AI Assignment 4

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1 Task 1

By using the random importance function for our learner, we obtain that the accuracy of the learner when classifying the test set is varying. By averaging the results over 10 runs, we observe that the average accuracy of the decision tree with random importance is 73.56%. Compared to the decision tree that is using expected information gain which got 92.86% correct. We conclude that the EIG-method is better when running once, but does not always find the best tree, since it is greedy. The random attribute method may choose the best tree, but performs worse on average.

We observe that the tree generated by the Expected Information Gain (EIG) method, on average, is much smaller than the tree generated when choosing a random attribute. With the EIG method, we achieve the same tree all the time. The exception to this is when some attributes has the same EIG - then one of the tied attributes are chosen at random. With the random attribute method, we will get different trees based on the ordering of the attributes. **??** shows the tree produced by the EIG-method.

Listing 1: Resulting tree with EIG-method.

```
N0
{T:T,F:N4}
– N4
– {T:N2,F:N5}
—— N2
—— {T:N1,F:N1}
——— N1
——— {T:T,F:F}
——— N1
——— {T:F,F:T}
—— N5
—— {T:N1,F:N3}
——— N1
——— {T:N2,F:N2}
———— N2
———— {T:T,F:F}
```

——— N2
——— {T:F,F:T}
—— N3
—— {T:N1,F:N1}
——— N1
——— {T:N2,F:N2}
———— N2
———— {T:T,F:F}
———— N2
———— {T:F,F:T}
——— N1
——— {T:F,F:N2}
———— N2
———— {T:F,F:T}

Listing 2: Resulting tree with random-attribute method.

N6
{T:N1,F:N2}
– N1
– {T:N6,F:N3}
—— N6
—— {T:N4,F:T}
—— N4
—— {T:N4,F:N2}
——— N4
——— {T:N3,F:T}
———— N3
———— {T:N2,F:N3}
————— N2
————— {T:T,F:N0}
—————— N0
—————— {T:T,F:F}
————— N3
————— {T:T,F:N1}
—————— N1
—————— {T:N6,F:T}
——————— N6
——————— {T:N6,F:T}
———————— N6
———————— {T:N5,F:T}
————————— N5
————————— {T:N3,F:T}
—————————— N3
—————————— {T:T,F:N6}
——————————— N6
——————————— {T:N4,F:T}

——————————— N4
——————————— {T:N5,F:T}
———————————— N5
———————————— {T:N3,F:T}
————————————— N3
————————————— {T:T,F:N1}
—————————————— N1
—————————————— {T:N5,F:T}
——————————————— N5
——————————————— {T:N1,F:T}
———————————————— N1
———————————————— {T:N4,F:T}
————————————————— N4
————————————————— {T:N3,F:T}
—————————————————— N3
—————————————————— {T:T,F:N3}
——————————————————— N3
——————————————————— {T:T,F:N0}
———————————————————— N0
———————————————————— {T:T,F:N5}
————————————————————— N5
————————————————————— {T:N4,F:F}
—————————————————————— N4
—————————————————————— {T:N6,F:F}
——————————————————————— N6
——————————————————————— {T:N2,F:F}
———————————————————————— N2
———————————————————————— {T:T,F:F}
——— N2
——— {T:T,F:N6}
———— N6
———— {T:N3,F:T}
————— N3
————— {T:T,F:N6}
—————— N6
—————— {T:N2,F:F}
——————— N2
——————— {T:F,F:N3}
———————— N3
———————— {T:F,F:N1}
————————— N1
————————— {T:N1,F:F}
—————————— N1
—————————— {T:N6,F:F}
——————————— N6
——————————— {T:N2,F:F}

———————— N2
———————— {T:F,F:N0}
———————— N0
———————— {T:T,F:F}
—— N3
—— {T:N3,F:N4}
—— N3
—— {T:N2,F:T}
——— N2
——— {T:N4,F:T}
———— N4
———— {T:N2,F:N0}
————— N2
————— {T:N2,F:F}
————— N2
————— {T:N0,F:F}
————— N0
————— {T:T,F:F}
————— N0
————— {T:T,F:F}
—— N4
—— {T:N4,F:N4}
——— N4
——— {T:N6,F:T}
———— N6
———— {T:N4,F:T}
————— N4
————— {T:N4,F:T}
————— N4
————— {T:N2,F:T}
————— N2
————— {T:N5,F:T}
————— N5
————— {T:F,F:T}
——— N4
——— {T:T,F:N4}
———— N4
———— {T:T,F:N0}
————— N0
————— {T:T,F:N6}
————— N6
————— {T:N0,F:F}
————— N0
————— {T:F,F:N1}
————— N1
————— {T:F,F:N2}

———————— N2
———————— {T:F,F:T}
– N2
– {T:N5,F:N5}
—— N5
—— {T:N2,F:N0}
——— N2
——— {T:N3,F:T}
———— N3
———— {T:N2,F:N4}
————— N2
————— {T:N6,F:T}
—————— N6
—————— {T:T,F:N6}
——————— N6
——————— {T:T,F:N0}
———————— N0
———————— {T:T,F:N3}
————————— N3
————————— {T:N4,F:T}
—————————— N4
—————————— {T:T,F:N0}
——————————— N0
——————————— {T:F,F:N5}
———————————— N5
———————————— {T:N4,F:F}
————————————— N4
————————————— {T:F,F:N3}
—————————————— N3
—————————————— {T:N2,F:F}
——————————————— N2
——————————————— {T:N5,F:F}
———————————————— N5
———————————————— {T:N0,F:F}
————————————————— N0
————————————————— {T:F,F:N3}
—————————————————— N3
—————————————————— {T:N2,F:F}
——————————————————— N2
——————————————————— {T:N4,F:F}
———————————————————— N4
———————————————————— {T:F,F:N0}
————————————————————— N0
————————————————————— {T:F,F:N1}
—————————————————————— N1
—————————————————————— {T:T,F:F}

——— N4
——— {T:N4,F:N0}
——— N4
——— {T:N2,F:T}
——— N2
——— {T:N5,F:T}
——— N5
——— {T:N2,F:T}
——— N2
——— {T:N2,F:T}
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——— {T:N5,F:T}
——— N5
——— {T:N2,F:T}
——— N2
——— {T:N1,F:T}
——— N1
——— {T:T,F:F}
——— N0
——— {T:T,F:N6}
——— N6
——— {T:F,F:N4}
——— N4
——— {T:F,F:N6}
——— N6
——— {T:F,F:N3}
——— N3
——— {T:F,F:N1}
——— N1
——— {T:T,F:F}
—— N0
—— {T:T,F:N3}
—— N3
—— {T:N1,F:N3}
——— N1
——— {T:T,F:F}
——— N3
——— {T:F,F:N3}
——— N3
——— {T:F,F:N1}
——— N1
——— {T:T,F:F}
— N5
— {T:N6,F:N5}
—— N6
—— {T:T,F:N0}

——— N0
——— {T:T,F:N5}
———— N5
———— {T:N0,F:F}
————— N0
————— {T:F,F:N2}
—————— N2
—————— {T:F,F:N1}
——————— N1
——————— {T:F,F:T}
—— N5
—— {T:T,F:N4}
——— N4
——— {T:N0,F:N2}
———— N0
———— {T:T,F:N6}
————— N6
————— {T:F,F:N6}
—————— N6
—————— {T:F,F:N3}
——————— N3
——————— {T:N1,F:N1}
———————— N1
———————— {T:F,F:T}
———————— N1
———————— {T:F,F:T}
———— N2
———— {T:T,F:N0}
————— N0
————— {T:T,F:F}