Abstract

A Multi-Agent system, a loosely coupled network of solvers which interact to find a solution to a problem beyond individual capabilities and knowledge [29], is a common notion in the literature with application to a broad range of problems. One approach in the design and application of such systems is machine learning. Machine Learning deals with the design of programs which take advantage of data, examples and experience to improve accuracy or performance [16]. Specifically, the area of Machine Learning algorithms that deals with Multi-Agent systems is known as Ensemble Methods. Common problems addressed by these techniques are Classification and Prediction.

When designing a Multi-Agent system using Ensemble Methods, 4 different stages can be identified: 1. Pre-processing 2. Partition 3. Training 4. Post-processing

These 4 stages are independent and have different goals. Preprocessing refers to preparing the data in order to improve learning efficacy. Partition refers to dividing the data among the different agents. Training corresponds to the process where the data is used to learn how to solve the problem at hand. Finally post-process includes techniques to analyze or modify the learning results. At the end of this process, enough information has been learned to attempt to solve unseen problems of the same type.

For each stage, there exist multiple techniques that may be applied which might be proper for one sort of problem but not for the other. One specific combination might be more adequate than other and finding an optimal combination is an aspect of our

research.

To habilitate experimentation, we have designed a framework in which different interchangeable components may be connected and different Multi-Agent Systems created. These systems may then be exported through XML to be used in other applications. Using this framework, a comparative analysis on the different stages was performed, and an ensemble based solution was applied for the HLA multi-classification problem [20], for which our research represents the first attempt of applying machine learning techniques.