

Université libre de Bruxelles

**ANALYZING MARL ALGORITHMS IN
DYNAMIC ENVIRONMENTS:
EVALUATING PERFORMANCE WITH AN
ADDITIONAL UNKNOWN ELEMENT**

Preparatory work for the master thesis -- MEMO-F-403

Promoter:

Yannick MOLINGHEN

Author:

Kevin VANDERVAEREN

Supervisor:

Prof. Tom LENAERTS



ABSTRACT

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I Introduction

I.1 Background and Objectives

A Multi-Agent Reinforcement Learning (MARL) is a subfield of the Reinforcement Learning domain which focuses on the interaction between multiple agents in a shared environment. Through the recent years, an increasingly amount of research has been conducted in this field to resolve issue that has arisen in the real world. However, most of the research are done through simulations on environments which does not involve incremental changes. This thesis aims to evaluate the learning performance of MARL algorithms from a known environment to a slightly modified one by adding an unknown element. Under the supervision of Prof. Tom Lenaerts, and advisor Yannick Molinghen, from the Machine Learning Group (MLG) of the Université Libre de Bruxelles (ULB).

Currently, the research is focused on the the environment of LLE (Laser Learning Reinforcement) which is a environment created by Yannick Molinghen. The environment is a grid world where a single or multiple agents are placed in a grid world. The goal of the agent is to reach a target while avoiding obstacles.

The objective of the Master thesis is to develop a new feature in the LLE environment that was also includes in the original Game moreover this feature has also a other objective which is to add a new element in the environment which are not included in the agents learning process.

I.2 Notations and Definitions

II State of the Art

II.1 Distributed artificial intelligence

Distributed artificial intelligence (DAI) is the a field of study which is rising in the last two decades. which is mainly focused on the domain of distributed systems. A distributed system by the definition of [ref to book] is a (quote)“where a number of entities work together to cooperatively solve problems”(endquote). this kind of study is not new, it has been studied for a long time. But what is new is the rise of the internet and the multiple electronic devices that we have today. Which bring the need of a new field of study which is the DAI that simply is the study of the interaction between multiple artificial intelligence (AI) or agents in a distributed system.

II.1.1 Multi-Agent Systems vs. Distributed problems Solving

In the field of DAI, we can find two main subfields a more traditional one which is the Distributed Problem Solving (DPS) which us the paradigm of a divide and conquer. The DPS is a field which is focused on distributing the problem to independent slaves which are solving the problem independently. On the other hand, the Multi-Agent Systems (MAS) emphasizes on the interaction between the agents.

II.1.2 Multi-Agent Systems

II.2 Cooperative Multi-Agent Reinforcement Learning

II.3 Multi-Agent Reinforcement Learning

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