

# The Application of Artificial Intelligence in Enhancing the Sense of Reality in Games

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**Abstract.** With the rapid development in the field of computer science, game development has emerged as one of its significant branches. Artificial Intelligence (AI), as an emerging discipline, has become increasingly integrated with the field of game development, offering new possibilities for enhancing the sense of realism and player experience in games. This paper delves into the application of AI in enhancing the sense of reality in games. Firstly, the paper analyzes the importance of the sense of reality in games and explores how AI can enhance the player's immersive experience by simulating game character behaviors. Secondly, the paper discusses the application of AI in game physics and environmental simulation. Next, the paper explores the application of AI in enhancing game audio and visual effects. Additionally, AI's application in image generation and enhancement technologies has raised the quality of game graphics to new heights. Lastly, the paper discusses the application of AI in the field of VR and AR, and how it can enhance user perception by optimizing hardware performance and providing more realistic physical experiences. The paper examines the potential of AI in improving the emotional experience of users and provides an outlook on future trends in game development.

**Keywords:** Application, AI, sense of reality, games.

## 1. Introduction

Nowadays, game developing has already become one of the most important subjects as a discipline of computer science. The acquisition of the game has also become an extremely huge number compared to the past decades, even half a century. That is the same as Artificial Intelligence (AI). These new subjects and the research in the past suggest the possible connection of them in the new era [1]. AI, which has the ability to give the outcome of some specific phenomenon and demand much faster than a common robot, and that is due to the similarity of the way it thinks and the human brain. Although the route of solving a question is the same for us, it has a higher efficiency than us, just like the computer “Deep Blue”, which is a super computer and it beat one of the best chess players in the 19th century. Moreover, the Artificial also have self learning ability, which is the biggest difference between other robots. Like ChatGPT, it can learn from the mistakes it made in the past and fix it in a short time, even if it just needs a little information to achieve the desirable outcome.

The sense of reality is becoming one of the most important factors of a success game. The engine of the game and the compiler decide the final affection of the project, like Unity and Unreal. However, it is insufficient to get enough information to find out the capable insert point for AI in Game Engine. How to make a game combine with the reality world and unreal physical formulas together is a huge

problem, cause it cannot explain with a single equation and a single technology to express them out. Above these things this paper will put the point on the relationships of AI with the new technologies in the new era and explore how humankind can improve this field and push AI and computers to a new high place.

## **2. AI enhancing the sense of reality in games**

### *2.1. AI in game character behavior simulation*

In the realm of game design, behavior simulation involves creating virtual characters whose actions and decisions mimic those of individuals or groups in real life. This process encompasses multiple levels of simulation, from simple reaction to complex cognitive decision making, to the construction and development of social relationships. The core of behavior simulation is to create a system capable of making autonomous decisions and adapting to environmental changes.

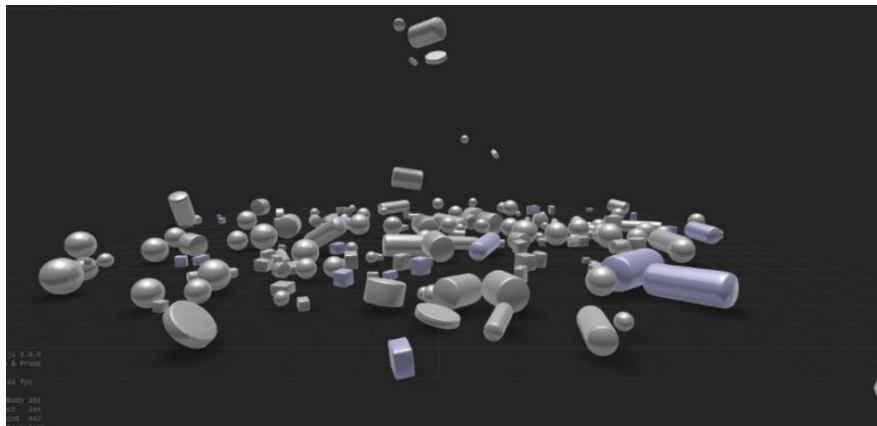
With advancements in AI technologies, particularly machine learning and deep learning, behavior simulation has become more intelligent and flexible [2]. By training models on large datasets, AI can learn patterns and gradually improve its adaptability across different scenarios. For example, in the game *Detroit: Become Human*, AI technology is extensively used for character emotional expression and social interaction. Each character has an emotional model that can react to player choices and behaviors with corresponding emotional responses. This emotional expression extends beyond facial animations and voice acting to include body language and behavioral patterns. When the protagonist makes a decision, other characters adjust their perception of the protagonist based on this decision, influencing subsequent plot developments [3].

