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Artificial Intelligence

Scenario 2

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1 Introduction

In this report an AI classifier will be put forward which maps mamographical data to desired outputs (diagnoses). In order to do this two types of AI classifiers will be evaluated on their performance in this task, along with relevant pre-processing of the attributes to enhance classifier performance. The two classifier types will be a Decision Tree (J.48) and an Artificial Neural Network (Multilayer Perceptron, Minsky et al. (2017)). In order to evaluate their performance, considerations of both learning time & classification accuracy will be taken into account.

2 AI classifiers

In this section a brief study will be conducted into the two classifier types mentioned previously.

2.1 Decision Trees

A Decision Tree is a hierarchical variant of a multistage classifier (Safavian & Landgrebe 1991). The tree structure itelf could be described as a single root node with 0 to many connected children, each themselves with 0 to many connected children. Any node in a decision tree with no children is known as a leaf node and will have a direct relationship with two or more class labels.

2.2 Artificial Neural Networks

Multilayer Perceptron (Minsky et al. 2017).

3 Data set analysis

4 Classifier Prediction

5 Initial Experiments

6 Main Experiments

Table 1: Confidence (MO=2)

Confidence	Accuracy
0.05	82.2
0.1	82.16
0.15	82.19
0.2	82.27
0.25	82.19
0.3	**82.33**
0.35	82.31
0.4	82.12

7 Advanced Pre-processing

8 Conclusions

Table 2: Minimum number of objects highest classification 1 (C=0.3)

Min Objects	Accuracy
2	82.33
5	82.3
10	82.24
15	82.54
18	82.83
19	82.99
20	83
21	83.04
22	82.98
30	83.16
35	83.53
40	83.73
45	83.8
50	**83.82**
60	83.04
70	82.82

Table 3: Learning rate accuracy from 200-3000 epochs

	Learning Rate				
	0.1	0.3	0.5	0.7	0.9
Epochs	Accuracy (%)				
200	**81.19**	80.72	80.49	80.21	79.93
250	80.19	**80.99**	80.58	80.39	79.97
350	81.27	**81.36**	81.01	80.5	80.2
450	81.49	**81.52**	80.87	80.55	80.39
550	**81.72**	81.56	81.13	81.08	80.74
650	**82.05**	81.7	81.34	81.27	80.92
750	**82.04**	81.68	81.59	81.37	81.14
850	**82.16**	81.77	81.76	81.52	81.16
950	**82.12**	81.9	81.71	81.66	81.32
1050	**82.13**	81.96	81.84	81.77	81.28
1150	81.99	**82**	81.8	81.81	81.34
1500	82.08	**82.22**	81.84	81.92	81.5
2000	82.23	**82.32**	81.88	81.94	81.74
3000	**82.25**	82.24	81.84	81.86	81.69

Table 4: Momentum accuracy from 200-3000 epochs (LR=0.4, HL=A)

	Momentum				
Epochs	0.1	0.3	0.5	0.7	0.9
200	80.59	**80.66**	80.24	79.92	79.31
300	**81.07**	80.96	80.55	80.46	79.34
400	**81.31**	81.17	80.68	80.55	79.49
500	81.33	**81.36**	80.96	80.72	79.39
600	81.45	**81.51**	81.22	80.98	79.5
700	81.55	**81.64**	81.38	81.15	79.48
800	81.52	**81.71**	81.52	81.41	79.52
900	81.69	**81.72**	81.53	81.46	79.38
1000	**81.85**	81.78	81.55	81.42	79.46
1100	81.89	**81.98**	81.61	81.63	79.66
1500	**82.07**	82.04	81.69	81.61	79.9
2000	**82.06**	82.03	81.78	81.66	80.05
3000	81.98	**82.05**	81.81	81.64	80

Table 5: Two hidden layer ANN structure (LR=0.4, M=0.2, E=950)

	Second Layer Neurons				
First Layer Neurons	1	2	3	4	5
1	82.34	82.25	82.43	82.64	**82.67**
2	81.78	81.89	82.29	82.06	**82.38**
3	81.02	81.32	81.79	81.96	**82.01**
4	80.66	81.38	80.92	80.99	**81.07**
5	80.55	80.53	**81.29**	81.02	80.7

Table 6: Learning rate impact on accuracy from 250-3000 epochs (M=0.2, HL=1)

	Learning Rate				
Epochs	0.1	0.3	0.5	0.7	0.9
250	81.73	**81.88**	81.85	81.87	81.8
350	**82.27**	82.24	82.21	82.19	82.23
450	**82.58**	82.49	82.39	82.33	82.35
550	82.55	**82.61**	82.58	82.41	82.33
650	**82.73**	82.7	82.72	82.66	82.45
750	82.77	82.8	**82.83**	82.74	82.5
850	82.79	**82.93**	82.88	82.66	82.5
950	82.89	**83**	82.87	82.78	82.55
1050	82.9	**83**	82.89	82.83	82.61
1150	82.89	**83**	82.87	82.88	82.69
1500	82.98	82.99	**83.09**	83	82.87
2000	83.08	83.15	**83.19**	83.14	83
3000	**83.25**	83.19	83.21	83.18	83.01

References

Minsky, M., Papert, S. A. & Bottou, L. (2017), *Perceptrons: An introduction to computational geometry*, MIT press.

Safavian, S. R. & Landgrebe, D. (1991), 'A survey of decision tree classifier methodology', *IEEE transactions on systems, man, and cybernetics* **21**(3), 660–674.