AS-74.115 NEURO-FUZZY Computing in Automation
Tentti 14.5.2007
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All questions are of equal value.
Use of books or lecture notes is not allowed.

1)
a) Define a fuzzy set.
b) Demonstrate fuzzy reasoning with an example. Draw a figure to indicate how the reasoning proceeds.

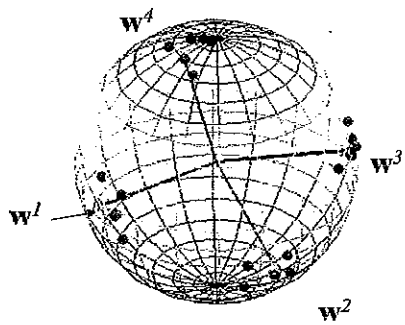
2) a) Explain what is the basic difference between Mamdani type of reasoning compared with Sugeno type of reasoning
b) Give an example of Sugeno type of rule and then derive an analytical relationship between the input and output. For simplicity, use scalar input-output system. Make any necessary assumptions you need.

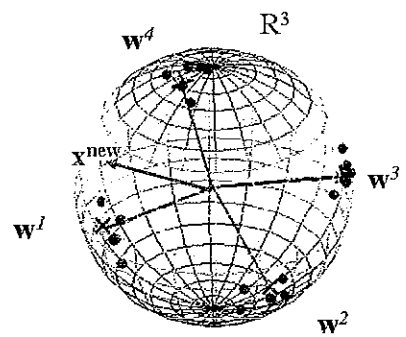
3) Give an example of a rule base of PD or PI type of fuzzy controller.

4) a) Name at least three types of neural network architectures and describe them for example using drawings.

b) Compare the characteristics of the neural networks that you mentioned in a).

5) a) Suppose you have four weight vectors of unit length $\mathbf{w}^j = \left[w_1^j, w_2^j, w_3^j\right]$, $j = 1,\ldots,4$ as shown in the figure (left).





A new input vector $\mathbf{x}^{new}$ is introduced (Figure on the right). Explain how competitive learning works.
b) How does Kohonen Self-Organizing Map differ from competitive learning.

6) Explain the procedure of a genetic algorithm.