**DESIGN ACTIVITY**

*IMAS 21/22*

**

**Authors**: *Sergi Albiach, Anna Garriga,*

*Benet Manzanares and Ramon Mateo*

1. **INTRODUCTION**

The goal of this project is to develop an agent-based decision support system.

*Description: In this activity, a first* ***analysis of the practical exercise*** *must be performed. An* ***architecture for the multi-agent system*** *must be designed and its* ***characteristics*** *defined. The design decisions include the* ***types and properties of the agents*** *in the MAS system, the* ***functions of each agent****, the* ***overall architecture of the system****. Write a detailed justification for those decisions.*

1. **AGENT DESCRIPTION**
   1. **User Agent**

* **Properties:** proactive, social ability, rationality, temporal continuity
* **Functions:** It is in charge of loading the dataset, splitting the data into training and test, starting the training and managing user queries. Its communication is limited to the coordination agent.
* **Number of agents:**  1

| **MESSAGE\_NAME** | **DESCRIPTION** |
| --- | --- |
| train\_agents(DATA, COORD\_AGENT) | Send the training data to the coordinator agent to train the classification system. |
| test\_agents(DATA, COORD\_AGENT) | Send the test data to the coordinator agent in order to obtain the accuracy of the model. |

| **FUNCTION\_NAME** | **DESCRIPTION** |
| --- | --- |
| (TRAIN, TEST) = prepare\_data(DATASET) | Splits the loaded data into test and training sets |

* 1. **Classifier Agent**
* **Properties:** learning, social ability, rationality,
* **Functions:** It receives a part of the training data and creates a Decision Tree based on it. It also receives test cases and sends the output classification result to the coordinator agent.
* **Number of agents:** 10

**MESSAGE\_NAME**

| **MESSAGE\_NAME** | **DESCRIPTION** |
| --- | --- |
| end\_training(PROCESS\_NAME,ACC,COORD\_AGENT) | Sends to the coordinator agent the notification of the ending of the training process with its accuracy. |
| end\_prediction(PROCESS\_NAME,CLASSES,COORD\_AGENT) | Sends to the coordinator agent the notification of the ending of the prediction process with the resulting output classes. |

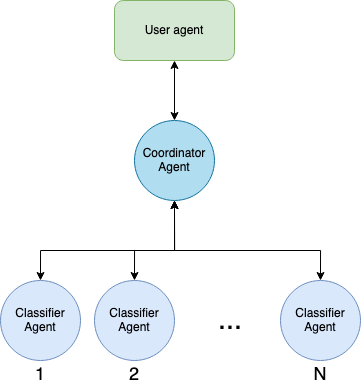
| **FUNCTION\_NAME** | **DESCRIPTION** |
| --- | --- |
| (ACCURACY) =  train\_tree(DATA) | Creates the decision tree and returns the accuracy of the validation step ? |
| (PREDICTIONS) =  predict(DATA) | Classifies the input data and returns the classification results |

* 1. **Coordinator Agent**
* **Properties:** learning, social ability, rationality, reasoning capabilities
* **Functions:** It is responsible for receiving the output classifications from the classifier agents and elaborating the final classification output by weighting the options using the validation step accuracy. This result will be sent to the user agent.
* **Number of agents:** 1

| **MESSAGE\_NAME** | **DESCRIPTION** |
| --- | --- |
| end(PROCESS\_NAME,VALUE,USER\_AGENT) | Sends to the user agent the notification of the ending of a process with a return value. |
| train(DATA, CLASS\_AGENT) | Sends the data to a classification agent to start the training process |
| predict(DATA, CLASS\_AGENT) | Sends the data to a classification agent to start the testing process |

| **FUNCTION\_NAME** | **DESCRIPTION** |
| --- | --- |
| (ATTRIB\_DISTRIBUTION) = assign\_attributes(N\_ATTRIBUTES, N\_CLASSIFIERS, ATTRIBUTES) | Assigns randomly the attributes to the classifiers and returns a dictionary with the name of the attributes for each classifier. |
| (DATA\_ASSIGNMENT) = split\_data(DATA, ATTRIB\_DISTRIBUTION) | Returns a dictionary where every agent has associated its subset of the data based on the attribute distribution |
| (FINAL\_ACCURACY) =  compute\_accuracy(VALIDATION\_ACCURACY, AGENTS\_OUTPUT) | Computes the final accuracy given the classification of the agents on the test set and its accuracy on the validation step |

1. **SYSTEM ARCHITECTURE**



**Fig. 1**: general diagram of the system architecture

| **Fig. 2**: diagram of the distributing step | **Fig. 3**: diagram of the aggregation step |
| --- | --- |

Draws will be resolved by weighting the output based on the accuracy of the validation step.

* 1. **Training**
  2. **Prediction/Evaluation**