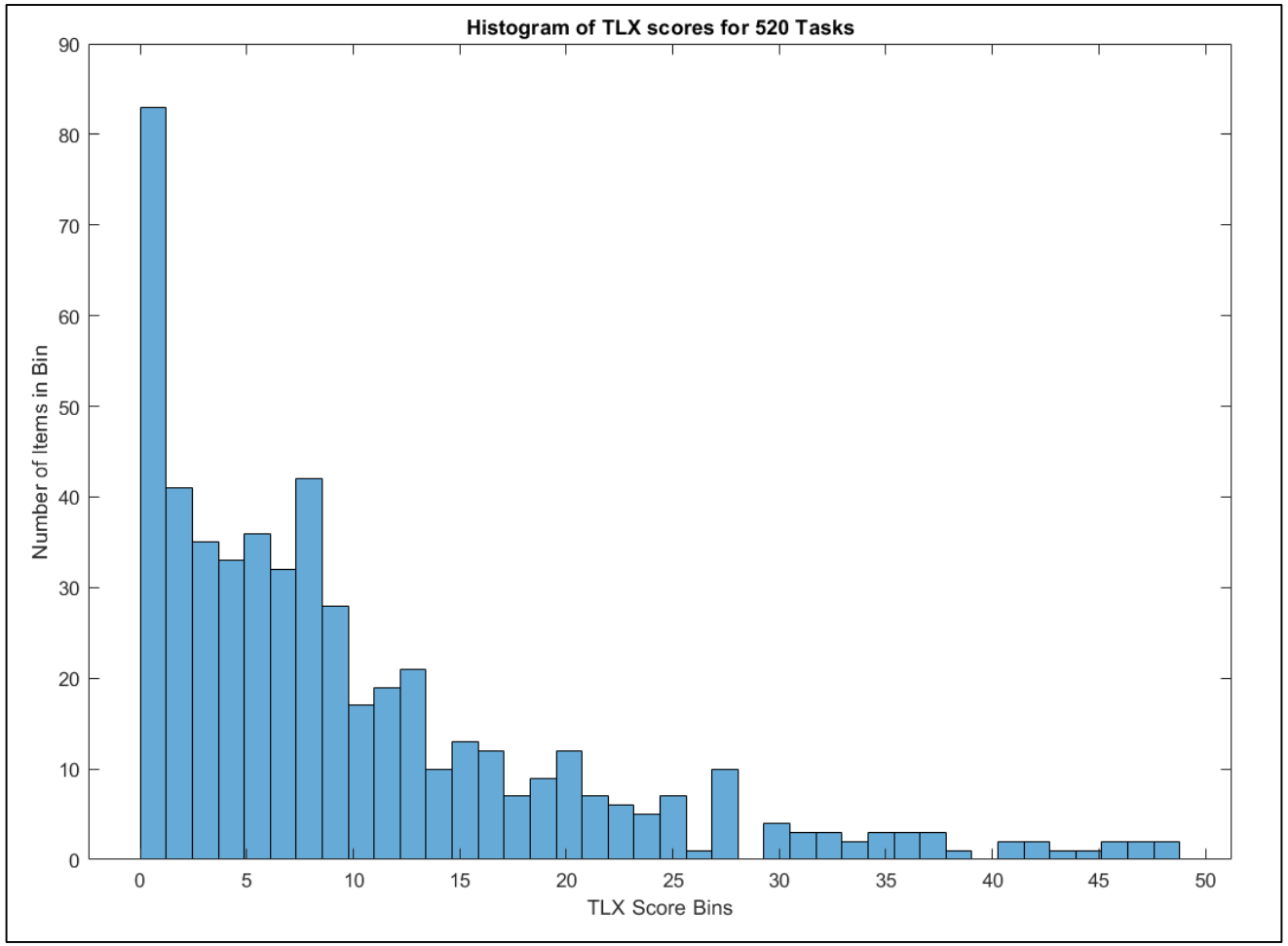
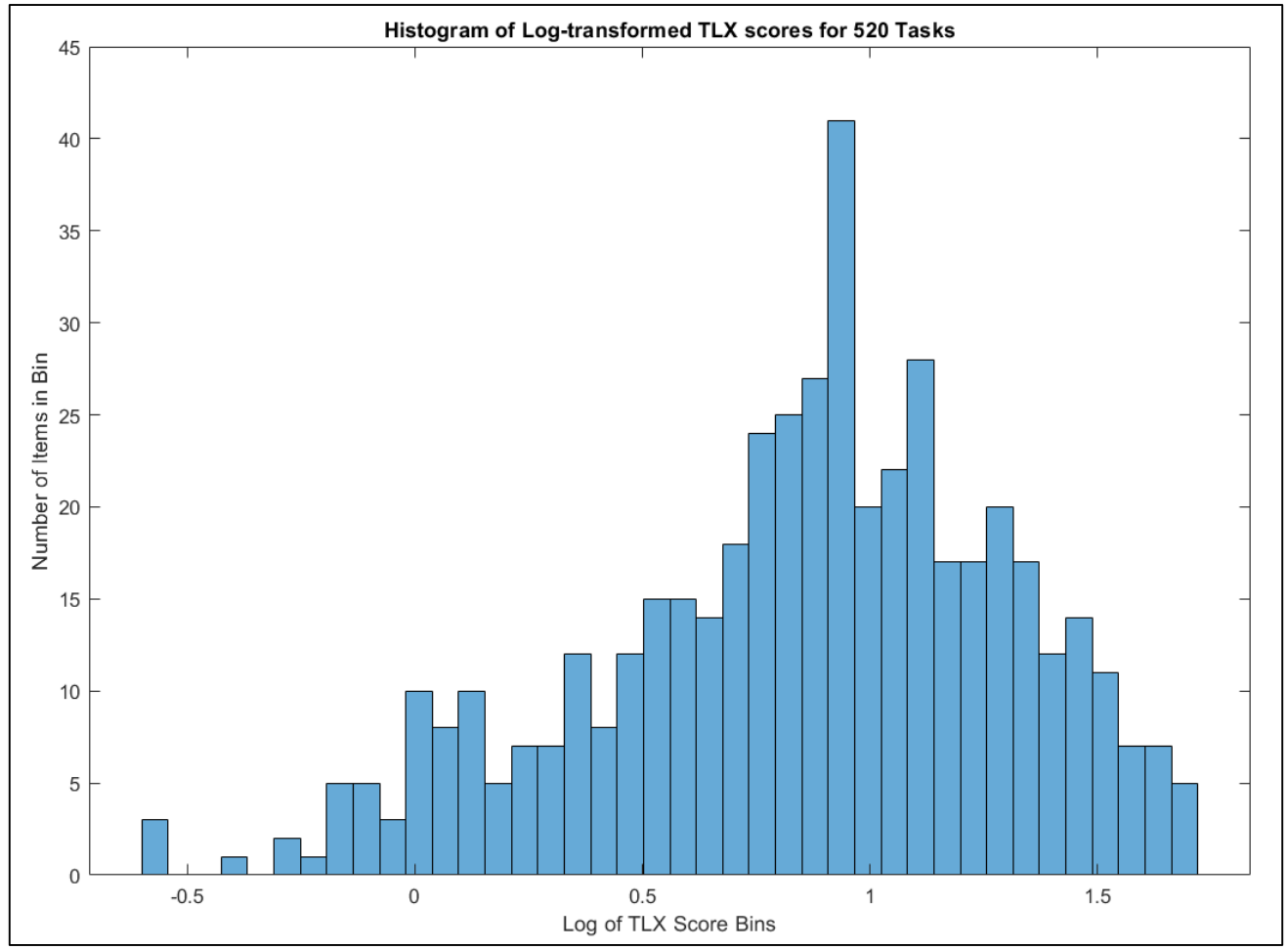
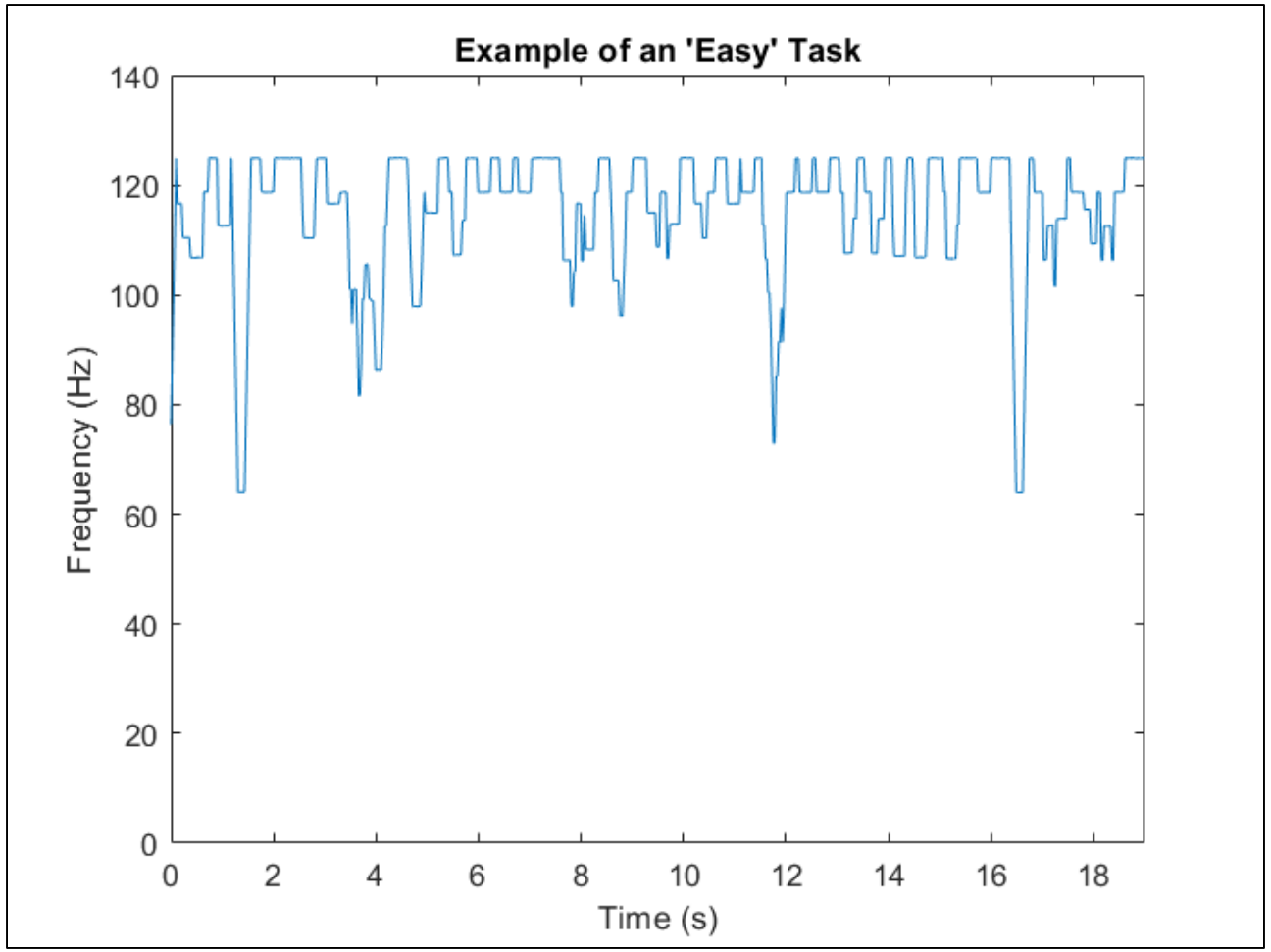