To further enhance the gaming experience, modern game design focuses on predicting and adapting to player behavior. This means that the AI systems within games must not only understand and predict player actions but also adjust according to player habits and preferences to provide a more personalized experience. In *Assassin's Creed: Odyssey*, the game dynamically adjusts difficulty levels and other elements based on the player's play style, ensuring that the gameplay remains challenging yet manageable. This personalized experience design not only increases the game's replay ability but also makes the game world feel more dynamic and interactive. Additionally, the social dynamics within the game evolve continuously as the story progresses, enriching the game's narrative depth and realism.

### *2.2. AI in game physics and environment simulation*

In contemporary games, precise physics simulation and dynamic environment generation make game worlds more realistic, interactive, and unpredictable. AI plays a crucial role in this process by enhancing physical representations and enabling environments to change dynamically based on player actions and game progress.

Physics engines are responsible for simulating object movement, collisions, gravity, and other physical phenomena. Traditionally, physics engines relied heavily on mathematical formulas and predefined parameters to calculate these phenomena. However, with advancements in AI, particularly in machine learning, physics engines are now integrating AI to achieve more natural and complex physical interactions [3]. For instance, in the game *Death Stranding*, advanced physics engine technology simulates the character's movement across various terrains, including mountains, rivers, and forests. AI optimizes the character's gait, making it more natural and stable across different terrains. Furthermore, items in the game possess realistic physical properties, such as weight affecting the character's speed and friction varying depending on the surface. These details make physical interactions more authentic, enhancing the player's immersion (Figure 1).



**Figure 1.** AI environment simulation [3]

Dynamic environment generation is another method to increase realism. This technique not only adds diversity to game worlds but also enhances replay value. AI's role here includes random environment generation and intelligent environmental response. For random environment generation, AI algorithms create diverse maps and landscapes. In sandbox games like Minecraft, AI generates vast worlds containing mountains, forests, deserts, and more. Every new game starts with a fresh world, ensuring unique experiences each time. For intelligent environmental response, AI helps the game environment react to player actions. In Metal Gear Solid V: The Phantom Pain, AI simulates animal behavior, with animals responding differently to the player's movements, such as fleeing or becoming alert. This makes the game world feel more alive. Additionally, weather systems adjust based on player activity and time changes. AI controls weather variations, simulating conditions like sunny, rainy, and stormy weather. These weather conditions affect visual effects and player actions, such as reduced visibility and slippery roads. AI can also dynamically adjust weather changes based on the player's location and time, diversifying the gaming experience.

### 2.3. AI in game audio and visual quality

*2.3.1. Audio design and AI* Traditionally, game music was pre recorded and played at different stages of the game. However, this approach lacked flexibility and could not achieve true interactivity. AI technology enables dynamic music generation, adjusting rhythm, melody, and overall style in realtime to match the current game state. In Assassin's Creed: Origins Background music changes automatically based on the player's context. During combat, the music becomes tense and intense; during exploration or NPC interactions, it becomes gentle and calm. This dynamic music system enhances immersion and provides a richer auditory experience. In the Battlefield series, AI simulates various sounds in battlefield environments, such as explosions and gunfire, to enhance the realism of battles. By training AI models to recognize and generate specific sound effects, developers can quickly produce high quality audio materials, saving significant time and resources [4,5].

Emotionaware music systems represent a more advanced form, adjusting music not just based on game states but also according to the player's emotions. By analyzing player behavior patterns and physiological indicators like heart rate, AI can perceive the player's emotional state and adjust background music accordingly, enhancing emotional resonance. For example, in Alan Wake. The music system adjusts the rhythm and volume based on the player's actions and the intensity of the situation. During tense chase scenes, the music becomes fast paced and urgent; during peaceful exploration phases, it becomes slow and serene [5]. This emotion aware technology integrates music deeply into the narrative, strengthening the connection between the player and the game world (Figure 2).



