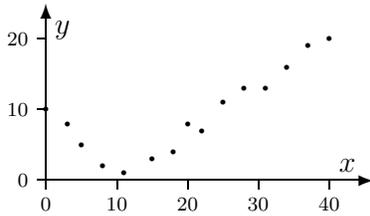


## Assignment Sheet 14

### Assignment 51      Fuzzy Rule Generation

Consider the following two-dimensional dataset:

$x$	0	3	5	8	11	15	18	20	22	25	28	31	34	37	40
$y$	10	8	5	2	1	3	4	8	7	11	13	13	16	19	20



This dataset is also shown in the diagram on the right. Use the Wang-Mendel algorithm to construct a fuzzy controller from this dataset, which has the  $x$ -coordinate as input and the  $y$ -coordinate as output! Use a fuzzy partition with five equidistant triangular fuzzy sets for the input interval  $X = [0, 40]$  and a fuzzy partition with three equidistant triangular fuzzy sets for the output interval  $Y = [0, 20]$  (the cores/tips of the outermost fuzzy sets should coincide with the boundaries of the intervals). Draw a sketch of the function that is computed by the controller you constructed! To simplify computations, neglect the rule weights for the evaluation of the controller and use the weighted sum of the mean of maxima of the individual rule outputs as the defuzzification method.

### Assignment 52      Fuzzy Rule Generation

Use the Higgins-Goodman algorithm to construct a fuzzy controller from the dataset given in Assignment 51. Again the input domain should be the interval  $X = [0, 40]$  and the output domain should be  $Y = [0, 20]$ . Stop the construction when you have four triangular fuzzy sets. Draw a sketch of the function that is computed by the fuzzy controller you constructed!

As in Assignment 51 neglect the rule weights and use the simplified defuzzification method. Compare the result to those of Assignment 51. What would happen if there was an additional data point  $(13, 20)$ ?

### Assignment 53      Fuzzy Rule Generation

The results of the preceding assignments can be improved upon if the fuzzy sets can be modified. Suppose that you were free to modify and to combine fuzzy sets (provided they stay triangular), how would you optimize the controllers resulting from the Wang-Mendel and the Higgins-Goodman algorithm?

Hint: You need not carry out a formal algorithm. Just look at the resulting control functions and think about how they can be improved without introducing new fuzzy sets.