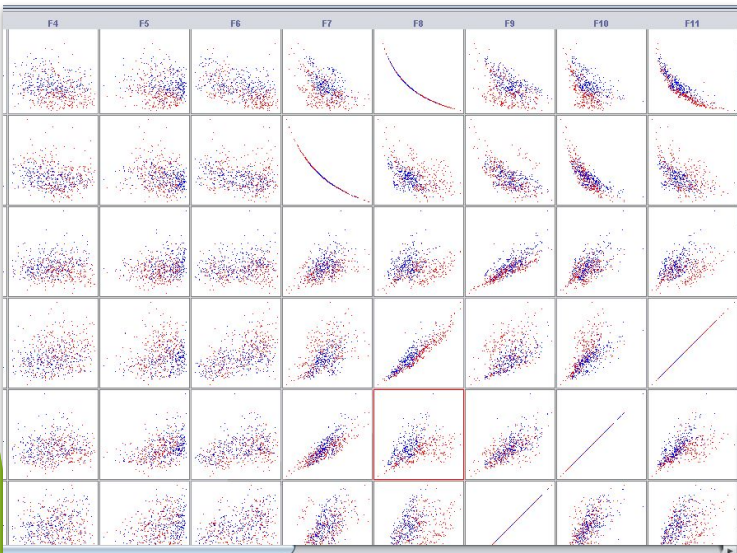
RMS_peaks : x,y,z

Number_of_peaks : x,y,z

Pipeline Modelling

- ▶ Weka
- ▶ MATLAB
- ▶ Google sheets
- ▶ Python for data extraction

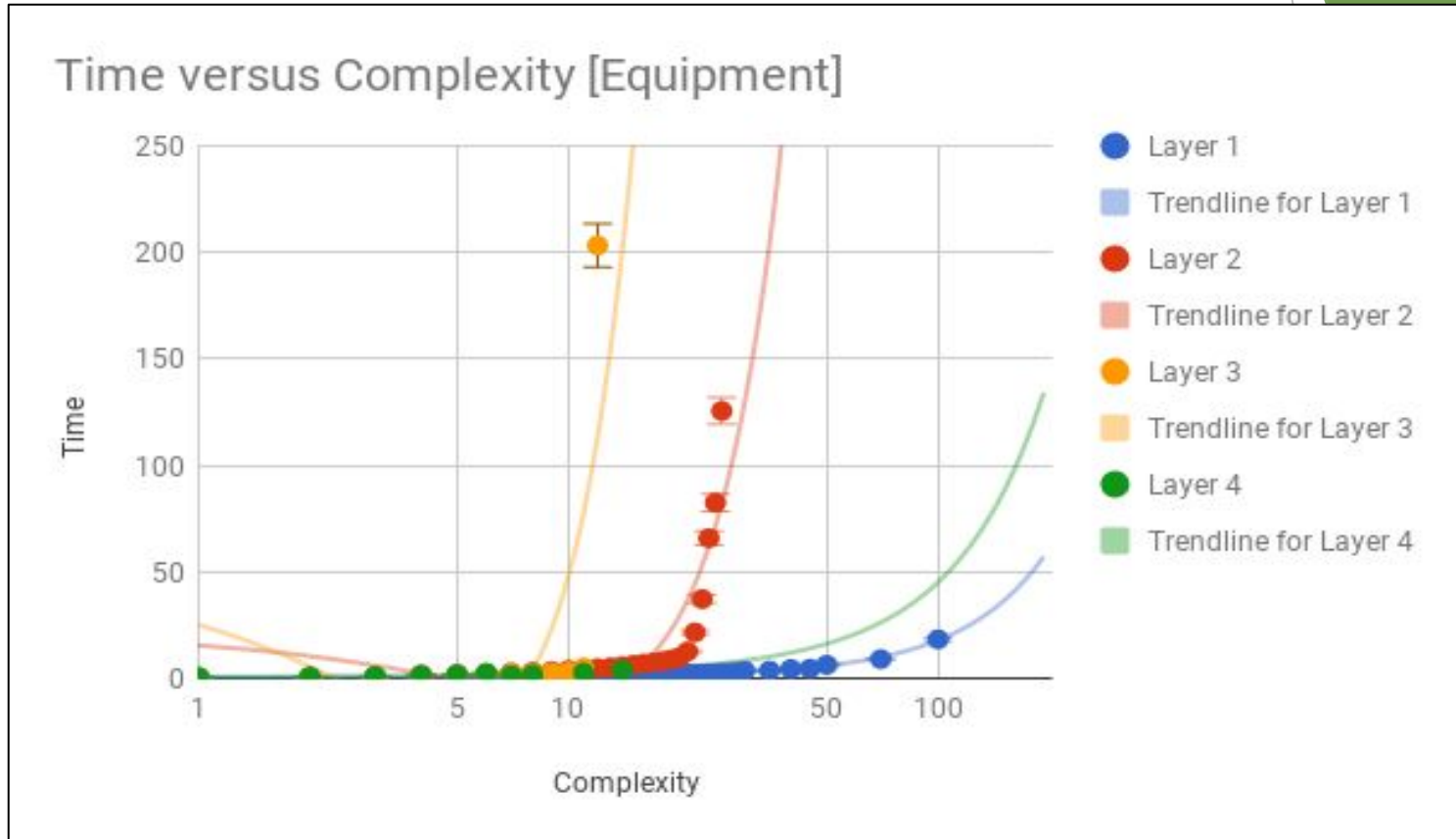
Feature Space Visualization



