Artificial Intelligence in Games

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Scan Me

Aim

- Making games more realistic
- Transforming skills of developers
- Making games smarter
- Making games more interactive

Introduction

- Due to their vast space and high complexity, games are great benchmarks for evaluating different techniques in artificial intelligence. [1]
- AI in games refers to going beyond scripted interactions into interactive, responsive, adaptive, and intelligent.
- In these systems, players can learn more about the game while they are playing, adapt their own behaviour beyond what is programmed by the developers, and are more interactive. [2]
- Games use AI in a variety of ways. It can be used for image enhancement, automated level generation, scenarios, and stories, balancing in-game complexity, and adding intelligence to non-playing characters (NPCs).[4]

Background

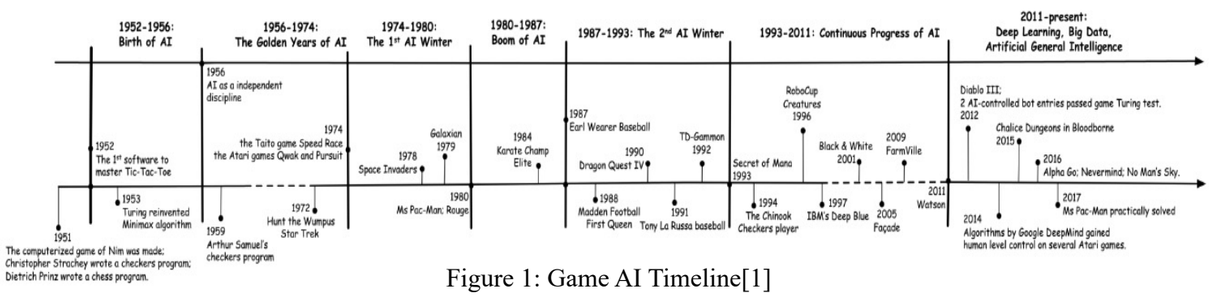


Figure 1: Game AI Timeline[1]

- Arcade games were the first commercial games that used stored patterns to simulate arbitrary enemy movements.
- Games such as space invaders and Pac-Man were one of the first games to make use of this and kickstarted the evolution of AI in gaming.
- Deepmind's development in the field of Artificial Intelligence in games achieved superhuman performance in ancient games such as Go, Chess, Shogi and Atari.

