International Journal of Research in Engineering, Science and Management
Volume-1, Issue-9, September-2018
www.ijresm.com | ISSN (Online): 2581-5782

Artificial Intelligence to Play a Game

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***Abstract*—In computer games, Artificial Intelligence generally means creating computer players that can think rationally and also can act humanly. First problems of game AI were solved by making challenging computer players that play the best move. But as the games involved more imagination, new problems emerged such as designing humanly behaving and responding characters.**

Games are traditionally played by a group of players. Few examples are chess, hide-and-seek, football. In contrast, many computer games are single-player. So, there is a problem of interactivity in computer games. If the player perceives the game to be a deterministic machine, giving predictable outcomes, it probably will no longer feel like a game. To solve this problem, AI programmers create rational agents in the game to give the illusion of human players. If the player is faced by the challenge to win against intelligent rational opponents, the game feels more like a game.

***Index Terms*—UI & UX, Autonomous Characters, NPCs, and Virtual Humans.**

I. Introduction

The question here is whether achieving as high a performance as possible in the game is the overarching goal of the AI method. High performance here means getting a high score, winning over the opponent, surviving for a long time or similar. It is not always possible to define what high performance and "playing to win" means—for example, The Sims (Electronic Arts, 2000) has no clear winning state and the winning condition in Minecraft (Mojang, 2011) is not strongly related to playing the game well—but in a very large number of games, from Tetris (Alexey Pajitnov and Vladimir Pokhilko, 1984) to Go to the Halo (Microsoft Studios, 2001– 2015) series, it is straightforward to define what playing better means. However, not all players play to win, and few players play to win in every game all the time. Players play to pass time, relax, test new strategies, explore the game, role- play, and keep their friends company and so on. An AI algorithm might likewise be used in a number of roles beyond simply playing as well as possible. For example, the agent might play in a humanlike manner, play in an entertaining manner, or behave predictably. It is important to note that optimizing an agent for playing a game to win might be at odds with some of the other ways of playing: many high-performing AI agents play in distinctly non- human, boring and/or unpredictable ways, as we will see in some case studies.

A. Objective of Research

- Playing to Win in the Player Role
- Playing to Win in a Non-player Role
- Playing for Experience in the Player Role
- Playing for Experience in a Non-player Role
- Game Design and AI Design Considerations

II. Literature Survey

The word "Game" has been defined in a vast number of ways over the years. The definition of the term seems to evolve with various implementations and technological upgrades that come along. However, the definition of a game always seems to include the concept of accomplishing a goal via a defined set of rules. Some games pit two parties competitively against one another while others allow single players to accumulate some kind of quantifiable currency. In this section we discuss and analyze various aspects of games, specifically the traits that distinguish games from other media outlets. We will look at the ways past games have utilized these features, think about their success or failure, and introduce arguments for how serious games research can move forward while considering the use of such features. We begin by considering how goals are used within games. Goals having an explicit goal is a relatively unique feature of games which is tied closely with their interactive nature. Many forms of media are passive in that the user is not directly involved. Because of this passive nature, these mediums cannot present users with challenging goals which can be actively obtained. Games on the other hand, present users with a well-defined goal, and challenge them to achieve. One of the most important aspect of making a game both educational and fun is thus being able to define goals that accomplish academic feats, but are interesting and engaging. Research shows that the most important categories for engagement in games are fantasy, challenge, and fun [2]. In general, game players do not wish to conquer the same problems in a game that they encounter in everyday life. Games like "World of Warcraft" and "Second Life" have become so popular in part because they allow players to immerse themselves in a new reality in which their existence can be freely defined by them. The challenge then for educational games is to find frameworks that help designers choose goals for players that optimize fantasy, challenge, and fun for players while not sacrificing an academic focus. "Mathblaster" does this by creating a storyline (though a relatively vague one) [3]. One such storyline includes the players traveling through space to save a friend from an evil alien. "SimCity 2000" on the other hand, has players become mayor of a futuristic city. Players