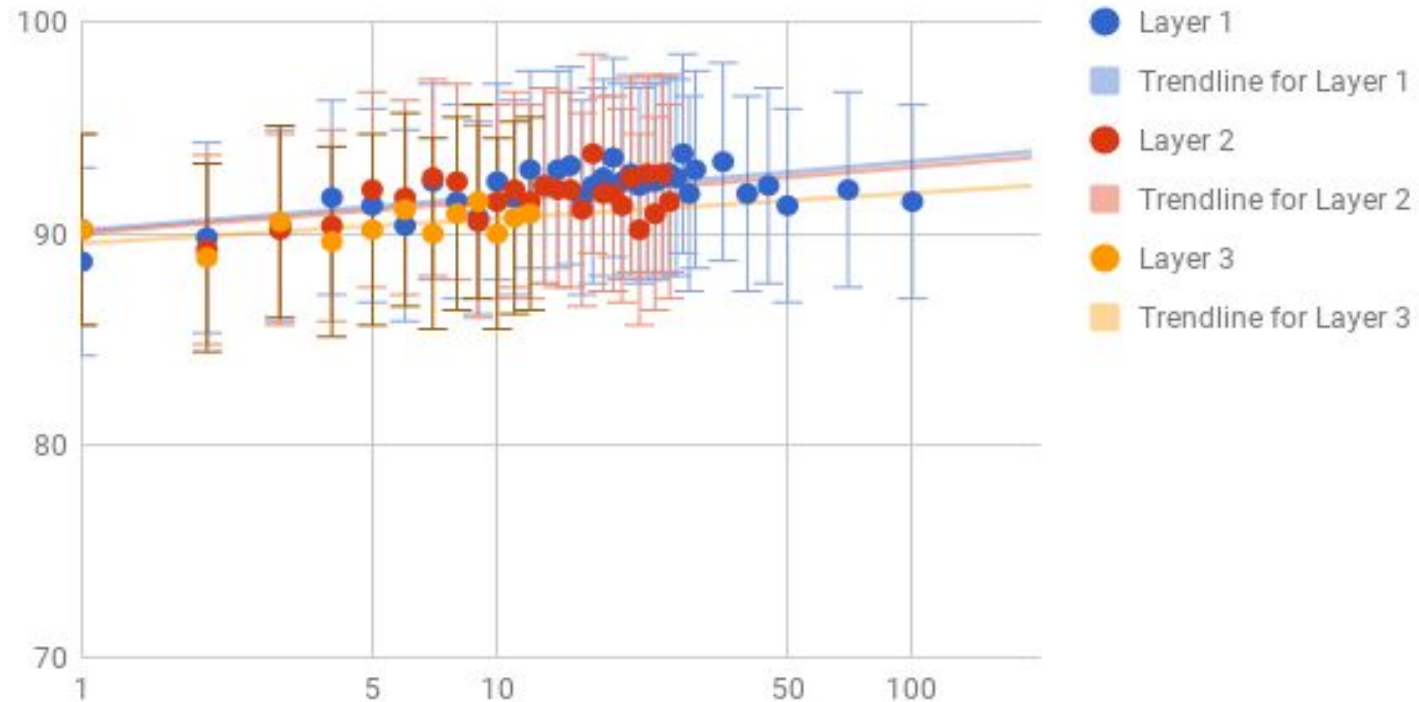
Accuracy and Big-O analysis

- For All three classes
- After various changes to the pipeline model & iterations :
 - Change number of layers
 - Change number of nodes
 - Change training data