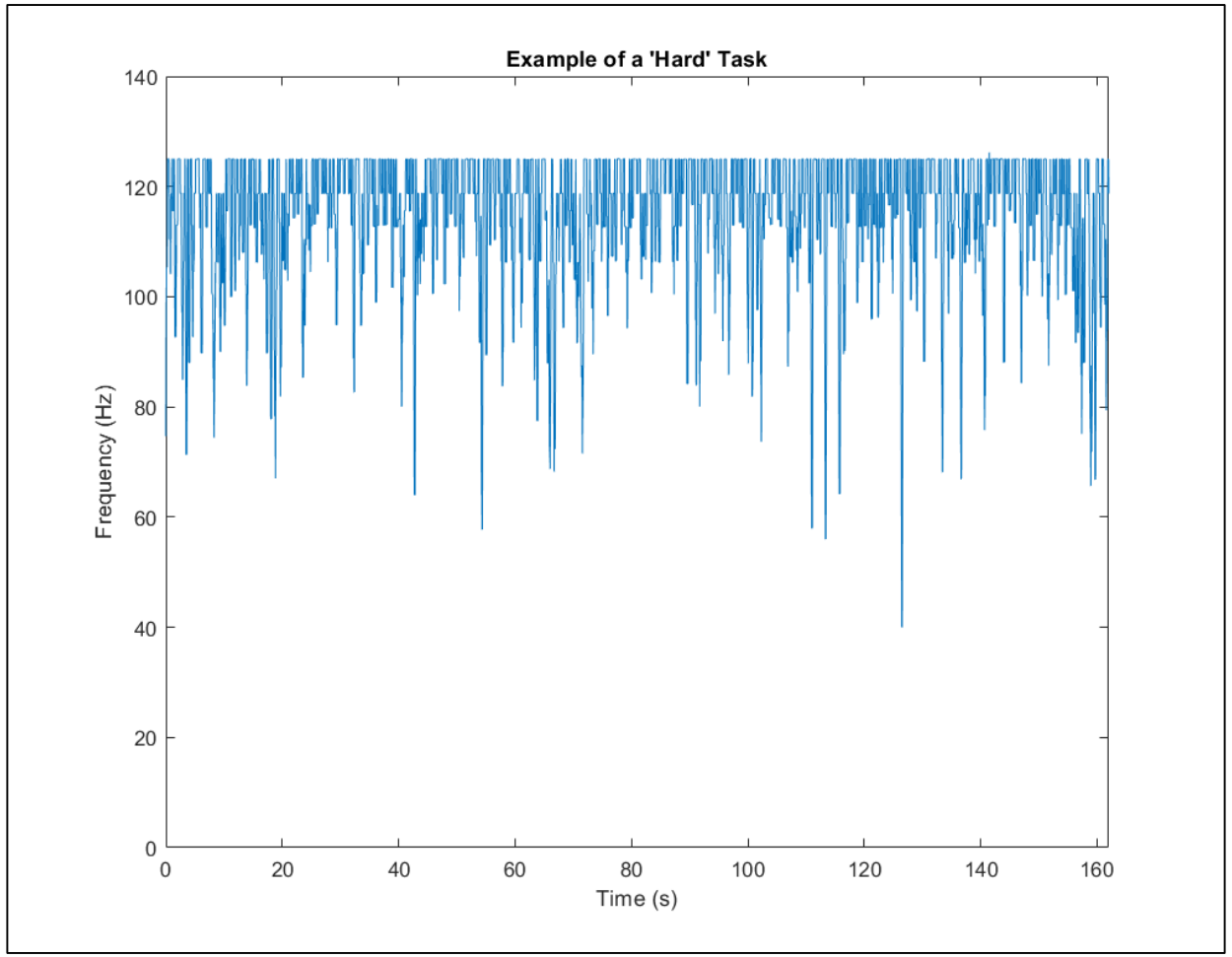
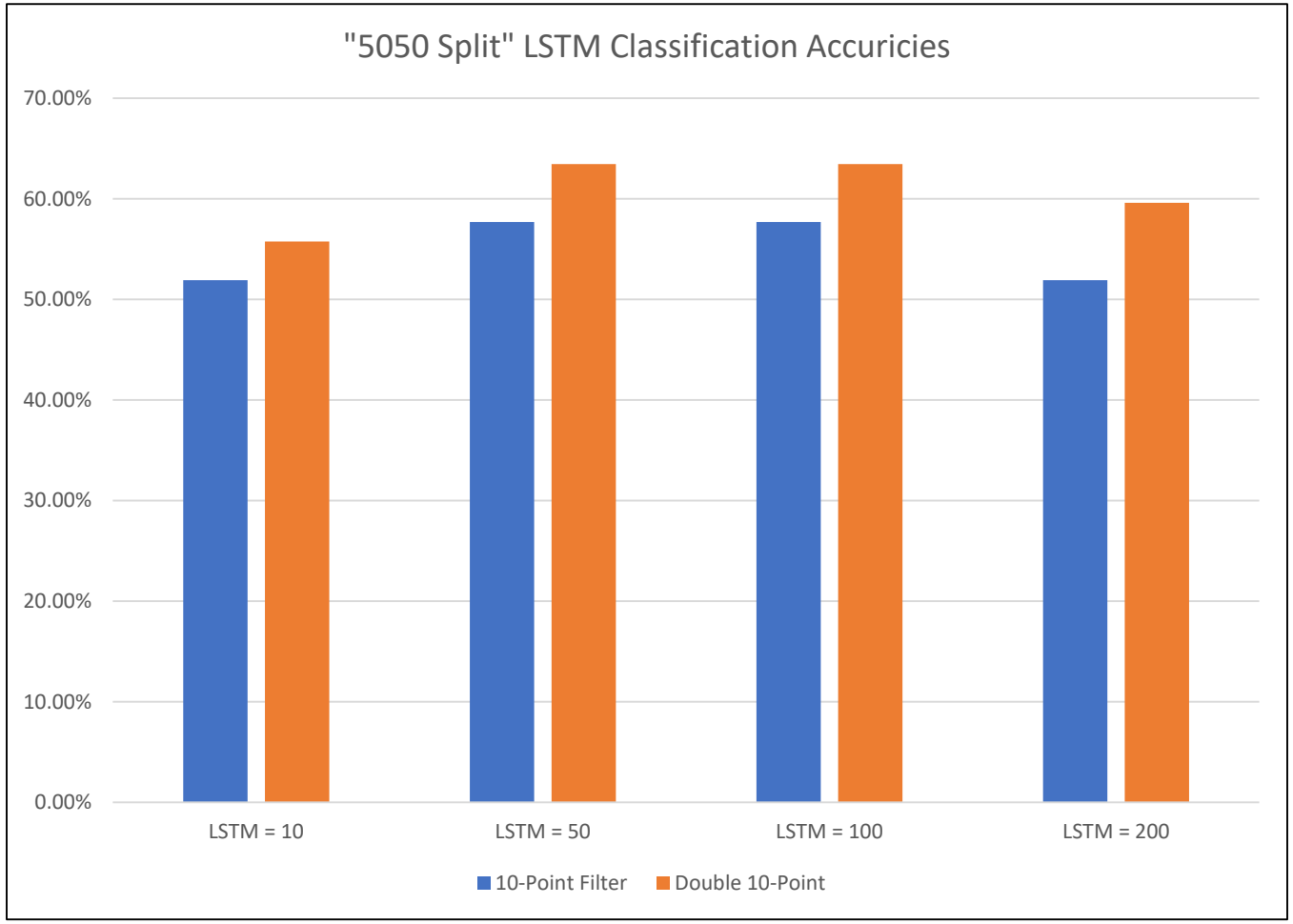
The Kinova Mico Robotic Arm and Joystick

