

**IMPLEMENTING EFFICIENT PLANNING AND
LEARNING ALGORITHMS FOR AGENTS IN
MINECRAFT**

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June 2018

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Dissertation submitted in partial fulfillment of the requirements for the degree in
Master of Science in Computer Science specializing in Data Science, Engineering
and Analytics

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DECLARATION

I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for Degree or Diploma in any other University or institute of higher learning. To the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Signature of the Supervisor:

Date:

Name: Dr. Surangika Ranathunga

ABSTRACT

An intelligent agent should possess the capability of solving problems related to the task of interest based on the perception of its virtual environment acquired from its past and present interactions. These agents should be able to extract the fundamental trait of being intelligent in order to possess human behavior. Learning and planning are the major modalities that contribute to this trait. Brown-UMBC Reinforcement Learning and Planning (BURLAP) is an existing library that comprises of algorithms that help the agent imitate the planning and learning behaviors of a human being. The algorithms in BURLAP can be used to implement intelligent agents in virtual worlds including Minecraft as it offers challenges that of a real-life platform. Minecraft allows the use of mods which are modifications to the environment based on the user's preference. The mod, BurlapCraft can be used to deploy the algorithms present in BURLAP. It includes scenarios such as dungeons that are of different caliber to test these algorithms. In literature, the developers of BurlapCraft have tested Rmax, Breadth First Search (BFS) and A star (A*) but have not implemented algorithms, Iterative Deepening A star (IDA star), Depth First Search (DFS), Q learning and State Action Reward State Action (SARSA) in BURLAP which makes the potential benefits of these algorithms unknown.

This research focuses on testing the efficiency and effectiveness of the reinforcement learning and planning algorithms, Q learning, SARSA, IDA star and DFS developed in BURLAP using the mod, BurlapCraft to make certain of their potential in solving a task oriented problem. It further analyses the potential of applying these algorithms in a pre-designed scenarios that are of different caliber which in turn would lead to the selection of the best fit and worse fit algorithms for the respective problems.

The performance evaluation identified that IDA star and Q learning algorithms do make an impact in improving the efficiency of the agent in completing the specified task. It also identified the best fit and the worst fit algorithms for the respective scenarios that could be mapped to general Artificial Intelligence (AI) related problems such as decision making, traversal and search present in the real world.

Keywords: BURLAP, BurlapCraft, Minecraft, Reinforcement Learning

ACKNOWLEDGEMENT

I would like to express my heartfelt gratitude to Dr. Surangika Ranathunga, my supervisor, for her support and guidance in selecting and conducting this research. I would especially appreciate her patience and her feedback on the report, to correct, fine-tune and finally bring up to this level. I also appreciate our MSc coordinator, Dr. Amal Shehan Perera for his dedication and support. I would like to extend my gratitude to all the lecturers at the Faculty of Computer Science and Engineering, University of Moratuwa, for their valuable support. Further, I am grateful to my family especially my aunty, Ms. P. Anantheswary who has supported me throughout this effort. Finally I would like to thank my friends who have endured this long process with me.

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List of Abbreviations

Abbreviation Description

BURLAP	Brown-UMBC Reinforcement Learning and Planning
VE	Virtual Environment
OOMDP	Object Oriented Markov Decision Process
MDP	Markov Decision Process
RL	Reinforcement Learning
AI	Artificial Intelligence
DFS	Depth First Search
BFS	Breadth First Search
IDA*	Iterative Deepening A star
SARSA	State Action Reward State Action