make executive decisions in an attempt to lead their small city to prosperity [4]. These games both succeed in developing entertaining goals for students. The games above both take an instructionist approach to serious games, in which players learn through playing. Some researchers however believe that students obtain greater fluency in a subject matter when asked to build a serious game. This approach is known as the constructionist approach [5]. When applying the constructionist approach, students use tools to create a game that instructs their peers effectively. The hypothesis here is that creating an effective educational game requires academic fluency, whereas playing a game does not. With this approach, the goal of the game becomes the actual construction of a game. In this way, we can see that the idea of setting goals for students has some inherent flexibility, and allows room for creativity. Yet another example of a creative goal is using games as subjects for creative writing assignments. Researchers are investigating the use of games to excite students to write interesting papers. The project has students play the popular game "World of Warcraft". Students play the game, and must create their own creative writing assignment related to their gaming experience [6]. Projects varied from strategy guides on certain areas of the game, all the way to a fictional story about the childhood of one of the game's characters. Another student wrote about the design of a twitter like website, where World of Warcraft players could collaborate effectively online. Although the game in this example did not directly teach any material, it served as a catalyst for the enthusiasm students had for their writing assignments. It is easy, when thinking naively about goals in games, to make the judgment that creating an interesting goal is a relatively simple task. However, an effective educational game cannot have goals that are too disjointed from other game aspects. Players must be able to see the connection between educational tasks they are given, and the goals in which they are presented. For example, students are very aware that solving a math problem alone will not save their friend from an evil alien. Students must be able to understand the interaction between the content, the given tasks, and the desired goals. Therefore, lofty and entertaining goals cannot be chosen if they cannot be well interwoven into the game. Keeping the design of goals in mind, we now discuss content and user tasks in games. Content and User Tasks All games, due to their nature, contain a certain amount of content. In many cases, this content is not respected as an academic skill, and thus games have slowly acquired the stereotype of being useless and "a waste of time". However, it is hard to argue that games do not transfer some kind of knowledge to players, and it is important for researchers to categorize this content [7]. Once this content can be understood, it can be leveraged for educational purposes. For example, games communicate visual knowledge, such as the names of characters and their personalities.

III. Literature Survey

Player Behavior: In this section, we exemplify player behavior modeling via three representative use cases. The two first examples are based on a series of studies on player modeling by Drachen et al. in 2009 [176] and later on by Mahlmann et al. in 2010 [414] in the Tomb Raider: Underworld (EIDOS interactive, 2008) game. The analysis includes both the clustering of players [176] and the prediction [414] of their behavior, which make it an ideal case study for the purposes of this book. The third study presented in this section focuses on the use of play traces for the procedural creation of player models. That case study explores the creation of procedural personas in the MiniDungeons puzzle roguelike game.

Games vs. Search Problems:

Game playing is a search problem Defined by – Initial state – Successor function – Goal test – Path cost / utility / payoff function.

Characteristics of game playing:

- "Unpredictable" opponent: Solution is a strategy specifying a move for every possible opponent reply
- Time limits: Unlikely to find goal, must approximate

Game Playing:

Plan of attack

- Computer considers possible lines of play
- Algorithm for perfect play
- Finite horizon, approximate evaluation
- First chess program
- Machine learning to improve evaluation accuracy
- Pruning to allow deeper search

Types of Games:

- Perfect information
- Imperfect information

A. Clustering Players in Tomb Raider: Underworld

Tomb Raider: Underworld (TRU) is a third-person perspective, advanced platform puzzle game, where the player has to combine strategic thinking in planning the 3D-movements of Lara Croft (the game's player character) and problem solving in order to go through a series of puzzles and navigate through a number of levels. The dataset used for this study includes entries from 25,240 players. The 1,365 of those that completed the game were selected and used for the analysis presented below. Note that TRU consists of seven main levels plus a tutorial level. Six features of gameplay behavior were extracted from the data and are as follows: number of deaths by opponents, number of deaths by the environment (e.g., fire, traps, etc.), and number of deaths by falling (e.g., from ledges), total number of deaths, game completion time, and the times help was requested. All six features were calculated on the basis of completed TRU games. The selection of these particular features was based on the core game design of the TRU game and their potential impact on the process of distinguishing among dissimilar patterns of play. Three different clustering techniques were applied to the task of identifying the number of meaningful and interpretable clusters of players in the data: k-means, hierarchical clustering and self-organizing maps. A

self-organizing map (SOM) creates and iteratively adjusts a low dimensional projection of the input space via vector quantization. In particular, a type of large SOM called an emergent self-organizing map was used in conjunction with reliable visualization techniques to help us identify clusters.