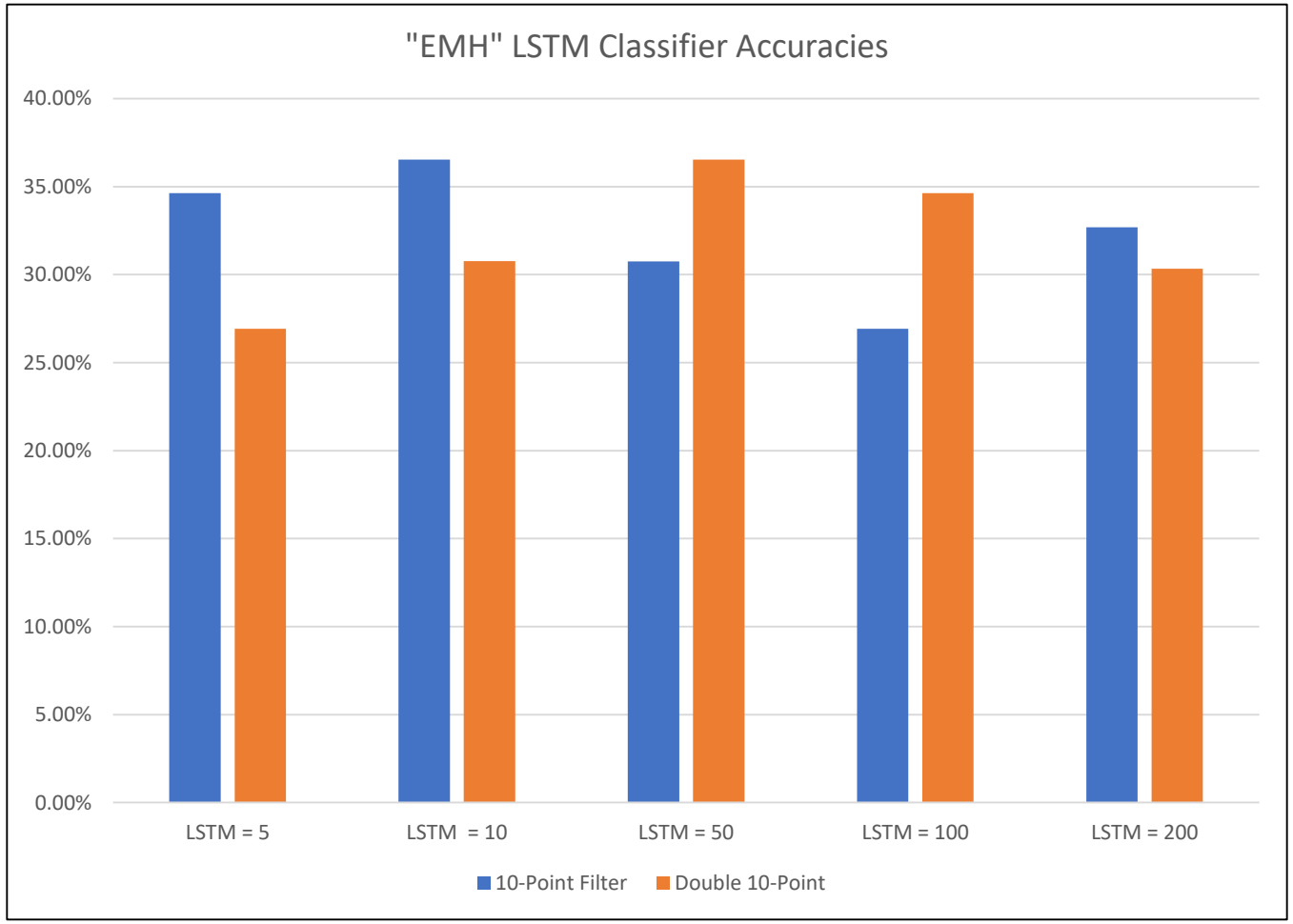

Histogram of TLX scores for 520 Tasks
Number of Items in Bin
TLX Score Bins
0
10
20
30
40
50
60
70
80
90
0
5
10
15
20
25
30
35
40
45
50


Histogram of Log-transformed TLX scores for 520 Tasks
Number of Items in Bin
Log of TLX Score Bins
0
5
10
15
20
25
30
35
40
45
-0.5
0
0.5
1
1.5


Example of an 'Easy' Task
Frequency (Hz)
Time (s)
0
20
40
60
80
100
120
140
0
2
4
6
8
10
12
14
16
18


Example of a 'Hard' Task
Frequency (Hz)
