

## Foundations of Artificial Intelligence

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### Exercise Sheet 10

**Due: Friday, July 9, 2021**

#### Exercise 10.1 (Decision Trees)

No	Age	Engine power [kW]	Risk
1	< 25	< 100	low
2	< 25	> 200	high
3	≥ 25	> 200	high
4	≥ 25	100 – 200	low
5	< 25	100 – 200	high
6	≥ 25	< 100	low

Consider the data on car insurance risk in the table above. Produce a decision tree, which correctly classifies the insurance risk for the examples given, using the attributes *Age* and *Engine Power* in order of decreasing *information gain*. Give detailed calculations that justify the order in which the attributes are tested.

You can make use of the following values:

$$\log_2\left(\frac{1}{3}\right) \approx -\frac{3}{2}, \log_2\left(\frac{2}{3}\right) \approx -\frac{1}{2}, \log_2\left(\frac{1}{2}\right) = -1, \log_2(1) = 0.$$

#### Exercise 10.2 (Best practices in ML)

When doing machine learning, it is good practice to split the dataset into a training/validation/test set.

- Which subset(s) should you use for the following tasks:
  - (a) fitting models (R & D)<sup>1</sup>
  - (b) guard against overfitting (R & D)
  - (c) model selection (R & D)
  - (d) progress reports (R & D)
  - (e) evaluating the final model (product/publication)
- Which of these subsets should always be fixed a priori (before even looking at the data)?

Note: The exercise sheets may be worked on in groups of up to three students.

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<sup>1</sup>R & D: During research and development