IV. Future Work

Using the lessons of the literature above, I will develop serious games that combine game elements with intelligent tutoring techniques to create vivid learning experiences. The idea of building a game that can effectively teach is not new, however most attempts at doing so are either heavily education oriented (providing little excitement for students) or are heavily game oriented (providing little noticeable instruction). For example, "Grockit," has incorporated game mechanics yet feels like a study guide, not a game. Another example, "Contagion" is a serious game in which students explore a large city and experience a scare from a "black plague" like sickness. However, the student's large amount of freedom in exploring this environment leads them to engage in activities that interest them, but does not necessarily lead to the desired learning effect. Research has shown the pedagogical role of fun in learning and recognizes that fun is a characteristic of successful learning processes. This research also shows the potential of digital games to facilitate 'flow.' Also, it is not surprising that individuals have profound preferences for games. One solution is to combine techniques from intelligent tutors, which demonstrate vast learning gains for students in numerous domains. For example, student models help computers form images of a student's progress, while expert knowledge bases reason about necessary interventions. AI tools also reason about students' affect or emotion. These techniques can be applied to tailor serious games to individual students. My research focuses on developing serious games that engage individuals and groups of students in challenges relevant to their interests and expertise that are conducive to acquiring knowledge. I will extend an intelligent tutor, Rashi, built at UMass, in which students try to diagnose a "sick" patient. More than 1,000 students have used this tutor, formed hypotheses and collected data to support or refute their hypotheses. Students are given freedom to explore, but still have specific and well-defined goals. This tutor will extend itself naturally into a game where students are immersed in a virtual hospital, in which they are responsible for the caring of patients. A similar game, called "Crystal Island," has been shown to be effective for learning. In "Crystal Island," students are placed on an island, a disease breaks out, and they explore the setting to identify the disease.

A. Issue in using Serious Games in the Classroom

Even with all of the progress described above, there are many issues in trying to test serious games in the classroom. Games have obtained a bad reputation for being worthless, and this reputation can be dispelled by categorizing game usage and applying desirable features to the classroom setting. Many believe that the relatively new feature of on-line multi-player games, for example, greatly increases what games can do in the classroom. One of the big issues with regard to serious game classroom use is defining the specific role that games will play in the classroom. It is hard to believe that games will become a dominant form of learning. This is due in part to profound gender differences regarding game preferences as well as for varying learning styles for students. Some researchers believe that the optimal usage of games in the classroom is in inquiry and exploratory learning games that supplement material. Whether this is correct or not, it is important that games attempt to reach real classrooms so that evidence can be collected regarding the best usage of games in schools. Even if games achieve usage in classrooms, the role of the teacher becomes another important issue. Because teachers have the ultimate control over the behavior of their classroom, it is important that a teacher understand and agree with the goals and philosophy of the game and its pedagogy. Teachers, when faced with a new learning technology, tend to embrace aspects of the technology that suit their vision and teaching beliefs.

V. Conclusion

In this way we can say that an artificial intelligence is very useful term to play a game. Due to artificial intelligence we can play a game without any support of human opposition.

Acknowledgement

This is a great pleasure & immense satisfaction to express my deepest sense of gratitude & thanks to everyone who has directly or indirectly helped me in completing my work successfully. I express my gratitude towards project guide Prof. Ashwini Bhatkal and subject incharge Department of Computer Engineering, MGMCET, Kamothe, Navi Mumbai who guided work in scheduled time.

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