Time (s)
0
20
40
60
80
100
120
140
160


"5050 Split" LSTM Classification Accuricies
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
LSTM = 10
LSTM = 50
LSTM = 100
LSTM = 200
10-Point Filter
Double 10-Point


"EMH" LSTM Classifier Accuracies
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
LSTM = 5
LSTM = 10
LSTM = 50
LSTM = 100
LSTM = 200
10-Point Filter
Double 10-Point

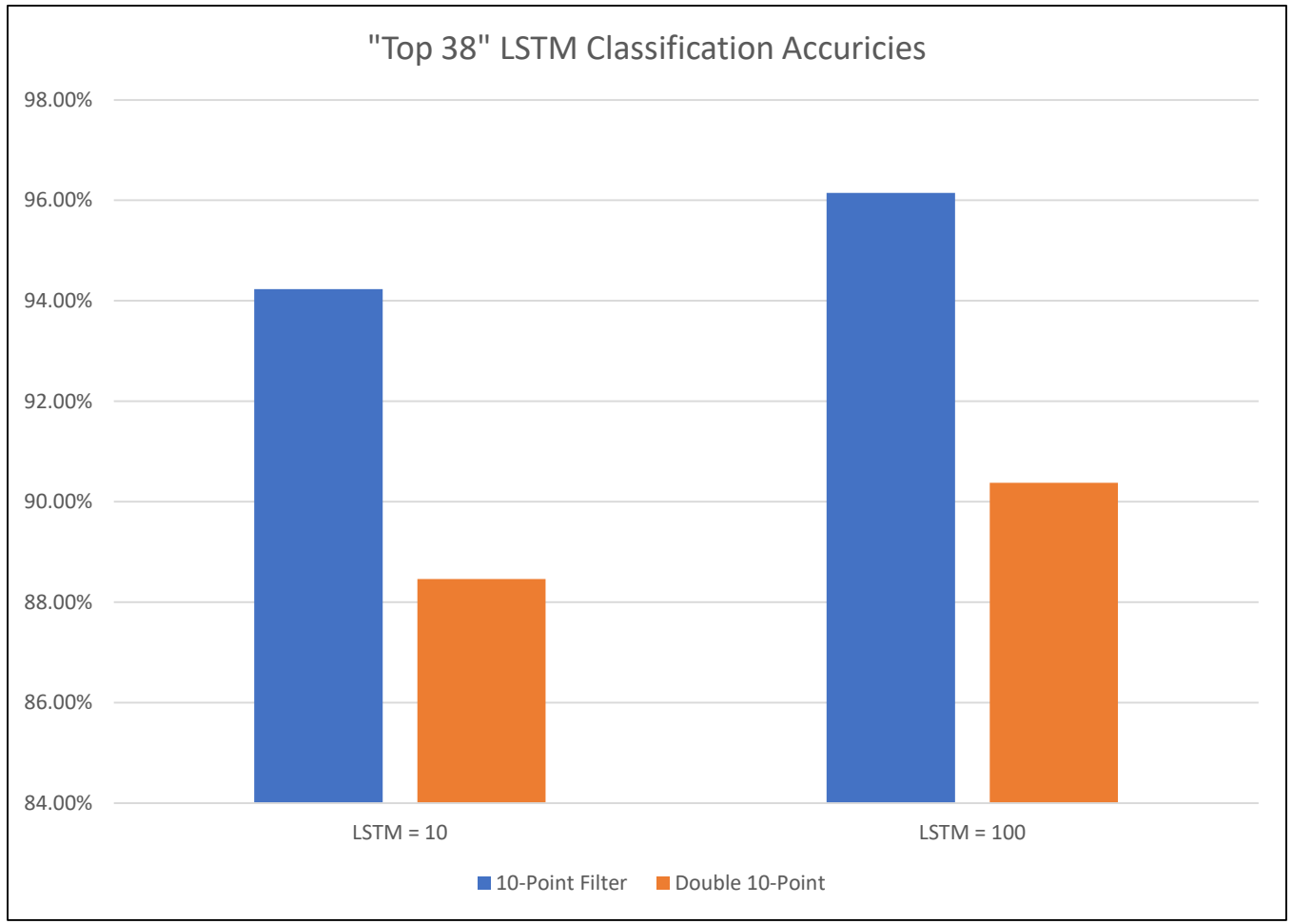
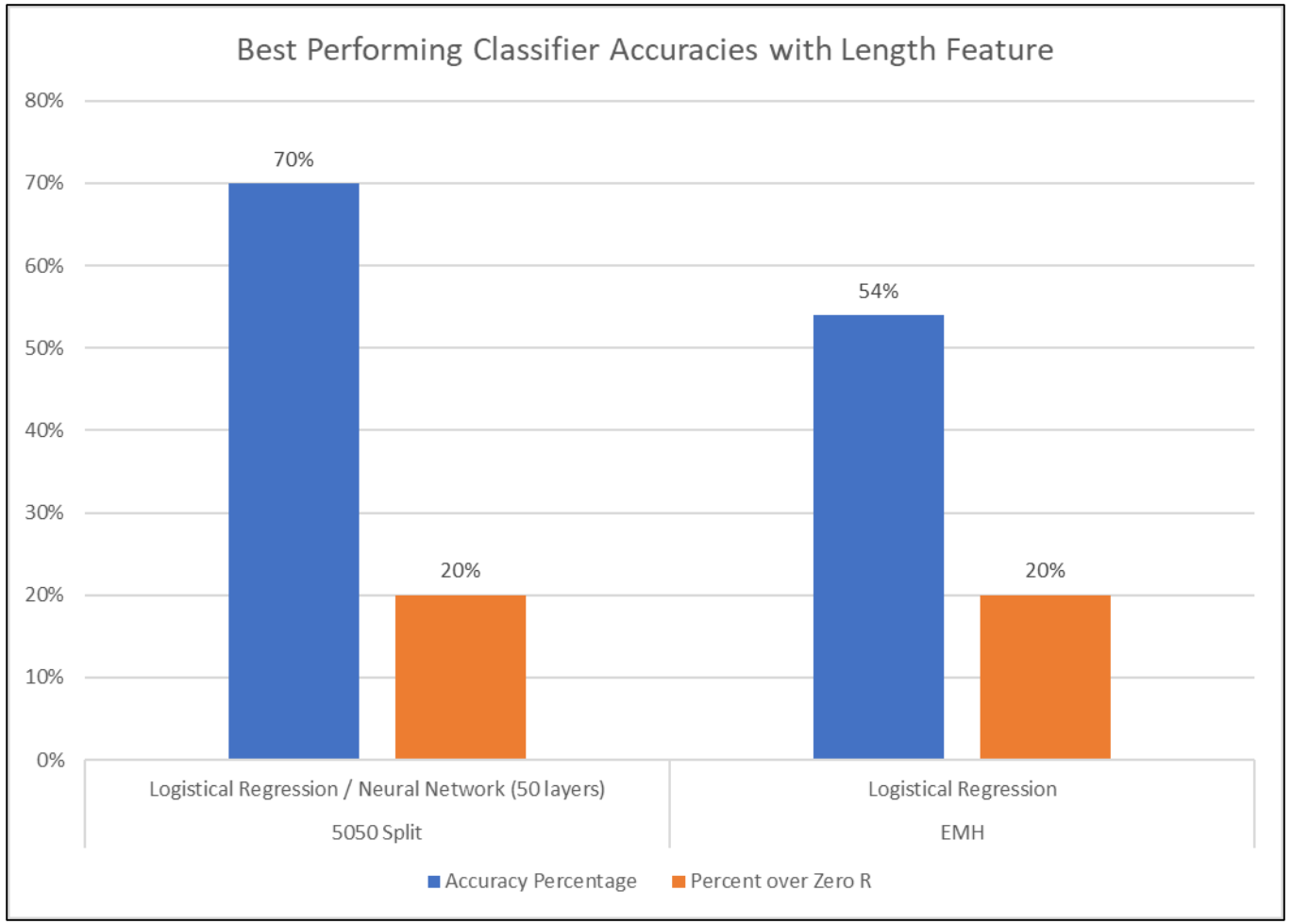