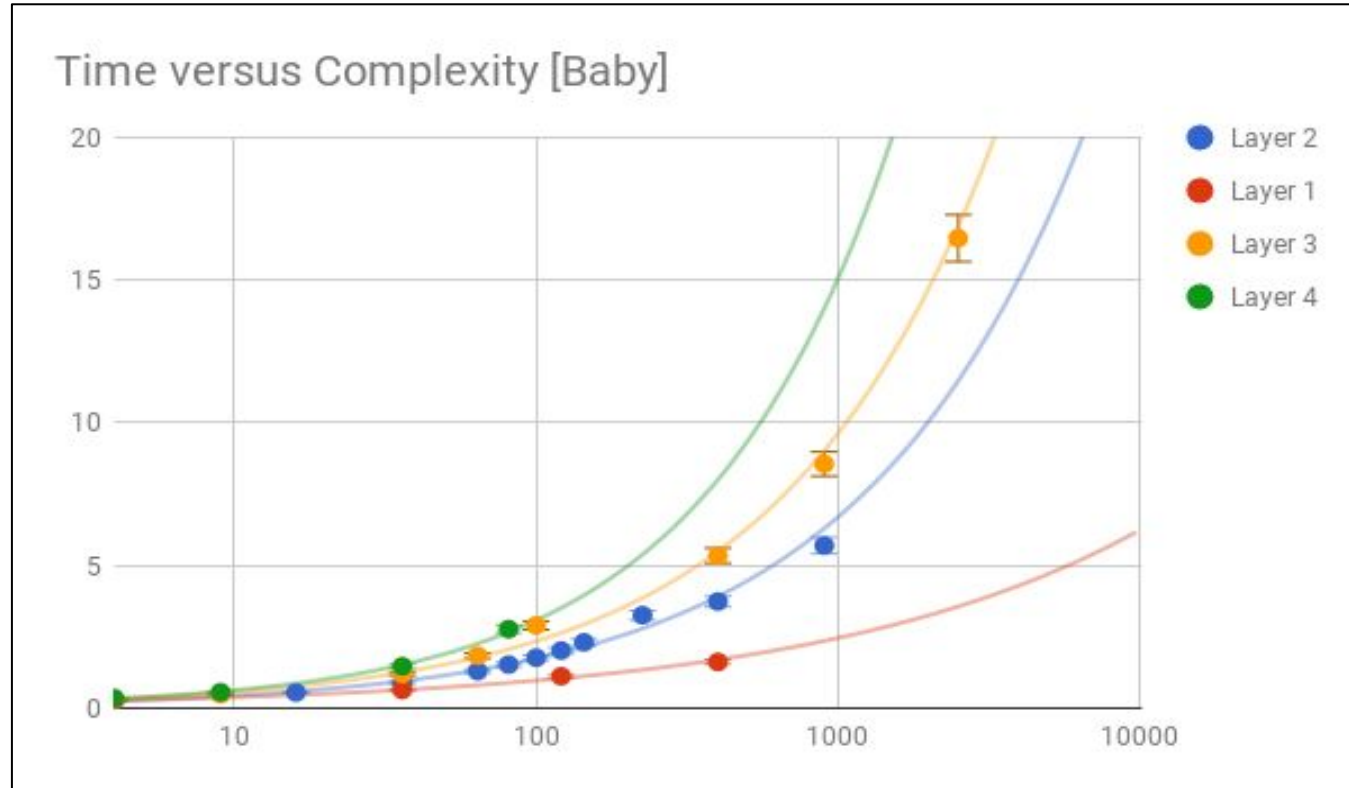
For Equipment Type :



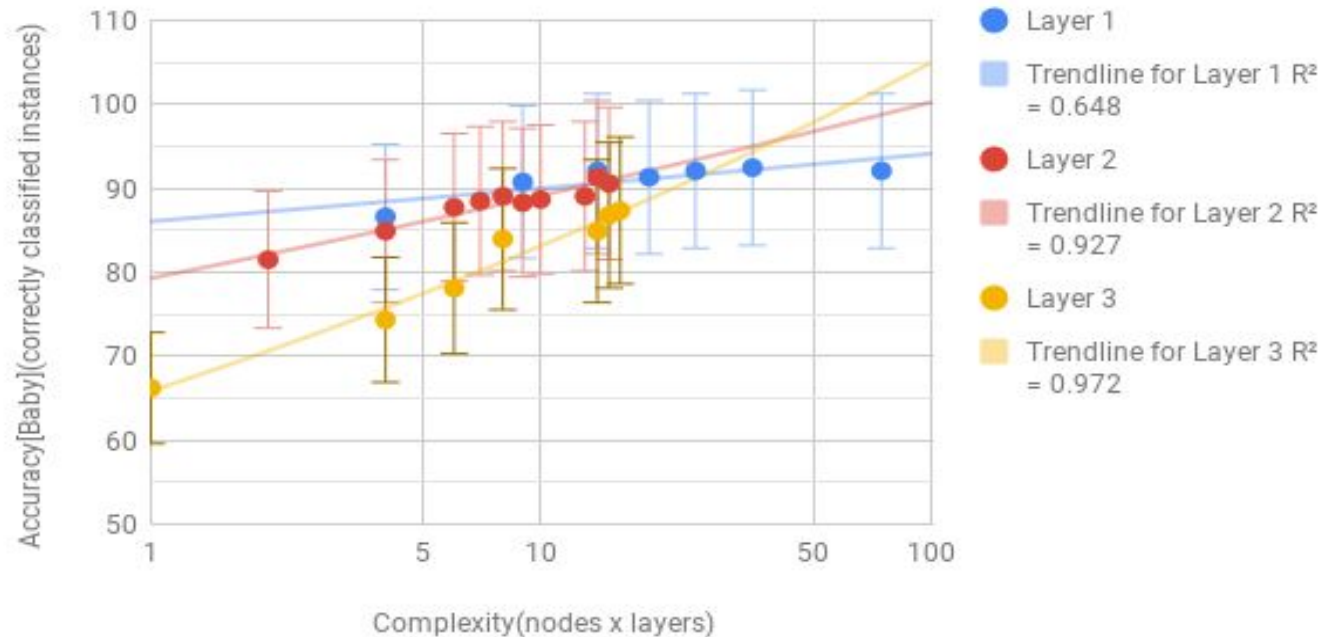
Accuracy vs Complexity[Equipment]