**Figure 2.** AI for game design [6]

*2.3.2. AI in game visual effects enhancement* Image generation and enhancement technologies have elevated game image quality to new heights. Through deep learning algorithms, AI can generate high resolution textures, realistic materials, and complex scenes. To represent facial expressions, traditional methods involved capturing actors' facial movements, which required extensive post production work. AI applications have made facial animation more efficient. By training models to identify and simulate facial muscle movements, AI can generate natural facial expressions in real time, making characters appear more lifelike. For example, in *The Last of Us Part II* The characters display nuanced emotions such as sadness, anger, and surprise, thanks to AI driven facial animation. Additionally, AI can be used for emotion recognition, allowing NPCs to respond to players' behaviors and expressions, enhancing game interactivity. Lighting and shadows are another factor in creating atmosphere. AI applications make realtime lighting and shadow effects more realistic. By simulating light propagation and reflection in complex environments, AI can generate natural lighting effects. For instance, in *God of War*. The way light passes through trees or reflects off water surfaces is highly realistic, all achieved through AI technology.

### **3. The capable of game development and AI**

#### *3.1. VR and AR with the help of AI*

VR and AR need precision calculation in the stage rendering. And the core technology of VR is all about how to make the reality atmosphere and real life. AI could insert into the compile of making an operating environment. VR is mostly made with Unity and Unreal engine 5, and they support out insert coding. And AI can also use hardware devices with extra extra stuff. In other words, the devices which lift with the VR system need another system for the calculation and replenishment of performance of the whole situation when they are running. However, VR usually needs mountains of combinations in the hardware and it will be decided by the frequency of hardware and the calculation of extra devices. At the same time, AR needs some real situation in the real world and makes virtual things approach the real world infinitely.

Even in the details of the computer, there are also problems in the capability of different hard devices. VR devices usually use outer parts to help it run in a suitable environment. So with AI, the data that comes from the 3D rendering software can be dealt with using the simplified compute method in the AI. The model counting can be simplified and make the detail of the stage which present above the sight of the user become more flexible, such as improving the frame rate of the user's VR glasses. Then the basic problem of hardware will come out again. If the dealing process cannot be done well, then the steps after that will all become no use. Fortunately, AI has its fastest route to make the problem simple and make sure it will use the least space to deal with it. Then the capability of VR and AR with AI is obvious. It is not only the best match in efficiency, but also a good choice to face a trouble issue [7].

Moreover, about the trend of game players, VR gaming has already become a potentially important subtitle in the world. With the high efficiency engine the developer of games can make lots of games which are popular all over the world, and that is already hard to make it up to a new level. It can be said that there is almost nothing to develop in this field of game. In the past, the technology of VR and AR was not strong enough to make a good outcome that is satisfied by a huge group of people. And the cost of VR technology is much more expensive than the common way of making games on PCs and mobile phones. The demand of VR is not just about the proper rendering, in fact, it is about the reality of physical experience. It is extremely hard to prove the devices surrounding the people will give them a good experience which is the same as the feeling in their daily life. And more seriously, the feeling of the user is the most important issue affecting their thinking about a VR game rather than the reality of the graphics. It is fortunate that the related technology is already familiar to scientists nowadays. It is all about the realistic feeling of humans.

Convenience is also an important characteristic of VR and AI. With the input of AI the VR devices could decrease the area of use, even become a tool that can take it like a smartphone. If VR devices become convenient, it will probably become the most popular devices in the world, and that may be beyond the PC, which is impossible to take them out of people's house.

### 3.2. Use AI to argument feeling of user

Reflecting the actions of humans has already become the basic ability of any computer in this world. There is nothing to say about it unless about VR Devices. As this paper said in the last section, the VR devices need an absolute solution of the physical experience. And that will refer to a restricted demand of any user [8]. The rendering of the stage can only make the user satisfied about the common games or videos on the screen, but not on the reality world. Imagine that a person cannot have the feeling that contains all physical things, that will be bad for that guy. Considering the nature of a human the outcome is easy to know. VR will probably become a popular tool in the future life of everybody. Then the VR will flow into the making of good games naturally. According to the things this paper mentions in the previous paragraphs, it is obvious that VR needs the assistance of AI.

## 4. Conclusion

This paper delves into the application of AI in enhancing the sense of reality in games, including character behavior simulation, physical and environmental simulation, audio and visual effect enhancement, as well as the application of VR and AR technologies.

In conclusion, the application of AI technology in game development has greatly enriched the content and form of games, enhancing the immersive experience for players. By simulating complex character behaviors, dynamic environment generation, real-time audio adjustments, and high-quality visual effects, AI has made the game world more realistic and interactive. Furthermore, the application of AI in the fields of VR and AR has demonstrated its immense potential in enhancing hardware performance and providing authentic physical experiences. As technology continues to advance, it is anticipated that AI will continue to propel the development of the gaming industry, offering players more enriched and realistic gaming experiences. Future research can further explore new applications of AI in game design, as well as how to better integrate AI technology with players' emotional experiences to create more captivating game worlds.

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