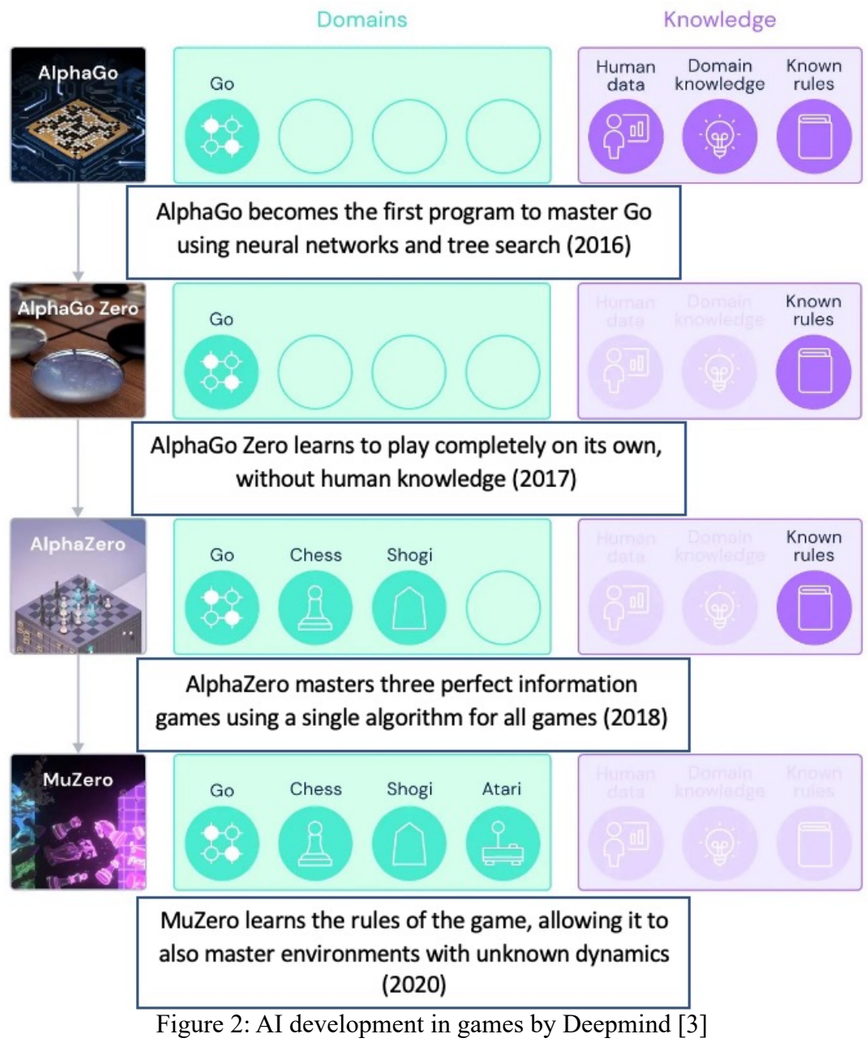


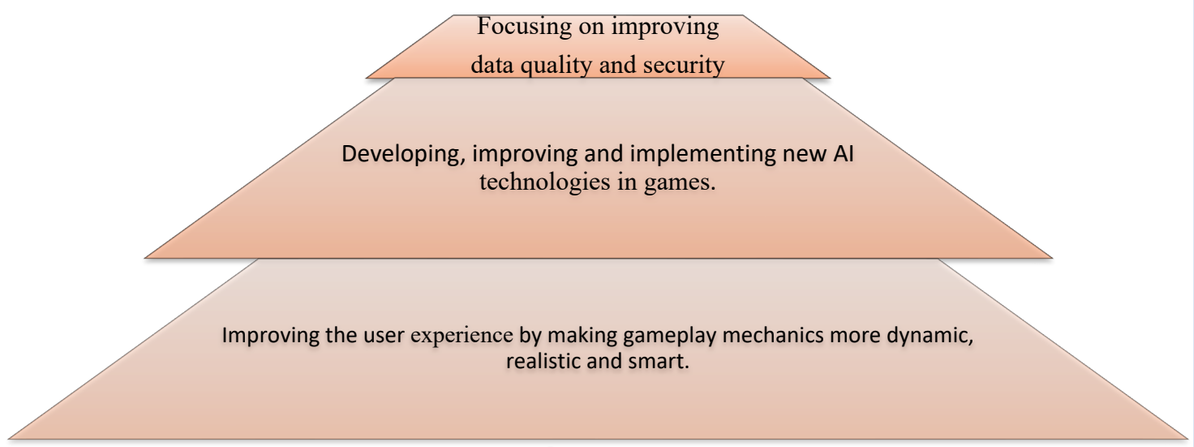
Figure 2: AI development in games by Deepmind [3]

Technical and Ethical Issues

Technical Details

- AI was first used in games programming to define NPC behaviour and their exploration of open worlds through A* pathfinding algorithms. [4]
- Various popular games use nondeterministic methods such as decision trees, deep neural networks, genetic algorithms, and reinforcement learning. [4]
- A decision tree (DT) is a supervised learning model that can perform both classification and regression. By learning simple decision rules from data features, it can be possible to predict the value of a variable of interest. In general, DTs describe choices and consequences (predictions of actions). [4]
- Artificial neural networks (NNs) are structures similar to human brains that can learn different features from training data. A neural network is self-adaptive and can adapt well to game environments in which changes occur in real-time. The learning process can be applied in real time during gameplay (online) or the agents can be trained offline before taking part in a game (offline). Multi-layer neural networks are used in games to progressively extract features from input data. [4]
- Genetic Algorithms mimic the process of natural selection, where the fittest candidates are selected to produce the next generation. Various optimization tasks are performed using a Genetic Algorithm. GAs can deliver excellent results for multicriteria optimization when compared to other optimization techniques. [4]
- Reinforcement learning (RL) is a machine learning technique based on trial and error. Reinforcement learning is a useful tool for designing decision-making NPCs in dynamic and unknown environments. [4]

Future Work



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[4] K. Belova, "How artificial intelligence (AI) is used in game development," *PixelPlex*, 02-Nov-2021. [Online]. Available: https://pixelplex.io/blog/how-ai-enhances-game-development/.