

DEVELOPMENT OF AYO GAME MODEL FOR HANDHELD DEVICES

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ABSTRACT

In this study, Ayo game model was designed, simulated and evaluated. This was with a view to optimizing resources on low priced handheld devices as existing models consume resources, making their deployment on handheld devices computationally challenging

Data relating to Ayo game playing patterns were collected from human experts and from a computer simulated game involving Alpha-beta search algorithm and Random player. The data collected were analysed to extract key game's states (appropriate time to play the 'Odu'). The extracted data were used to train an unsupervised neural network- the Learning Vector Quantization (LVQ) network. The LVQ network was then combined with the Alpha-beta search algorithm to make the intelligent component of the Ayo game model (synthetic player). The model was designed using Unified Modelling Language (UML) and simulated in a MATLAB environment. The performance of the Ayo game model (LVQ with Alpha-beta search algorithm) against the Alpha-beta search algorithm and Random player (with randomized effect) was evaluated in terms of response time (computer's turn) and the win percentage.

The average number of games won by the Alpha-beta algorithm against Random (excluding games drawn) was 18% while the average number of games won by LVQ with Alpha-beta algorithm against Random (excluding drawn games) was 29%. The percentage increase in games won by LVQ with Alpha-beta search over the Alpha-beta search algorithm was approximately 40%. The average number of turns used by Alpha-beta search and LVQ with Alpha-beta players were 65.8 and 41, respectively, giving a 38% decrease in number of turns used by Ayo game model, thus resulting in shorter game's length. The average response times for Alpha-beta search algorithm and LVQ with Alpha-beta search were 14161ns and 27202ns, respectively.

The result of performance evaluation of the model has shown that the model will run conveniently of any type of handheld devices.

Keywords: Ayo Game, Devices, Odu, MATLAB environment, Unified Modelling Language

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

A game is a physical or mental contest with a goal or objective, played according to a framework, or a set of rules, which determines what a player can and cannot do inside a game world (Huizinga, 1955).

According to Smed and Hakonen (2006), all games, including computer games, can be specified by means of the following components. The first component is the rule, which creates the pattern defined through the game rules that connects the player and the game. The second component is the challenge, which determines the bonuses to reward the good actions or the obstructions to be avoided by the player in reaching the game goal. The third component is the interaction, which represents the way the player communicates with the game. The last component is the objective which is defined as something that one's efforts or actions are intended to attain or accomplish.

Game playing is usually undertaken for enjoyment and sometimes used as educational tools. Games have existed among many ancient peoples and are known in all contemporary of human cultures. It has been suggested that the playing of games is one of the keys for defining characteristics of man (Akinyemi *et al.*, 2009).

Games in general (and more specifically, games of strategy) present an ideal class of environment models for testing of new ideas of problem solving and search (Amarel, 1968).

Games are also taking advantage of the ubiquitous nature of mobile phones, with games utilising the simple interface or touch sensitive screens to create casual games that can be complete in a few minutes.

Computer games are an aspect of machine learning, other aspects of machine learning include robotics, computer vision. Machine learning is an aspect of Artificial Intelligence (AI). Computer games include Baganom, Awale, and Chess (Zuva *et al.*, 2012)

Mobile games are those played on a handheld device (including mobile phones, mobile consoles and tablet computers). Several games have been developed for handheld devices such as Tetris game, the first game on mobile phone (Andreas, 2013), snake developed by Nokia which is found on more than 350million devices worldwide (nokia.com). The casual game market and more powerful mobile phones have led to more players who play for short periods due to game accessibility.

Ayo game is a traditional board game played in West Africa, especially, by the Yoruba people who occupy roughly the southern-western states of Nigeria and part of Benin (Akinyemi *et al.*, 2009). The game is believed to have originated from Ethiopia about 3500years ago and has since spread across Africa (Daoud *et al.*, 2004). The game is known differently as *Awari*, *Awale*, *Awele*, *Ajwa*, *Lela*, *Dara*, *Mancala*, *Bawo*, *Omweeso*, *Layo*, *Gilberta*, *Schach*, and *Wari* (Davis and Kendall, 2002). Ayo game requires calculation and strategy with the aim of capturing seeds while keeping to the rules agreed by the players (Daoud *et al.*, 2004). Due to the number of strategies and amount of calculation involved, Ayo game has captured the attention of many artificial intelligence researchers and computer scientists (Van, 2001, Romien and Bal, 2002).

Ayo game provides strategic thinking and employs some mathematical and logical skills that help to teach young people how to plan and think ahead. Some scientists do refer to the

game as one of the most arithmetic games that can be used to train children in some counting principles and to build skills (Agbinya, 2004). As

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