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Applying Artificial Intelligence for Emotional Cognition in Game Testing for Quality Assurance

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Abstract

Artificial intelligence (AI) is a branch of computer science that tries to develop computational tools and systems that can carry out tasks comparable to human decision-making and learning. The subject of AI is expanding quickly, and AI technology is becoming more and more significant in a variety of IT specialties. When more automated and intelligent solutions are employed instead of outdated techniques, the quantity of manpower and resources needed for game testing will be greatly decreased. The aim of this study is to find new models that will make game testing easier by utilising state-of-the-art AI techniques. In an attempt to determine the model base and algorithmic foundation for the new approach, the examination and comparison of existing theories, models, and algorithms is used to infer and identify the viability of certain current mainstream AI models and algorithms in game testing sessions. Standard software testing is not the same as game testing. Further consideration should be given to the whole gaming experience and entertainment value in addition to functional testing. User questionnaires and in-game testing are used in the current standard experience testing methodology. Artificial intelligence eliminates human aspects in emotional cognition. It may produce more objective test results while spending less money for both human and material resources by using massive data sets and its own learning and processing capabilities. This paper examines the state of AI in software testing, game creation, and emotion perception using expertise in using and applying AI approaches in game testing for quality assurance. It also demonstrates how well AI methods work for predicting player emotions during game testing. The AI testing reduces testing expenses related to labour and material resources while guaranteeing total game confidentiality before release. It also increases test accuracy and reduces the impact of subjectivity.

Keywords: *Game Testing, Artificial Intelligence, Quality.*

Introduction

Artificial intelligence technology is still developing as a result of the remarkable recent advances in computer and Internet technologies. In software testing, artificial intelligence is replacing human authors with more efficient test cases to better uncover potential issues with the programme (Russell & Norvig, 2010). Here, the tester supplies a sizable amount of input and output data for the purpose of training an AI approach. This finally allows the AI to create and execute tests in compliance with certain guidelines and generate a credible summary of the test results (Cheng & Li, 2021).

The number of games created each year has been steadily increasing, and the global games market, which reached $134.9 billion in 2018, is proof that the video game industry has grown significantly in recent years (Ertel, 2018). From early games with little or no visuals and limited keyboard instructions to more recent titles with realistic graphics and fully interactive situations, the complexity of making video games has likewise increased over time. The quantity of effort needed to maintain quality has increased as a result of this rise of complexity. One of the most important aspects of software engineering quality assurance is testing. Software testing is an evaluation process used to find bugs in software development and gauge how well an application functions in relation to requirements. Compared to traditional software development, video game quality assurance requires a number of additional considerations (Yannakakis & Togelius, 2018).

The increasing demand from game production organisations has led to a widespread usage of procedural generation techniques in video games to ensure both amount and quality of material, thereby raising replay value (Li et al., 2018). Procedural generation includes the creation of gaming levels, which may be automatically produced by carefully designed algorithms, giving the user a new experience every time. Characters, both player and non-player, level geometry, and interactive components are all included in these

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game levels. Automating procedurally generated level testing might be a wise choice because it can be tedious to test levels manually. Play testing might be the exclusive use of AI.

Game developers can use AI advancements in the gaming industry to create immersive and intelligent games by creating complex games that can be built automatically, that can adapt and respond to player feedback, and that have in-game characters that can change over time instead of just responding to the player. A third of the development cycle is often devoted to testing, which is an essential phase in the production of gaming software (Zheng et al., 2019). Every phase of the development process involves testing. According to the game development process, testing may be broadly divided into four categories: unit, module, overall, and product testing (Cheng & Li, 2021).

Traditional game product testing involves distributing an internal test version, inviting a select group of players to test it out, getting their input, and addressing any criticism. In addition to needing a bigger investment of time and materials throughout the testing procedure, this type of testing has a higher chance of leakage. AI has the potential to develop models of emotional cognition by employing data to establish correlations with human behaviour and emotions. The emotions that people express through their activities in their environment may then be monitored using these models (Powell, 2019). Based on the current state and experience of AI in software testing, game development, and emotion cognition, this paper further explores the viability of using AI techniques in game testing to predict the emotions of players' experiences and provide player emotion feedback for game testing efforts.