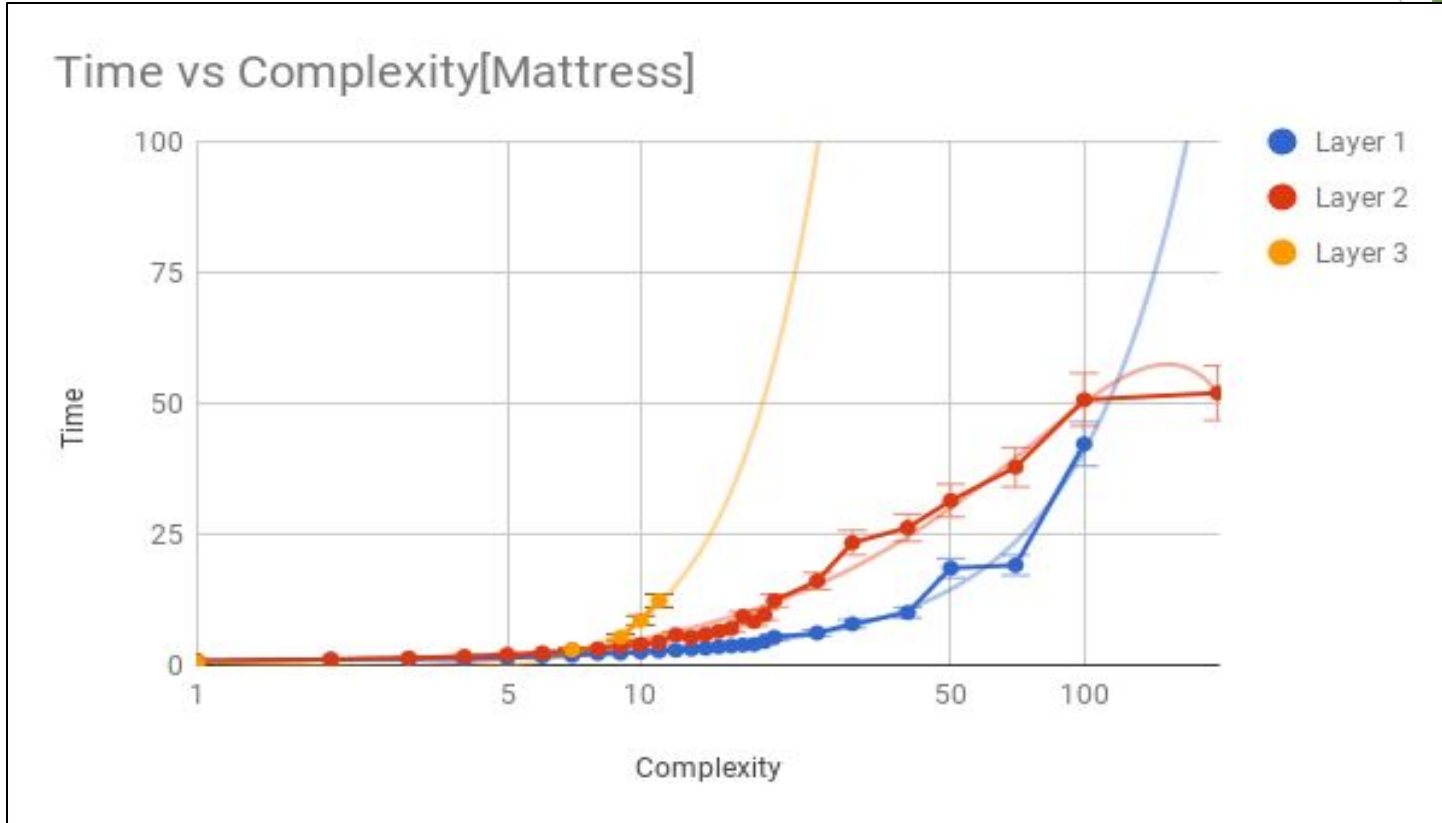
For Baby Type :



