

Artificial Intelligence in Computer Games

*Prof. Dr. Ghotekar D. B.

**Prof. Joshi P. D.

Introduction:-

There are many types of computer programs that use AI. Market simulators, logic systems, and economic planners are some of the different fields of computer software that rely heavily on elements of artificial intelligence. . The computer game has grown from modest text based adventures all the way to contemporary three dimensional graphical games with complex and immense worlds. Computer games typically find themselves on micro-computer technology but have also been built on distributed parallel systems as well. Computer games have a way of evolving and adapting to their environment. As soon as the computer hardware is developed, computer games somehow find a way to maximize the resources available. Video games have gone through drastic improvements in the past ten years. The topic of this paper is to discuss the different features that game AI provides to a computer game along with the different AI techniques used to provide those features. A survey of research is provided for the AI techniques presented that shows how important academic research is to the advancement of computer games.

History of Computer Games and AI:

Physicist Willy Higinbotham created the first video game in 1958. It was called “Tennis For Two” and was played on an oscilloscope. In 1970 the future founders of Atari, Nolan Bushnell and Ted Dabney released the first video arcade game, “Computer Space”. In 1980, Battlezone, the first 3-dimensional game ever, was released. The console industry caught back up in 1995 when Sony brought the PlayStation to the United States. It was the first practical CD based system. The advent of fighting games such as “Kung Foo” for Nintendo or “Mortal Kombat” for Sega Genesis saw only a slight improvement in AI.

McCarthy develops LISP programming language is first dedicated AI programming language in 1958. Scientist makes number of predictions of the future of AI which is Computer will be Chess Champion that happened in 1997 & Computer will be prove mathematical theorem that happened in 1996. PROLOG programming language developed which is based on AI in 1972.

What is Artificial Intelligence:-

The Intelligence means, the Greek philosopher Aristotle tried to identify the rules of “right thinking”, logical reasoning, by establishing patterns by which a true precondition would always lead to a true goal state. In Dictionary meaning is the capacity for understanding; ability to perceive and comprehend meaning.

The decision cycle of those NPCs constantly executes three steps

1. perceive (*accept information about the environment – sensor information*)
2. think (*evaluate perceived information & plan according actions*)
3. act (*execute the planned actions*)

A very small selection of the many available AI research articles is presented. The research articles are presented in the following groups; Path Finding, Fuzzy Logic, and Genetic Algorithms. The most popular way to compute the least cost and shortest path in computer games is by using the AI algorithm. Fuzzy logic helps build plausible human like behavior in NPC's in computer games. Fuzzy logic has been used to help make decisions in other applications as well. The canonical Genetic Algorithm has one variety restricting process which is Selection. Selection decreases the number of selections in the genetic population. A genetic algorithm works in the following way.

1. Create a first generation population of random organisms.
2. Test them on the problem that is being solved and rank them according to fitness. If the best organisms have reached our performance goals then stop.
3. Take the best performers and mate them by applying genetic operators such as crossover and mutation. Add a few brand-new random organisms to the population to introduce new variety and help ensure against convergence on a local maximum.
4. Loop to step 2.

* Associate Professor C. D. Jain College of Commerce, Shirampur

**Computer Department C. D. Jain College of Commerce, Shirampur

This AI technique has not found itself into many modern computer games because it takes a lot of computer resources and time to evolve a specimen or NPC into something worthwhile. Then there is "Game AI" which is used in game theory, which is not at all the same thing as the AI used in video games. This kind of AI is mainly concerned with various approaches to tree search (*used in chess playing and for other board games*). The uses of this kind of AI for video games is very limited, mainly because the prohibitively huge amount of computation that it requires, but it has been used in the game Worms which is a turn-based game. For real-time games, which usually deal with large numbers of NPCs that need to act simultaneously, this is not possible.

To understand, what the requirements of a typical AI in modern real-time computer games are, it is useful to look at the various stages in the history of computer game AI: From the first games with computer controlled players and NPCs on, AI was used for creating believable adversaries/enemies to compete/fight against the human player. Depending on whether this was a tactical opponent in classical board-games or a monster in a role-playing or arcade game, the methods used for creating the AI were different, but their purpose was ultimately the same – to create a life-like opponent to provide the player with a challenging and fun experience. As computers became more powerful and games grew bigger, incidentals were added to enrich the virtual game world without actively contributing to the plot of the game. People going about their own business in the background of the game action or secondary animation like flocks of birds in the virtual sky above, generate a sense of reality which aids in the players immersion within the game world. The development of the internet and networking technology for local area networks (LANs) soon led to the creation of games in which multiple players could engage over a network connection.

Problems Solved by AI:- One of the greatest problems that faces games AI programmers is the requirement for the NPCs to work in real-time. This automatically excludes a number of AI techniques from being used in games, as it would be unacceptable for an NPC to spend minutes of game-time with decision making. The AI has to be made to work so that to the player it looks like the decisions are made as the NPC plays along. Another problem that is closely related to the real-time requirement for games AI is the fact that the AI has to share the computer's processing resources with the rest of the game which will include graphics, input processing sound processing and possibly even networking. At first, CPU budgets for AI exploded and a number of games spent up to 30% of their processor time doing AI calculations, but this has now levelled off at about 10% of CPU time.

While the exact range of problems that an artificial character within a computer game will need to solve depends on the virtual environment in which the character exists, the most common problems found in modern computer games to which the intelligent actions of NPCs are restricted to are:

- path finding / path planning
- decision making
- steering / motion control

While each of these problems can usually be solved with relatively simple methods, it is the combination and balancing between those methods that create the illusion of intelligence in games.

Case Studies:

PacMan:- The result of this simple method is a personification of each of the ghosts by the player (*through subconscious projection*) as he will perceive the ghost's behaviour as that of an intelligent character.

Computer Chess:- The AI part is mainly involved with the search heuristics that are employed for evaluating the positions in the search tree. Some modern chess-playing programs can analyse millions of different positions per second.

CONCLUSION

This paper presented a survey of research articles regarding Artificial Intelligence and described how these AI techniques are used in computer games. AI is an important part of every computer game and is as equally important as computer graphics and computer audio.

References:-

- The chief AI developer for the game, Richard Evans, provided the gaming website www.gameai.com with some simple documentation of the game design.
- J. Shabbir and T. Anwer, "A Survey of Deep Learning Techniques for Mobile Robot Applications," *ArXiv e-prints*, Mar. 2018.
- J. Doshi, Z. Kira, and A. Wagner, "From deep learning to episodic

memories:Creatingcategoriesofvisualexperiences,”

▪ P. Gupta and P. Sahai, “A review on artificial intelligence approach on prediction of software defects,”2016.

▪ S. J. Russell and P. Norvig, *Artificial intelligence: a modern approach*. Malaysia; Pearson Education Limited,2016

#####