TECHNICAL PROPOSAL

USE OF MACHINE-LEARNING TECHNIQUES TO CREATE FUN EXPERIENCES IN VIDEOGAMES

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SUMMARY

In this document we explain the basics of the project that will be developed by the author during the following months based in finding ways of applying machine learning to video games. The main idea is to explore some machine-learning mechanisms and apply them to a video game, with the main objective being to make the game challenging enough to keep the player's attention and interest. In other words: we want to teach machines to play games in a way that they do not surpass the player excessively, increasing the game's fun factor. We expect to obtain a mechanism able to learn to play the game and adapt to the player skill.

KEY WORDS

Machine-learning, video games, adaptability.

INTRODUCTION AND MOTIVATIONS

This project main objective is to implement machine-learning mechanisms like Montecarlo Tree Search and neural networks in a video game. After that, these mechanisms will be adapted to grant player adaptation. We are not really interested in the learning aspect of the problem (aspect that has been addressed numerous times before); instead, our main objective is to learn how to teach machines to play in a fun way. We want them to adapt to the player, presenting a challenge just hard enough for the player to want to overcome it without generating frustration and anger due to an excessive difficulty.

The main motivations behind all of this are mainly two. The first one is the experience of the author as a player. Hundreds of hours of gameplay have made the writer notice that the current IA development systems, although complex, fail when presented to players away from the average. Either because their skill level is too high or to low, the AI fails to adapt to them and making the game fun. Segmented difficulties often leave players in the gaps between the steps they provide (easy – medium – hard). Progressive ones (those that can be scaled by the player) provide the player with the control of the world, and that not only affects the immersion, it also delegates the balancing

difficulties to the player. Bottom line, a game should push the player to his or her limits, this limits being a difficulty hard enough to be challenging but not frustrating.

The second main motivation is the interest of the author in the subject. During the course of the current academic year, the concept of machine learning has captivated his attention and thus, encouraged him to explore it further trough this project.

The project will be developed following 3 main steps: developing the base game in which everything will be tested, implementation of the machine learning techniques and adjustments and adaptations of the techniques to make them *fun*.

Auralux has been chosen as the base game in which this systems will be developed. The project will use a simplified version with the same main mechanics. We believe that this kind of games is perfect for the purpose of the project. They provide a simple set of rules and direct confrontation between players, in other words, an ideal environment to develop and test machine-controlled agents.

RELATED COURSES

Advanced Interaction Techniques (VJ1234)

Algorithms & Data Structures (VJ1215)

Programation I & II (VJ1203 – VJ 1208)

OBJECTIVES

- Implementation of Montecarlo Tree Search and neural networks

- Creation of a learning model for the project's version of *Auralux*.

- Real-time adaptation to the player's level of skill.

- Implementation of other machine-learning techniques (only if the objectives above have been accomplished).

PLANIFICATION

Task	Description	Estimated Hours
Game design	Implementation and testing of a simplified version of the game *Auralux*.	40 hours
Montecarlo Tree Search Research	Research to learn the basics of the method and to prepare its implementation	10 hours
Montecarlo Search Implementation	Implementation and testing of this machine learning technique in the game.	60 hours
Montecarlo Search Game Adaptation	Investigation of methods to adjust the method to gaming to obtain adapted and fun behaviours.	30 hours
Neural Network Research	Research to learn the basics of the model and to prepare its implementation.	15 hours
Neural Network implementation	Implementation and testing of this machine learning technique in the game.	75 hours
Neural Networks Adaptation	Investigation of methods to adjust the method to gaming to obtain adapted and fun behaviours.	30 hours

Note: The remaining 40 hours will be used for the following tasks:

1. Redaction of project documentation. This task will be done continuously during the project. That is the reason of its exclusion from the planification table.

2. Security margin: If one of the mentioned tasks took longer than expected, this hours will be used to complete it without affecting others.

Note 2: If the project development is faster than the predictions, the spare hours will be dedicated to finding new adaptations that use both methods.

EXPECTED RESULTS

- Obtention of new methods of adapting machine learning techniques to video games.

- A game that learns to play itself and that adapts its difficulty to the player.

TOOLS

- Unity 3D

- PyTorch