Expert Systems – exercises 2

This week we have only two tasks, but both of them give 3 points. **Return your solutions and first week learning diary in paper format in the next lecture 28.9. 2005.**

1. Read about general modelling principles (especially Model selection) in `http://cs.joensuu.fi/pages/whamalai/expert/modchapter.pdf` and explain the following concepts carefully with your own words:

   - score function
   - overfitting
   - inductive bias

   Draw a concept map about all important concepts and their relations! It is recommended that you give labels also for the relations.

2. The biologists are exploring diseases infected by small rodents in Finland. They would like to catch several voles and mice for further investigation, but the trap should not harm protected rodent species Eliomys quercinus (tammihiiri, dormouse).
   (Picture `http://www.glirarium.org/dormouse/photo/eliomys-quercinus.html`)
   In addition, the system should be able to disctinguish between mice and voles. Your task is to design an intelligent trap, which classifies rodents according to their body and tail lengths by linear regression. You can use e.g. Excel or Gnumeric for learning the linear regression model. (In the course page you can find brief instructions how to use gnumeric.)

   - What kind of linear regression model did you get?
   - How well does you model predict the rodent species?
   - Is the model safe for Eliomys?
   - What happens, if the data contains an outlier, an Elionymus with exceptionally long tail (body=14cm, tail=12cm)? (Add the outlier to data and test again!)
   - Suggest how to improve the model! Would some other approach suit better for rodent classification?

Data for intelligent trap:

`http://cs.joensuu.fi/pages/whamalai/expert/hiiri.csv`

Variables are: **Body length** (cm), **tail length** (cm) and **species**, 1=Microtus agrestis (peltomyyrä, vale), 2=Clethrionomys glareolus (metsämyyrä, vale species), 3=Mus musculus (kotihiiri, common mouse), 4=Eliomys quercinus (tammihiiri, dormouse), 5=Apodemus flavicollis (metsähiiri, mouse species).

Body	Tail	Species
10	4.5	2
11	5	2
9	4	2
10	3	1
12	4	1
8	8	3
9	9	3
8.5	8	3
14	10	4
13	9	4
14	11	4
13	12	5
12	11	5
12	12	5