Li et al. (2018) state that the phrase "product testing" refers to market research activities that developers do related to a product, for their own objectives, using specialised technological means and research methods, and usually in combination with specific market activities. The main objective of this article is to assess players' first experiences with the game in order to respond to criticism, improve players' perceptions of the game generally, and eventually increase the game's popularity and financial success after launch.

Artificial Intelligence

The technological revolution has brought together a wide range of tools and techniques to help solve issues that arise in daily operations. Most of these systems are focused on fixing problems. Alam (2022) asserts that the digital and industrial revolutions have a significant impact on all facets of life, society, enterprises, and jobs. One of the biggest breakthroughs of the technological revolution is AI technology. A computer-based system that can perform activities designed by humans is referred to as artificial intelligence (Perez-Liebana et al., 2019). According to Russell and Norvig (2010), AI is a technology that thinks like a human, acts like a human, thinks logically, and acts rationally. Understanding the underlying principle of artificial intelligence is essential before moving further. Perez-Liebana et al. (2019) list perception, logic, learning, planning, and reasoning as the main tenets.

AI seeks to build machines that can do tasks that would normally need human intelligence. However, the aim of those who research the fundamentals of intelligence is to add intelligence to the programme, not to imitate intelligence. AI is capable of making certain changes based on the pace of continuity (Powell, 2019). AI is significant because it enriches and improves human endeavours, which is another reason. This technology is capable of learning, developing, analysing nonlinear connections, and reaching well-informed conclusions. AI can examine large amounts of data quickly and correctly (Perez-Liebana et al., 2019).

A number of industries have used AI: games, robots, law, stock trading, remote sensing devices, scientific discoveries, and diagnostic treatments (Roohi, 2022). Since most sophisticated AI applications have heavily impacted everyday applications, it is impossible to distinguish between them separately, anything that is used as a general application and proves to be really beneficial loses its ability to be identified as AI. Applications of AI seem to be a ubiquitous component of the infrastructure in every industry. The late 1990s and early 21st century saw the start of the incorporation of technical aspects of AI into larger systems (Asensio et al., 2014). The primary area of interest in AI has been self-governing systems that might someday replace people in related fields. Since algorithmic-instruction theory assesses the complexity of human behavioural data, it might lead to new avenues for cognitive psychology study as well as more

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practical uses. Multidisciplinary synergistic research spanning from theoretical computer science to cognitive neuroscience and psychology forms the basis of this human-centred approach (Carbone et al., 2020).

AI is showing up in more and more games. Since the 1950s, it has been used to create non-player characters (NPCs) with responsive, interactive, intelligent behaviour patterns that mimic human intelligence. In a multi-agent situation, game theory dictates that decisions be made from a range of plausible options (Carbone et al., 2020). It was Von Newman who came up with this algorithm. This concept is applied by artificial intelligence anytime a person addresses many issues at once. Multiple people are working on a logical problem. One of the first algorithms in artificial intelligence, the Minimax algorithm is used in two-player game theory. It is quickly developing into a useful platform for producing and creating video games. Even though the gaming business is still young, games have started to exhibit improvements, such as better user experiences and more affordable prices.

Test cases are essential to the entire software testing process. In software testing, which seeks to find errors in the code before executing it, test cases are crucial to finding defects or mistakes. In the era of automated testing technologies, complex test case writing is still done by humans, with the possible exception of basic data tests, which may be generated automatically by computers (Elor & Song, 2020). Automated testing systems can only automate the output of human-prepared test cases in order to execute programmes and produce findings.