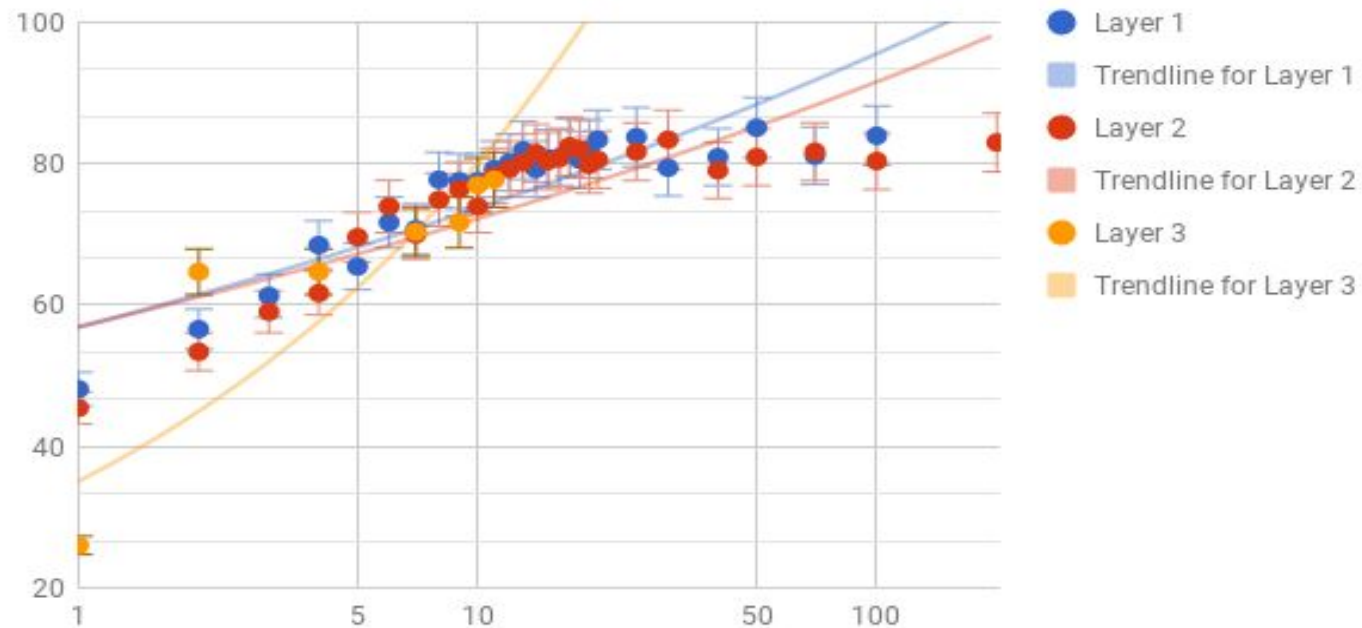
Accuracy vs. Complexity [Baby]



For Mattress Type :

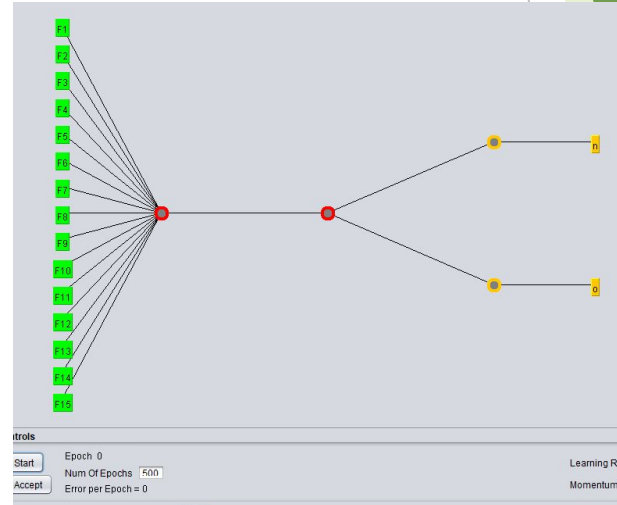
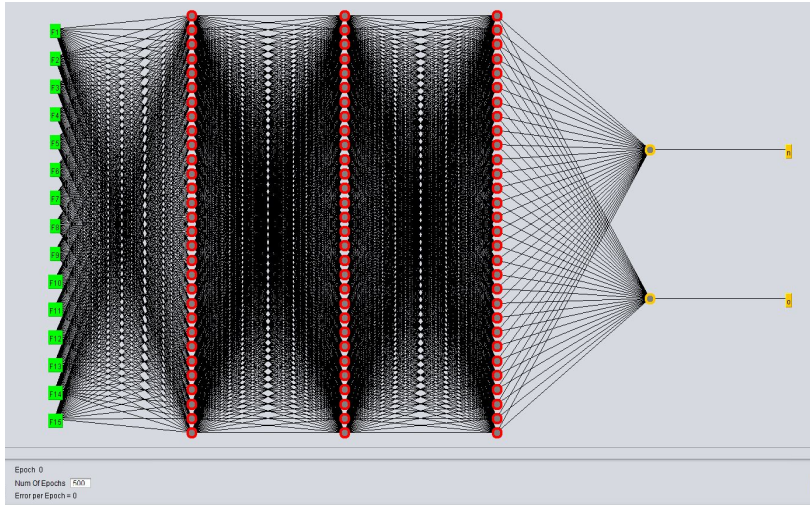