"Top 38" LSTM Classification Accuricies
98.00%
96.00%
94.00%
92.00%
90.00%
88.00%
86.00%
84.00%
LSTM = 10
LSTM = 100
10-Point Filter
Double 10-Point

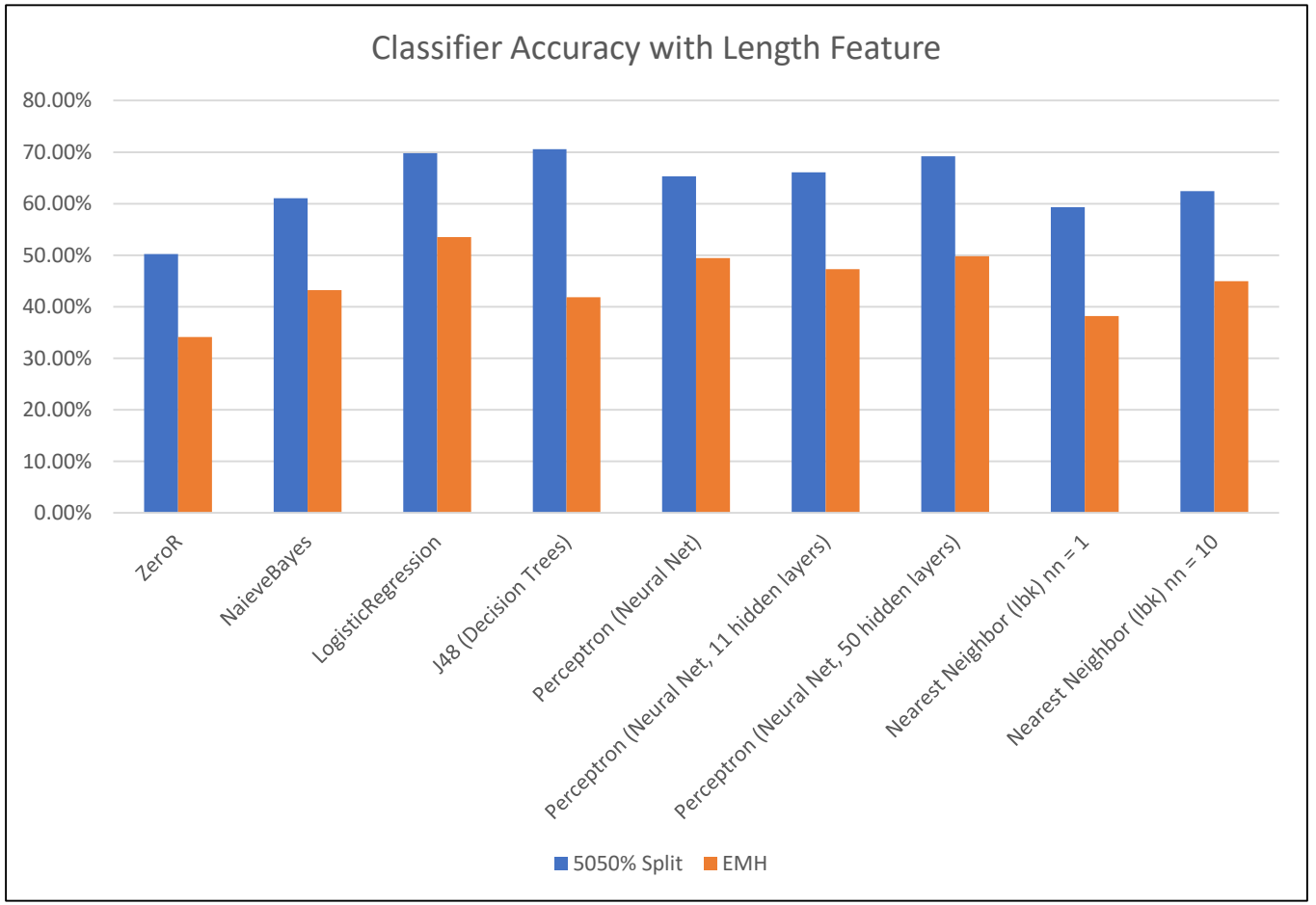
Table of LSTM Model Performances

Acc for "5050 Splt"	10-Point Filter	Double 10-Point
LSTM = 10	51.92%	55.77%
LSTM = 50	57.69%	63.46%
LSTM = 100	57.69%	63.46%
LSTM = 200	51.92%	59.62%