Artificial intelligence software testing will develop into a separate industry inside the IT industry. They believe AI software testing will replace tester engineers and quality assurance. Shank et al. (2019) predict that tester engineers and quality assurance teams will play a new role in monitoring and optimising AI results. Artificial intelligence will direct software testing; it will manage all facet of testing, including preparation, execution, and reporting, all without the need for human error or involvement (Cheng & Li, 2021). The software development lifecycle will be shortened and more accurate results will be produced by the AI software testing sector as compared to traditional testing methods. Because they might not be able to fulfil excessive software requirements, AI will bridge the gap and relieve this challenge by reducing the amount of time needed for testing (Roohi et al., 2018). This will assist with the issue of building software solutions to meet deadlines in particular. Artificial intelligence in the future will be equipped with tools made expressly to assess new technologies such as big data, cloud computing, and the Internet of Things. AI will produce the test data needed for a specific product as an integrator, therefore fusing new technologies will advance AI software testing. They anticipate having specialised hardware and software solutions that can execute AI deep learning as well as other AI algorithms and methods in order to acquire more accurate test results in a competitive time frame (Cheng & Li, 2021).

Artificial intelligence will also be critical in determining customer requirements, helping to better grasp which new products consumers need. We'll examine similar items and services using predictive analytics. Artificial intelligence-based software testing can increase productivity and hasten time to market for businesses producing complex software on schedule. Thanks to artificial intelligence, complex data may now be automatically analysed utilising nifty methods and algorithms. Cheng and Li (2021) predict that artificial intelligence will cover a broad spectrum of software product testing areas, including gaming, real-time critical applications, embedded solutions, database applications, mobile apps, application development, and more. The AI software testing tools of the future will be clever, adaptable, and creative. They will provide beneficiaries and end users with better results. AI algorithms and techniques may be used by businesses and organisations to improve consumer happiness, broaden their product options, elevate the quality of services provided, and stabilise software in their products. Artificial intelligence-powered predictive analytics will be essential for finding every possible test case and improving the software solutions' reliability, robustness, and customer satisfaction (Cheng & Li, 2021). Artificial intelligence disciplines such as machine learning, deep learning, natural language processing, and others are considered to be at the vanguard for most of the technologies that surround them. The promise of intelligent software test automation is highlighted, and they discuss how incorporating AI into software testing might usher in a new era of creativity and agility for the software development and testing industries (Fernández, 2012).

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In order to find software defects, artificial intelligence is used in software testing to generate more effective test cases in lieu of human testers. This leads them to believe that in order to train the AI using machine learning theory, testers would need a large amount of input and output data. In due course, the AI will be able to create test cases on its own, run tests, and evaluate test results based on predefined criteria. This will increase productivity by significantly reducing the amount of manual testing necessary (Cheng & Li, 2021).

Artificial Intelligence and Emotional Cognition

In medical psychology, human emotions can be classified into hundreds of different groups, and there is no one right method to arrange them. The four basic emotions that comprise all these complex emotions are fear, anger, sadness, and happiness, each of which has a distinct intensity. According to medical psychology, emotions need to be measured and modelled before artificial intelligence can identify them (Powell, 2019). For instance, in the emotion model presented in "an emotion-based approach to decision making and self-learning in autonomous robot control," the four emotions are melancholy, loneliness, disgust, and fear, with energy, companionship, cleanliness, and light serving as the sensory inputs. These four emotions, like the sensory inputs, have actual values between 0 and 1 (Cheng & Li, 2021). The way that emotion and sensory data interact is governed by a few basic principles.

Emotion and intellect are actually two sides of the same coin, despite their apparent differences (Cheng & Li, 2021). Emotion and cognition have really been seen as distinct and independent processes since Plato's time (Russell & Norvig, 2010). Emotion and cognition are, nonetheless, increasingly seen as linked and integrated in a growing corpus of recent research (Ertel, 2018). Several psychological investigations have demonstrated that affective states and the processing of prominent emotional cues can influence behavioural and cognitive processes. Cognitive and behavioural processes can then impact and regulate emotion (Cheng & Li, 2021). Research on the human brain has demonstrated that emotional and cognitive processes are interrelated and share a large number of overlapping regions, challenging previous theories that emotion is responsible for subcortical processing in the brain, such as the primitive limbic system, and that cognitive-related processes are primarily processed by cortex areas, such as the prefrontal cortex (Cheng & Li, 2021). Therefore, studying the connection between emotion and cognition can enhance human-computer interactions and aid in the creation of more dependable and human-like artificial intelligence.