Accuracy vs Complexity [Mattress]



Multilayer Perceptrons :

Changing nodes, layers for measuring accuracy



For Equipment type : Final Values

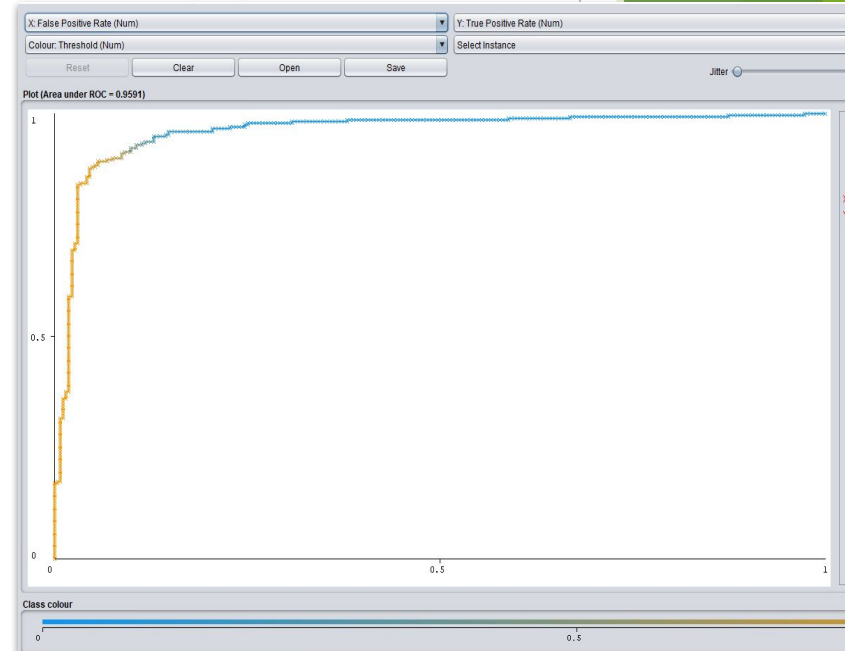
```
Correctly Classified Instances    481        90.7547 %
Incorrectly Classified Instances    49        9.2453 %
Kappa statistic                   0.8151
Mean absolute error               0.0948
Root mean squared error          0.2711
Relative absolute error           18.9628 %
Root relative squared error       54.2295 %
Total Number of Instances        530
```

=== Detailed Accuracy By Class ===

	TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
	0.901	0.086	0.912	0.901	0.906	0.815	0.959	0.949	n
	0.914	0.099	0.904	0.914	0.909	0.815	0.959	0.955	o
Weighted Avg.	0.908	0.093	0.908	0.908	0.908	0.815	0.959	0.952	

=== Confusion Matrix ===

```
a  b  <-- classified as
237 26 | a = n
23 244 | b = o
```



For Baby Type : Final Values

```
=== Stratified cross-validation ===  
=== Summary ===
```

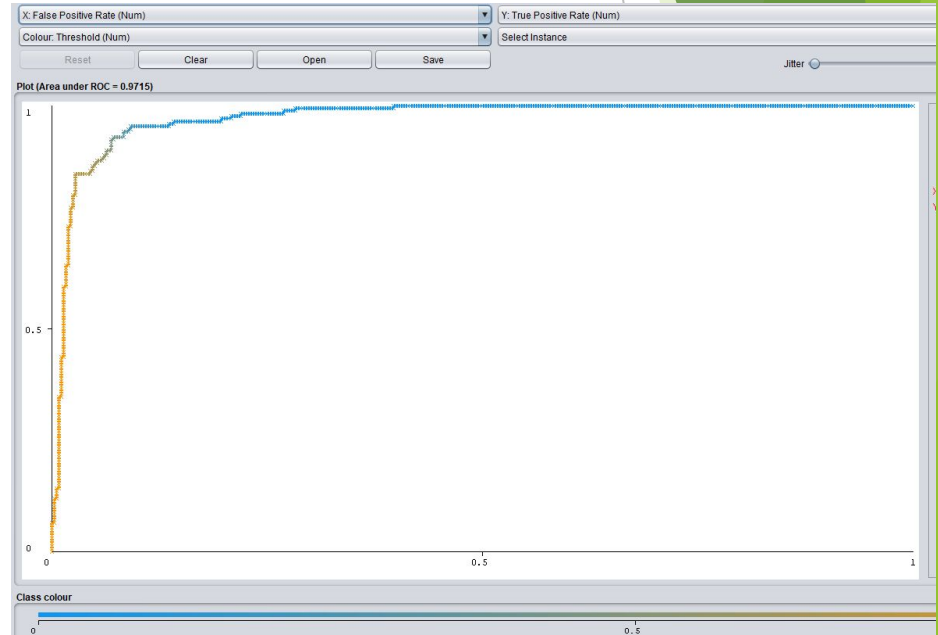
Correctly Classified Instances	481	90.7547 %
Incorrectly Classified Instances	49	9.2453 %
Kappa statistic	0.8613	
Mean absolute error	0.0709	
Root mean squared error	0.2144	
Relative absolute error	15.9688 %	
Root relative squared error	45.4911 %	
Total Number of Instances	530	

```
=== Detailed Accuracy By Class ===
```

	TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
	0.977	0.017	0.966	0.977	0.972	0.958	0.998	0.996	h
	0.847	0.052	0.896	0.847	0.871	0.806	0.963	0.946	l
	0.900	0.069	0.860	0.900	0.879	0.821	0.971	0.923	m
Weighted Avg.	0.908	0.046	0.908	0.908	0.907	0.862	0.977	0.955	

```
=== Confusion Matrix ===
```

```
a  b  c  <-- classified as  
173  3  1 | a = h  
4 155 24 | b = l  
2  15 153 | c = m
```



For Mattress Type : Final Values

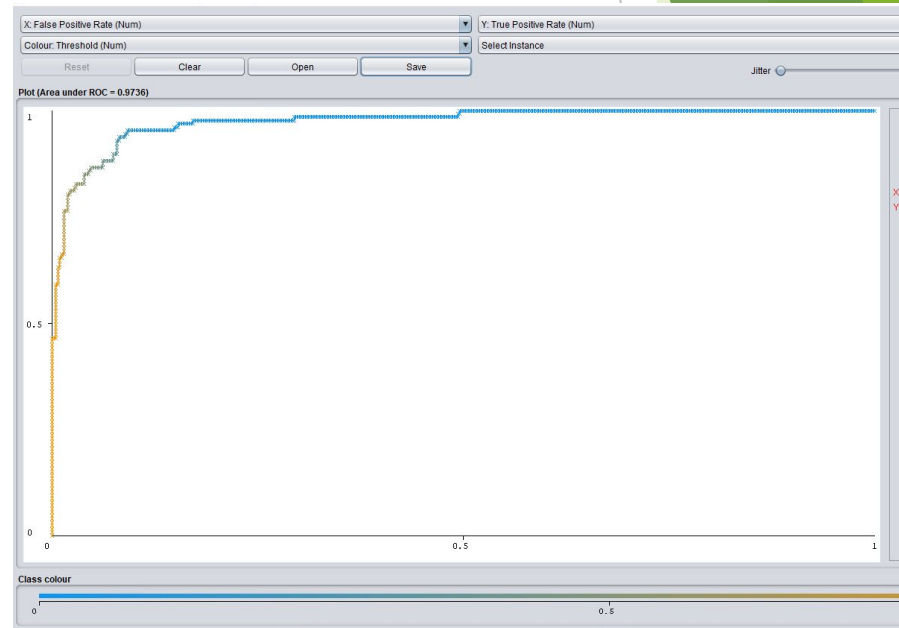
```
Correctly Classified Instances      442          83.3962 %
Incorrectly Classified Instances    88           16.6038 %
Kappa statistic                    0.7785
Mean absolute error                 0.1003
Root mean squared error             0.2529
Relative absolute error             26.7675 %
Root relative squared error         58.409 %
Total Number of Instances          530
```

=== Detailed Accuracy By Class ===

	TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
	0.860	0.050	0.847	0.860	0.854	0.806	0.957	0.903	C
	0.842	0.055	0.836	0.842	0.839	0.785	0.969	0.886	F
	0.794	0.077	0.789	0.794	0.792	0.716	0.925	0.860	G
	0.843	0.040	0.870	0.843	0.856	0.812	0.974	0.937	W
Weighted Avg.	0.834	0.056	0.834	0.834	0.834	0.778	0.955	0.895	

