

DECISION-MAKING AND MACHINE LEARNING USE OF AI TECHNIQUES IN SERIOUS GAMES

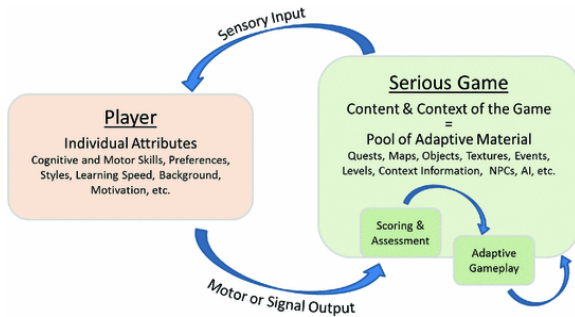
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ABSTRACT:

In recent years, however, the emergence of social networks, smartphones and tablets introduced new categories such as mobile and social games. Video games have come a long way since the first games emerged in the 1970s. Today's video games offer photorealistic graphics and simulate reality to a degree which is astonishing in many cases. In recent years, however, the emergence of social networks, smartphones and tablets introduced new categories such as mobile and social games. Video games have come a long way since the first games emerged in the 1970s. Today's video games offer photorealistic graphics and simulate reality to a degree which is astonishing in many cases. One of these is the field known as serious games. The main goal of this article is to collect all the relevant articles published during the last decade and create a trend analysis about the use of certain artificial intelligence algorithms related to decision making and learning in the field of serious games. However, researchers may need to improve their testing methodology for developed serious games, so as to ensure they meet their final purposes.

INTRODUCTION

The global video game market size was valued at USD 151.06 billion in 2019 and is expected to grow at a Compound Annual Growth Rate (CAGR) of 12.9% from 2020 to 2027. Technological proliferation and innovation in both hardware and software are expected to be the key factors driving the growth. The growing penetration of internet services coupled with the easy availability and access of games on the internet across the globe is also expected to keep the market growth prospects upbeat in the forthcoming years. Game developers are also constantly improvising and pushing the technological limits regarding the real-time rendering of graphics in the video game industry, which is further expected to propel the growth.



The main purpose of a serious game is both to be fun and entertaining, and educational. A serious game is thus designed both to be attractive and appealing to a broad target audience, and to meet specific educational goals.

They are designed to foster knowledge, skills or routine habits in the player.

Serious games span a broad range of fields and areas of expertise. In the literature, serious games were divided into several categories based on different classification schemes. These models can be divided into two main categories:

market-based and purpose-based classifications.

Several authors established different categories of market-based classification. This segmentation is based primarily on the different “markets” or fields the serious games are developed for. The different segments identified in the literature are:

- Military games, government games, educational games, corporate games, health-care games, political, religious and art games.
- Health, public policy, strategic communication, human performance engineering, training and simulation, education, game evaluation.
- Educational, social change, military, occupation and marketing.
- Defense, teaching and training, advertising, information and communications, health, culture and activism
- K-12 edutainment, higher education, health-care, corporate, military, non-government and other .

Different authors also provide different categories for purpose-based classifications, or intention they ere intended to satisfy.

- AdvergAMES, activism games, training and simulation games, edugames, newsgames and edumarket games.
- Business games, health and medicine, news, activism, advergAMES and political games.

Other classification approaches use alternatives to the market/purpose distinction, proposing labels or tags as means of classification. Meanwhile, the G/P/S classification model considers a gameplay, purpose and scopetrio. Finally, classification can also be conducted according to learning principles, target age group or game platform.

LITERATURE SURVEY

U. Ritterfeld, M. Cody and P. Vorderer, "Serious games: Mechanisms and effects", *Routledge*, 2009.

Serious Games provides a thorough exploration of the claim that playing games can provide learning that is deep, sustained and transferable to the real world. "Serious games" is defined herein as any form of interactive computer-based game software for one or multiple players to be used on any platform and that has been developed to provide more than entertainment to players. With this volume, the editors address the gap in exisiting scholarship on gaming, providing an academic overview on the mechanisms and effects of serious games. Contributors investigate the psychological mechanisms that take place not only during gaming, but also in game selection, persistent play, and gaming impact.