Acc for Trimodal	10-Point Filter	Double 10-Point
LSTM = 5	34.62%	26.92%
LSTM = 10	36.54%	30.77%
LSTM = 50	30.75%	36.54%
LSTM = 100	26.92%	34.62%
LSTM = 200	32.69%	30.33%

Acc for Binary - T38	10-Point Filter	Double 10-Point
LSTM = 10	94.23%	88.46%
LSTM = 100	96.15%	90.38%


Best Performing Classifier Accuracies with Length Feature
80%
70%
60%
50%
40%
30%
20%
10%
0%
70%
20%
54%
20%
Logistical Regression / Neural Network (50 layers)
5050 Split
Logistical Regression
EMH
Accuracy Percentage
Percent over Zero R


Classifier Accuracy with Length Feature
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
ZeroR
NaieveBayes
LogisticRegression
J48 (Decision Trees)
Perceptron (Neural Net)
Perceptron (Neural Net, 11 hidden layers)
Perceptron (Neural Net, 50 hidden layers)
Nearest Neighbor (Ibk) nn = 1
Nearest Neighbor (Ibk) nn = 10
5050% Split
EMH

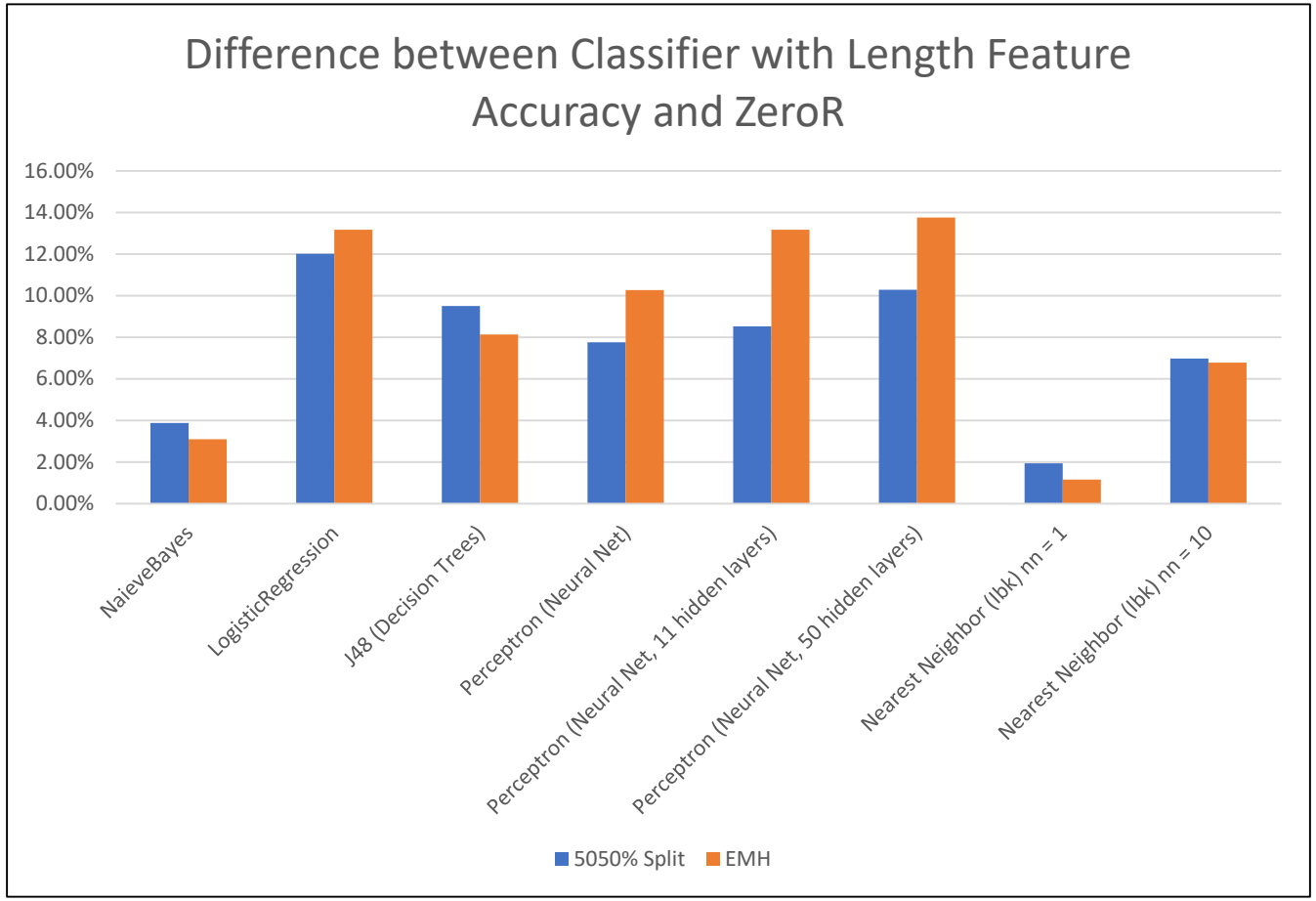
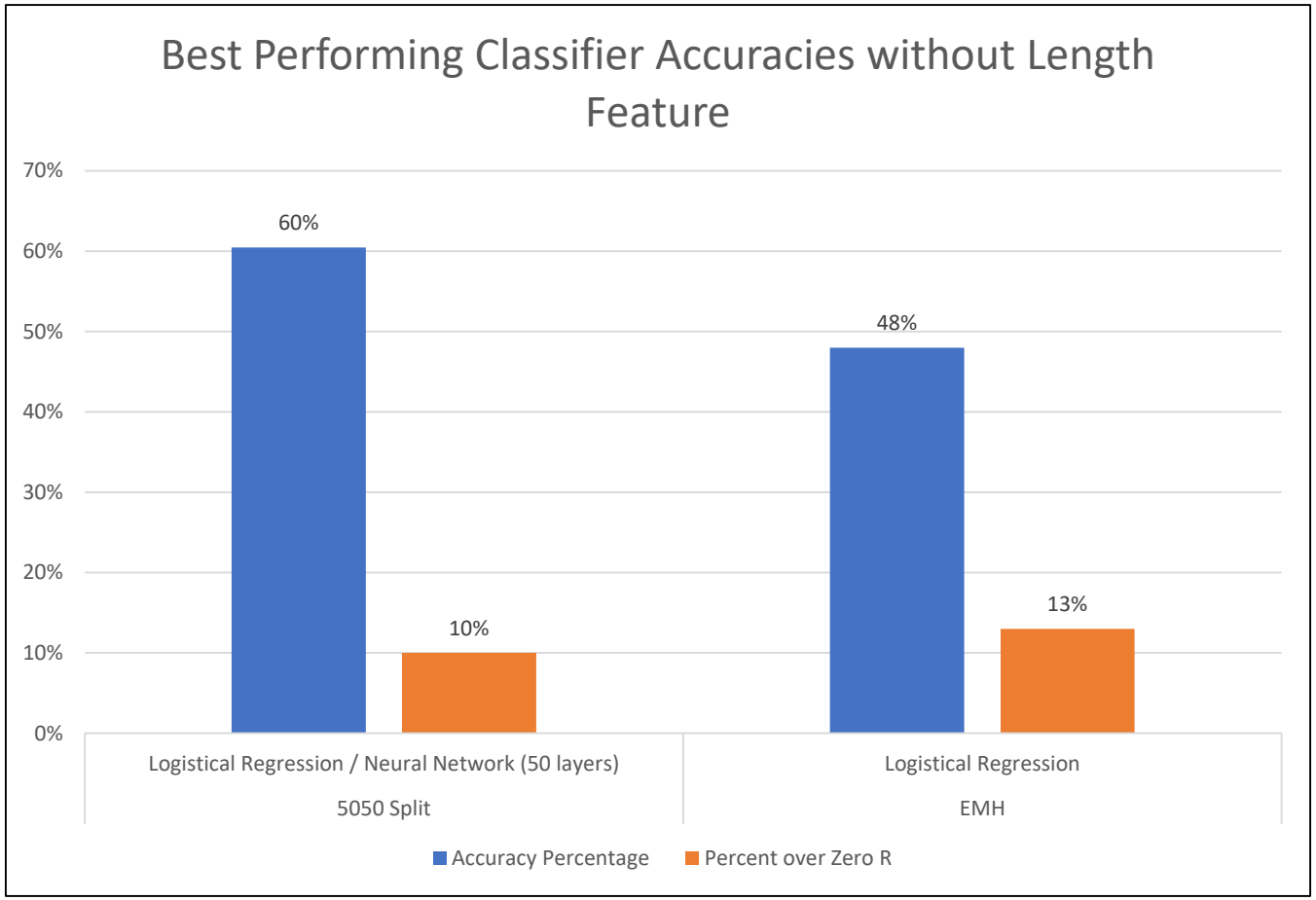

