# Exercise 8 Ensembles, Neural networks training and MAS

**Q1: Ensembles**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Name** | **Math** | **English** | **Civics** | **Science** | **PE** | **History** | **Status** |
| Tom | 6 | 6 | 6 | 6 | 6 | 6 | Excellent |
| Peter | 1 | 1 | 1 | 1 | 1 | 1 | Poor |
| Jane | 3 | 6 | 4 | 4 | 4 | 4 | Good |
| Jack | 6 | 2 | 2 | 5 | 3 | 3 | Good |
| Mary | 4 | 4 | 5 | 4 | 3 | 5 | Good |
| Phyllis | 4 | 2 | 2 | 6 | 2 | 3 | Good |
| Ron | 2 | 4 | 3 | 2 | 1 | 2 | Poor |
| Diane | 5 | 4 | 6 | 6 | 4 | 6 | Excellent |
| Fiona | 5 | 5 | 5 | 5 | 3 | 5 | Excellent |
| Rodger | 2 | 2 | 2 | 3 | 2 | 1 | Poor |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| Joy | 3 | 2 | 2 | 3 | 4 | 1 | ?? |
| Bob | 6 | 1 | 1 | 1 | 1 | 1 | ?? |
| Sam | 2 | 3 | 2 | 3 | 6 | 4 | ?? |

The upper table shows how students are graded in different subjects and what overall status that they are given on their final score card. This is your training set. The table below shows a non-labelled set of records that the computer is going to categorize.

1. Use KNN to train a system to help the categorization. Use K=3. Test the result for Joy, Bob and Sam.
2. Demonstrate bagging with KNN and use a committee approach to determine the result for Joy, Bob and Sam
3. Repeat the procedure in 1 above, but use subspace modelling and committee approach.
4. Compare the result in 2 and 3 with the outcome of 1.

You can do this part by hand, with Excel or Python.

**Q2 Assume that the numbers «1» and «2» can be encoded in binary form as shown below in a 9x9 matrix:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1:  0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| The number 2 |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |

You have two kernels:

A and B

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 |  |  | 0 | 1 | 0 |
| 1 | 1 | 1 |  |  | 0 | 1 | 0 |
| 0 | 0 | 0 |  |  | 0 | 1 | 0 |

Write small Python program that demonstrates convolution with stride 1 for both kernels. Present the resulting matrices.

**Q3 Agents**

1. Illustrate by a drawing what the difference between a simple controller and a sophisticated, high level reactive agent is.
2. Use the drawing in a. above and illustrate the difference between a mediated MAS, peer-to-peer MAS and a colony.