**CHAPTER I INTRODUCTION**

The introduction consists of the Background, Problem Statement, Research Objectives, Scope and Limitation, Research Methodology and Thesis Outline. The Background explains the current condition of the technology and information accessibility and the main problem that is created by the accessibility. The Problem Statement describes concisely some issues that is solved by the application.

**Background**

To prosper the quality of human’s life, human began to develop a man-made intelligence, or what we usually called *Artificial Intelligence (AI)*. The long development goal of AI is to achieve the ability for the machine to think and act both rationally and humanlyin solving any intellectual human task, which is called *Artificial General Intelligence (AGI)*. In this era, the recent development of AI is in creating an AI that could both think and act rationally.

AI have become a popular technology trends in business that enables human to predict, cluster and classify data. Copeland (2016), a Silicon Valley Journalist writes for NVIDIA, the biggest graphic card companies, believes that AI will not only be utilized by technology-driven businesses such as Google, Microsoft, and Amazon. However, another business fields such as sports, oil, personal loans, and other companies will also utilizes AI to help them wins the business. One example is mentioned by Copeland in the article created by Caulfield (2015), NVIDIA’s chief blogger, which report a beer’s business that utilizes machine learning to help the craft brewers crafting a better beer by gaining a knowledge from their customers.

Google DeepMind and OpenAI are companies that shows AI potential in solving problem that can be trained in simulated environment. RL is utilized by these companies to train an expert agent that outperforms humans in game. The agent created by DeepMind, the *AlphaGo Zero*, is able to defeat the 18-time world champion Lee Sedol in the game of Go (“The Google DeepMind Challenge Match”, n.d). OpenAI agent is also able to defeat the three best Dota 2 player in the world in 1v1 match and it puts a tough battle in five bots versus five players mode (“OpenAI Five”, n.d.).

By this achievement, the author deduct that using game as the environment to train an agent is the first step in solving complex real world problem. For example, researcher that would want to create a self-driving car could create an agent which excel in playing racing game. Strategic games also exist in the business such as the strategy to wins marketing, stock exchange, etc.

Seeing the potential of RL, in this study, the author implement *Reinforcement Learning (RL)* algorithms to create an agent that is excel in playing *Atari games*. The training results will be an agent that is excel in playing different kinds of Atari games environment.

**Problem** **Statement**

Kuder, D., Hans, S., & Mittal, N. (2019) stated that AI will become a powerful business tools that could help people to win at business. In order to studies the recent surge of AI trends in business, I intent to studies and compares different kinds of *reinforcement learning* algorithm which can train an agent to learn and interact within the specified environment to reach a specified goal.

**Research Objective**

This study is conducted with the following objectives:

1. To implement reinforcement learning as the machine learning algorithm in creating an agent that could outperform human in Atari games.
2. To analyse the algorithm performance in the simulated environment to achieve the best result.
3. To provide a reference materials for students who are interested in this field that would become a base for a more suitable learning process to solve real world problem.

**Scope and Limitation**

This study was conducted using Q-learning algorithm (and Deep Q Network algorithms) in the Atari games environment. The aspects looked into are the implementation of the algorithm and the agents performance in different environments (a specific environment).

**Methodology**

The author use the Waterfall Model of software development process. In this model, the whole software development process are divided into seven phase where the outcome of one phase will become the input for the next phase as shown by Figure 1. The seven phases in this model are:

* **Requirement Gathering and analysis** − All possible requirements of the system to be developed are captured in this phase and documented in a requirement specification document.
* **System Design** − the requirement specifications from first phase are studied in this phase and the system design is prepared. This system design helps in specifying hardware and system requirements and helps in defining the overall system architecture.
* **Implementation** − with inputs from the system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality, which is referred to as Unit Testing.
* **Integration and Testing** − All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures.
* **Deployment of system** − Once the functional and non-functional testing is done; the product is deployed in the customer environment or released into the market.
* **Maintenance** − There are some issues which come up in the client environment. To fix those issues, patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment.

**Thesis Outline**

The thesis consists of seven chapters, which are:

1. Chapter I: Introduction

Introduction consists of Thesis Background, Problem Statement, Research Objective, Scope and Limitation, Methodology, and Thesis Outline.

1. Chapter II: Literature Study

Literature Study describes the theoretical basis of references and guidance in the thesis creation.

1. Chapter III: System Analysis

System Analysis describes the analysis of the program – its behaviour and function. It consists of System Overview, Hardware and Software Requirement, Use Case Diagram, Use Case Narrative, and Activity Diagram.

1. Chapter IV: System Design

System Design describes the definition of the program’s architecture, components, and modules. It defines User Interface Design, Physical Design, Data Design, and Class Diagram of the program.

1. Chapter V: System Implementation

System Implementation describes how the application is implemented. It consists of User Interface Development and Application Details.

1. Chapter VI: System Testing

System Testing contains the testing documentation of the application. Included here are Testing Environment and Testing Scenarios, along with the results.

1. Chapter VII: Conclusion and Future Work

This chapter contains conclusion of the research. It also describes possible future improvements in section Future Work.

**CHAPTER II LITERATURE STUDY**

**CHAPTER III SYSTEM ANALYSIS**

**CHAPTER II SYSTEM DESIGN**