Difference between Classifier with Length Feature Accuracy and ZeroR
16.00%
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
NaieveBayes
LogisticRegression
J48 (Decision Trees)
Perceptron (Neural Net)
Perceptron (Neural Net, 11 hidden layers)
Perceptron (Neural Net, 50 hidden layers)
Nearest Neighbor (Ibk) nn = 1
Nearest Neighbor (Ibk) nn = 10
5050% Split
EMH

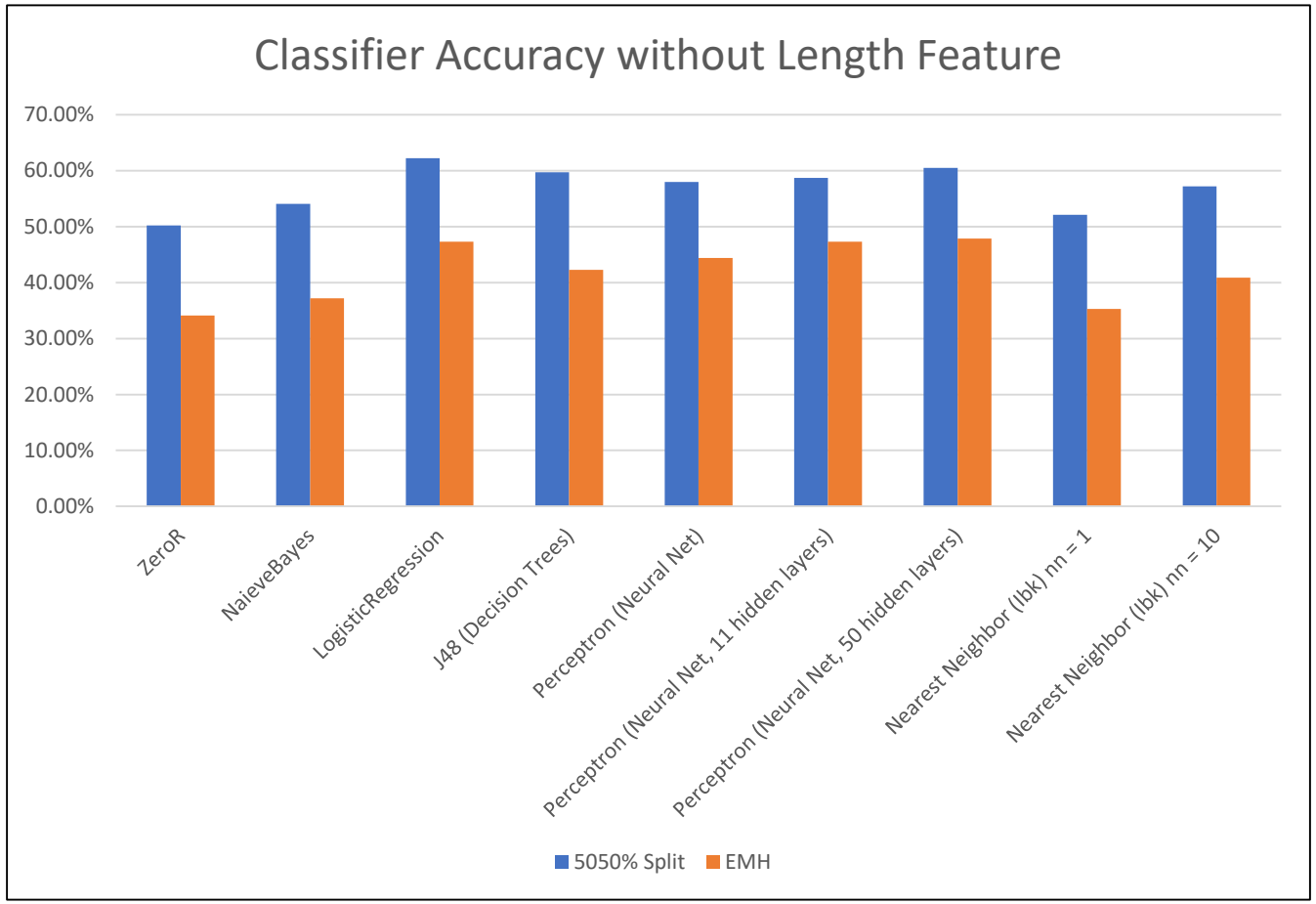
Table of Weka-Trained Model Performances

Classifier	5050% Split	EMH	Top38
ZeroR	50.19%	34.11%	92.64%
NaieveBayes	61.05%	43.22%	72.67%
LogisticRegression	69.77%	53.49%	92.05%
J48 (Decision Trees)	70.54%	41.86%	92.44%
Perceptron (Neural Net)	65.31%	49.42%	91.67%
Perceptron (Neural Net, 11 hidden layers)	66.10%	47.29%	92.25%
Perceptron (Neural Net, 50 hidden layers)	69.19%	49.81%	91.56%
Nearest Neighbor (Ibk) nn = 1	59.30%	38.18%	88.96%
Nearest Neighbor (Ibk) nn = 10	62.40%	44.96%	92.44%