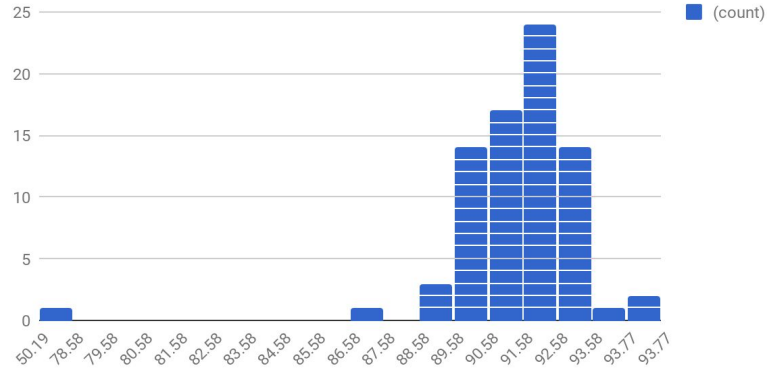
=== Confusion Matrix ===

```
 a  b  c  d  <-- classified as
111  6 10  2 | a = C
 7 112 10  4 | b = F
 7 12 112 10 | c = G
 6  4 10 107 | d = W
```

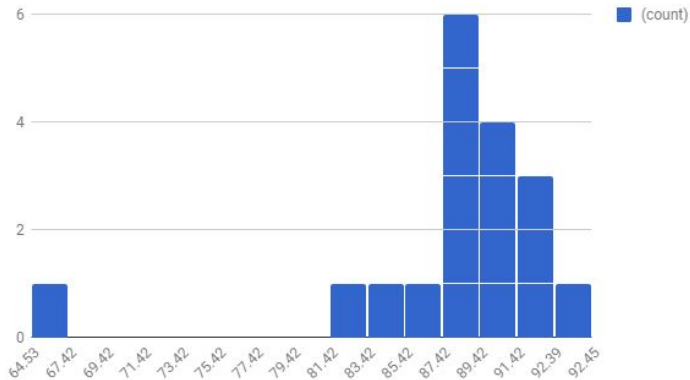


Histogram Plot for all class Accuracies

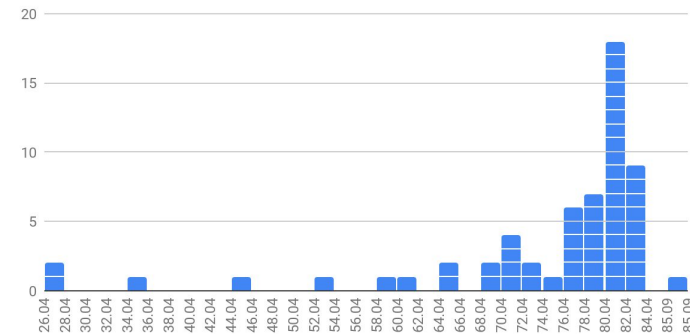
Histogram of Accuracy[Equipment](correctly classified instances)



Histogram of Accuracy[Baby](correctly classified instances)



Histogram of Accuracy[Mattress](correctly classified instances)



Meta-learning or AdaBoost-ing :

Using Meta learning : With Adaboost, we get a variable accuracy increase of 1-5% with all the classes but it seems to overfit on the training data, hence we do not include it in our final reported accuracies

```
Classifier output

Weight: 3.01

Number of performed Iterations: 10

Time taken to build model: 0.26 seconds

=== Stratified cross-validation ===
=== Summary ===
Correctly Classified Instances      455      85.8491 %
Incorrectly Classified Instances    75      14.1509 %
Kappa statistic                    0.7875
Mean absolute error                0.0958
Root mean squared error            0.2953
Relative absolute error            21.5559 %
Root relative squared error        62.6468 %
Total Number of Instances         530

=== Detailed Accuracy By Class ===

      TP Rate  FP Rate  Precision  Recall  F-Measure  MCC      ROC Area  PRC Area  Class
      -----  -
      0.938    0.020    0.960     0.938    0.949     0.923    0.991    0.967    h
      0.852    0.110    0.804     0.852    0.828     0.733    0.946    0.896    l
      0.782    0.093    0.816     0.782    0.799     0.707    0.937    0.885    m
Weighted Avg.   0.858    0.071    0.860     0.858    0.859     0.788    0.958    0.923

=== Confusion Matrix ===
      a  b  c  <-- classified as
166  4  7 |  a = h
 4 156 23 |  b = l
 3  34 133 |  c = m
```

Overall Results

We Report following class accuracies with Multilayer Perceptron from Histogram of accuracies after multiple iterations :

Classification Class	Mean Accuracy(%) : Instances identified correctly	Standard Deviation (%) \bar{x} (Deviation from mean accuracy)	Final reported accuracy
Equipment	91.7	3.5	0.917 \bar{x} 0.035
Baby	87.73	3.5	0.8773 \bar{x} 0.035
Mattress Type	80.6	5	0.806 \bar{x} 0.05
Final Accuracy			0.6481 \bar{x} 0.05

The background features abstract, overlapping green geometric shapes, primarily triangles and polygons, in various shades of green, creating a modern and dynamic visual effect.

Thank you all !