F. Bellotti, B. Kapralos, K. Lee, P. Moreno-Ger and R. Berta, "Assessment in and of serious games: An overview", *Adv. Human-Comput. Interaction*, vol. 2013, pp. 1, 2013.

A systematic approach—based on established principles and guidelines—is necessary to enhance the design of serious games, and many studies lack a rigorous assessment. An important aspect in the evaluation of serious games, like other educational tools, is user performance assessment. This is an important area of exploration because serious games are intended to evaluate the learning progress as well as the outcomes. This also emphasizes the importance of providing appropriate feedback to the player. Moreover, performance assessment enables adaptivity and personalization to meet individual needs in various aspects, such as learning styles, information provision rates, feedback, and so forth. This paper first reviews related literature regarding the educational effectiveness of serious games. It then discusses how to assess the learning impact of serious games and methods for competence and skill assessment. Finally, it suggests two major directions for future research: characterization of the player's activity and better integration of assessment in games.

IMPLEMENTATION

A. Data collection

1) Databases searched: This review was carried out mainly using the search engine provided by the Web of Knowledge. However, searches were also carried out in other electronic databases for this review, for instance databases particularly related to education, computer science, information technology, social sciences and health:

ACM (Association for Computing Machinery), IEEE (Institute of Electrical and Electronics Engineers), BioMed

Central, Science Direct, EBSCO, Emerald, and PsycINFO.

2) Search terms: Search terms for games in conjunction with terms for possible outcomes, impacts of effect games, as well as with related AI parameters. The authors performed a combined search of the terms game, serious game, games, serious games, play, playful, game based learning in combination with intelligent, artificial, intelligence, adaptive, decision trees, fuzzy logic, markov system, goal orientation, GOAP, finite state machines, naïve bayes, artificial neural network, case-based reasoning, support vector machines, adaptive hypermedia, dynamic difficulty adjustment, machine learning, decision tree, genetic algorithms and reinforcement learning. A third parameter was introduced to narrow down the search, using words for possible outcomes such as learning, education, health, training, motivation, behaviour, skills, attitude, military, among others

3) Selection of papers for inclusion: Abstracts were selected for the retrieval of the paper if they were judged to include data about the implementation of serious games including at least one of the displayed AI techniques.

RELATED WORK

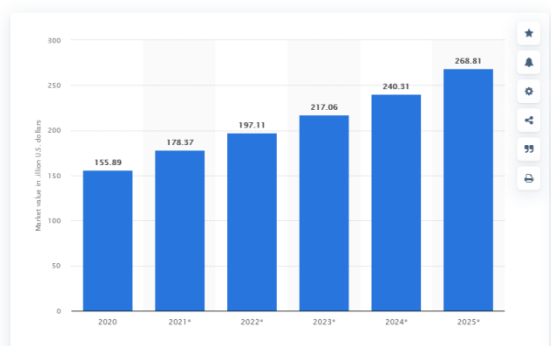
These algorithms and techniques are very popular in the design and development of serious games, i.e. Sordani et al. used decision-making agents in a game that was oriented towards raising people's awareness about the importance of making rational decisions concerning natural resources management in protected environments (21). Cantwell et al. developed a collaborative exergame for the elderly, in which game speed and difficulty were adjusted in the light of user profile and performance (22). The subsections below provide information about other developments classified by specific AI techniques within the field of decision making.

A. Decision Trees

The main objective of decision trees is to create a prediction model on the basis of a set of decision rules obtained from compiled data during system performance. These decision trees have been used

throughout the literature by several authors. This section categorizes the latest and most relevant publications using this technique applied to the serious games field.

Global video game market value from 2020 to 2025
(in billion U.S. dollars)



CONCLUSION

This new age of serious games is very close to the world of video-games, and they generate new solutions completely adapted to their target audience. However, researchers may need to improve their methodology for testing developed serious games, so as to ensure they meet their final purposes. Moreover, the authors would like to encourage other researchers to extend this article to other AI specific techniques and/or addressing new AI-related features, to extend this state of the art in the field of serious games,

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