Table of Weka-Trained Model Performances Compared to ZeroR

Classifier	5050% Split	EMH	Top38
NaieveBayes	10.86%	9.11%	-19.97%
LogisticRegression	19.57%	19.38%	-0.59%
J48 (Decision Trees)	20.35%	7.75%	-0.20%
Perceptron (Neural Net)	15.12%	15.31%	-0.97%
Perceptron (Neural Net, 11 hidden layers)	15.91%	13.18%	-0.39%
Perceptron (Neural Net, 50 hidden layers)	18.99%	15.70%	-1.08%
Nearest Neighbor (Ibk) nn = 1	9.11%	4.07%	-3.68%
Nearest Neighbor (Ibk) nn = 10	12.21%	10.85%	-0.20%


Best Performing Classifier Accuracies without Length Feature
70%
60%
50%
40%
30%
20%
10%
0%
60%
10%
48%
13%
Logistical Regression / Neural Network (50 layers)
5050 Split
Logistical Regression
EMH
Accuracy Percentage
Percent over Zero R


Classifier Accuracy without Length Feature
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
ZeroR
NaieveBayes
LogisticRegression
J48 (Decision Trees)
Perceptron (Neural Net)
Perceptron (Neural Net, 11 hidden layers)
Perceptron (Neural Net, 50 hidden layers)
Nearest Neighbor (Ibk) nn = 1
Nearest Neighbor (Ibk) nn = 10
5050% Split
EMH

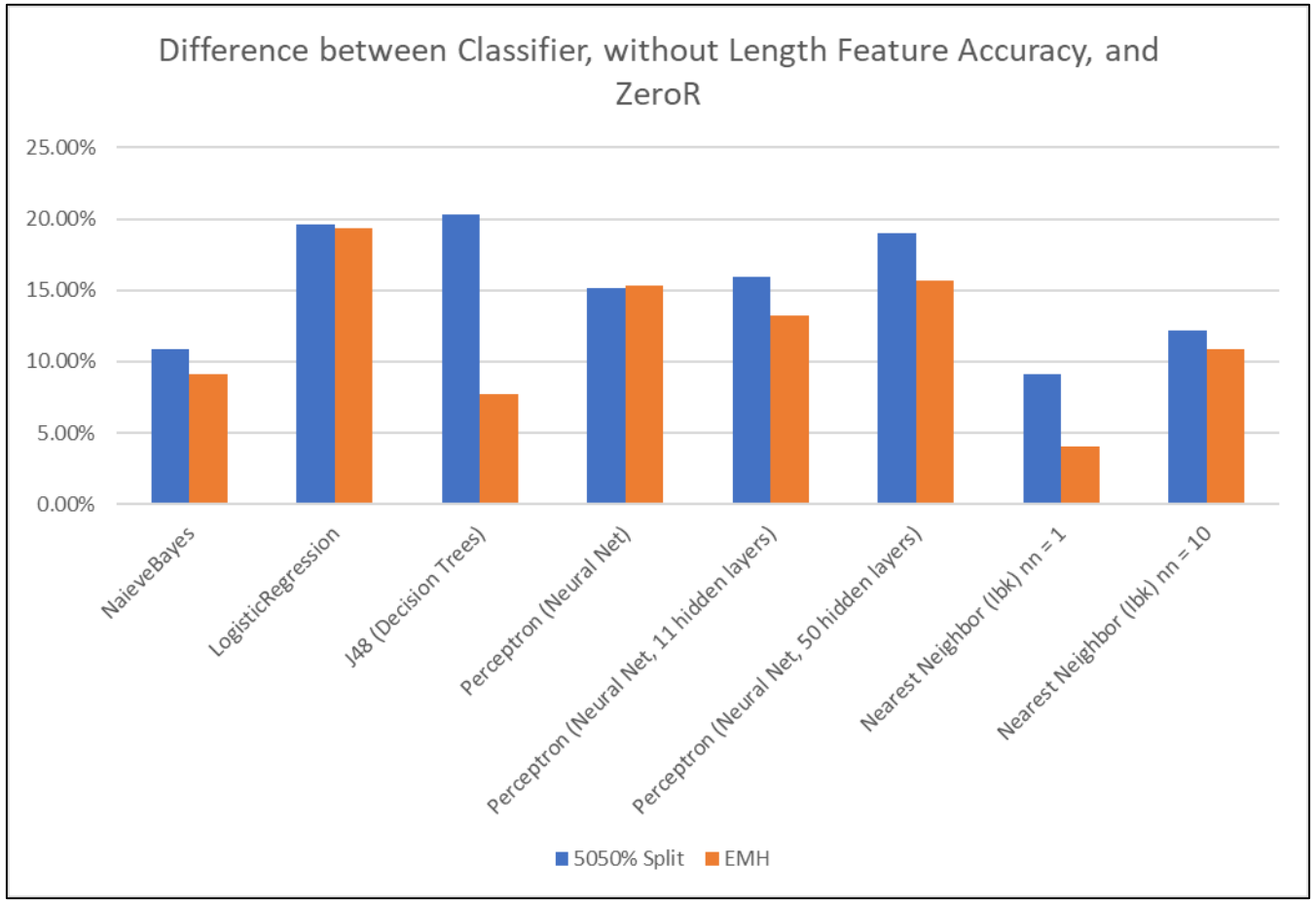

Difference between Classifier, without Length Feature Accuracy, and ZeroR
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
NaieveBayes
LogisticRegression
J48 (Decision Trees)
Perceptron (Neural Net)
Perceptron (Neural Net, 11 hidden layers)
Perceptron (Neural Net, 50 hidden layers)
Nearest Neighbor (Ibk) nn = 1
Nearest Neighbor (Ibk) nn = 10
5050% Split
EMH

Table of Weka-Trained Model Performances sans “length” feature

Classifier	5050% Split	EMH	Top38
ZeroR	50.19%	92.64%	34.12%
NaieveBayes	54.07%	65.89%	37.21%
LogisticRegression	**62.20%**	92.05%	47.29%
J48 (Decision Trees)	59.69%	92.63%	42.25%
Perceptron (Neural Net)	57.95%	91.86%	44.38%
Perceptron (Neural Net, 11 hidden layers)	58.72%	92.24%	47.29%
Perceptron (Neural Net, 50 hidden layers)	60.47%	91.86%	**47.87%**
Nearest Neighbor (Ibk) nn = 1	52.13%	86.05%	35.27%
Nearest Neighbor (Ibk) nn = 10	57.17%	**92.64%**	40.89%

Table of Weka-Trained Model Performances Compared to ZeroR sans “length” feature

Classifier	5050% Split	EMH	Top38
NaieveBayes	3.88%	-26.75%	3.09%
LogisticRegression	12.01%	-0.59%	13.17%
J48 (Decision Trees)	9.50%	-0.01%	8.13%
Perceptron (Neural Net)	7.76%	-0.78%	10.26%
Perceptron (Neural Net, 11 hidden layers)	8.53%	-0.40%	13.17%
Perceptron (Neural Net, 50 hidden layers)	10.28%	-0.78%	13.75%
Nearest Neighbor (Ibk) nn = 1	1.94%	-6.59%	1.15%
Nearest Neighbor (Ibk) nn = 10	6.98%	0.00%	6.77%