ARTIFICIAL INTELLIGENCE (E016350A)
GHENT UNIVERSITY
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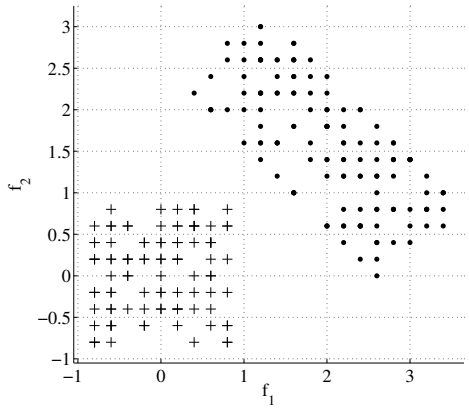
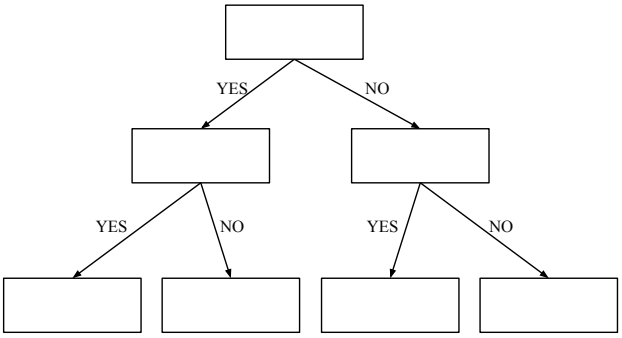
Decision trees

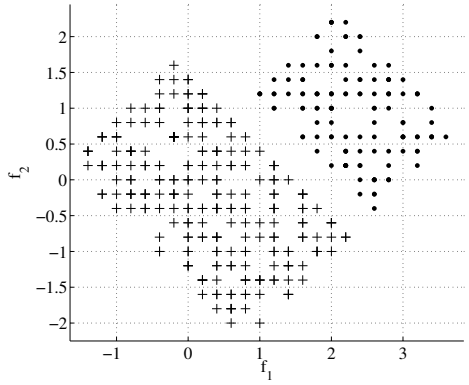
1. You are given points from 2 classes, shown as +'s and ·'s. For each of the following sets:

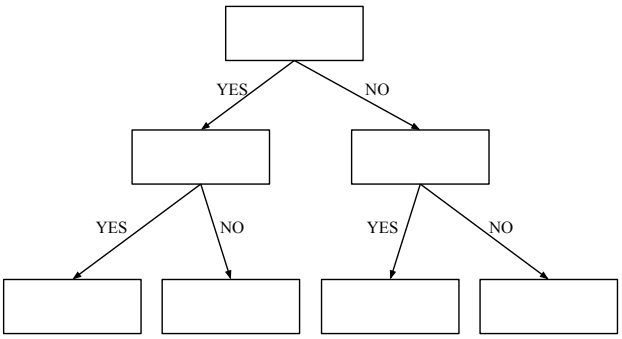
    1. Draw the decision tree of depth at most 2 that can separate the given data completely, by filling in binary predicates (which only involve thresholding of a single variable) in the boxes for the decision trees below. If the data is already separated when you hit a box, simply write the class, and leave the sub-tree hanging from that box empty.
    2. Draw the corresponding decision boundaries on the scatter plot, and write the class labels for each of the resulting bins somewhere inside the resulting bins.

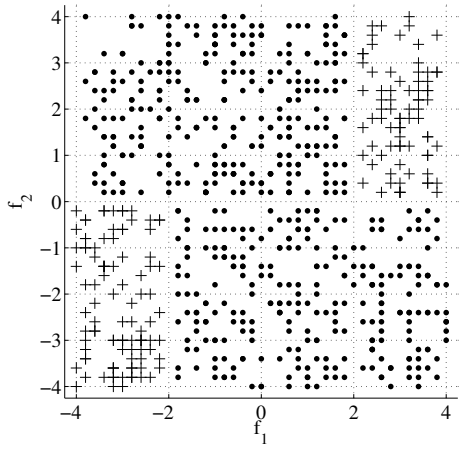
    If the data can not be separated completely by a depth 2 decision tree, simply cross out the tree template.

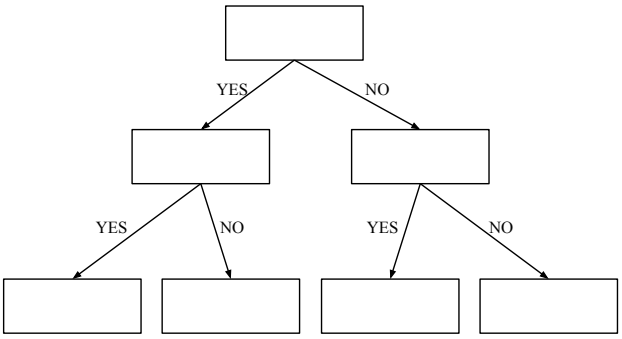









4
3
2
1
0
−1
−2
−3
−4
f2
−4
−2
0
2
4
f1


YES
NO
YES
NO
YES
NO

2. A friend asks you to babysit her cat for a few days. As you are inexperienced with animals but very good in machine learning, you build a decision tree to decide automatically whether you should feed the cat or not. Before she leaves you the cat, you spend a day with your friend and observe her to build the following data set. Ones and zeros stand respectively for *yes* and *no*.

Sample	Cat meowing	Cat rubbing against you	Min 2h since last meal	Food bowl empty	Feed the cat
1	0	0	1	0	0
2	0	1	1	0	0
3	1	1	0	1	0
4	1	0	1	0	1
5	1	1	1	0	1
6	0	0	0	1	0
7	1	0	1	1	1

(a) Use the entropy as a classification criterion to construct a minimal decision tree that predicts whether or not you should feed the cat. Show each step of the computation. Draw the final decision tree.

(b) Translate your decision tree into a collection of decision rules in plain language.