Emotion has a profound impact on human intellect and communication. Emotions are a tool used by humans to express a vast spectrum of emotions and to react to both internal and external situations. Even while not all AI systems need to feel emotions or even human-like feelings like sadness and worry, it would be more practical and user-friendly if AI could better comprehend emotions and develop systems that reflect them (Li et al., 2018). The goal of emotion AI is to make human emotions more visible to computers and enable them to perceive, evaluate, and even express emotions in a way that is similar to that of a human (Zheng et al., 2019). Emotion AI has applications in many sectors where emotions are important (Li et al., 2018). AI in mental health care, for instance, may help psychologists' spot illnesses or symptoms that people hide or are ignorant of. In the field of education, AI teachers are used in remote or hybrid learning environments because their ability to identify and respond to their students' emotional states enhances the learning process. Furthermore, emotion AI is beginning to be used in a broad range of other areas, such as intelligent agents, communication, and entertainment (Cheng & Li, 2021). The inventive methods developed in affective computing and emotion AI to date have substantially improved our lives in a number of areas, such as home care, security, e-teaching, and emotional health.

Emotional Cognition and Artificial Intelligence in Game Testing

Software testing and game testing are nearly same from a test engineering perspective. Actually, at its core, game testing is a type of software testing. Although game testing is unique, it is similar to software testing in many ways (Powell, 2019). The need that games offer a pleasurable experience for players is the main difference between the two. This is mostly seen in the way that game sceneries, characters, and interactions are designed. As such, one of the most important aspects of game testing is evaluating player emotions and

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game enjoyment. Most game testing done nowadays consists of two types: traditional software testing and game-specific testing. When testing software for games, game test engineers need to develop test strategies, test cases, and test requirements in order to find the defects in the game features (Cheng & Li, 2021). During the game format testing phase, an experienced test engineer will use some trial data to find any issues with the game design and fix them. The purpose of any game testing is to identify software bugs and unenjoyable game elements; resolving these issues will improve the game's playability.

Reinforcement learning (RL) models offer a chance to augment current scripted and automated solutions by learning via playing the game without human aid (Cheng & Li, 2021). Modern algorithms are capable of exploring complex environments and identifying flaws in game mechanics (Shank et al., 2019). For example, modern first-person shooter (FPS) games may be roughly divided into two phases: combat (shooting, reloading, hiding, etc.) and navigation (finding targets, enemies, weapons, and health). Reinforcement learning is particularly well-suited to these games. Artificial intelligence techniques may now learn a single model of the whole game dynamic (Roohi et al., 2018).

All of the computer-generated "thinking" that a game employs to simulate human intelligence or the player's visual and mental processes is referred to as artificial intelligence in games (Elor & Song, 2020). The application of AI technology in computer game design and development has the potential to improve game play, optimise workflow, and perhaps completely transform the game creation process (Shank et al., 2019). AI may be utilised in game testing to evaluate features' performance and implementation as well as problems with character and scenario design, based on its expertise in software testing (Carbone et al., 2020).

Traditional game testing relies on the use of human game testers, game test scripts, and prior knowledge of areas of interest in order to provide useful test results. They have used Deep Reinforcement Learning (DRL) to incorporate a self-learning mechanism into the game testing framework (Cheng & Li, 2021). Using DRL, the framework may explore or exploit game dynamics based on user-defined reinforcement reward signals. The results included increased test coverage and the discovery of unexpected game dynamics, flaws, and vulnerabilities in a range of game types. This research demonstrates how DRL may be used to identify common problems with first-person shooters, locate vulnerabilities and evaluate the map's complexity, and increase test coverage (Li et al., 2018).

The sentiment perception model of AI is used to collect historical game data and assess the degree of player amusement in different situations based on player activity in different scenarios and game episodes, including top-ups, game length, and motivation. After that, in order to evaluate player emotion in games, this model is put to the test on a variety of scenarios, levels, game episodes, etc. This will assess the emotional and entertainment deficiencies of the players in the game and help predict the players' feelings in the different stages, scenarios, and plots. Additionally, it will provide the developers with trustworthy data to assist them in addressing the game's lack of amusement.

Summary of the Findings

Games development, software testing, and emotional awareness are the three sectors that are now utilising artificial intelligence techniques to improve efficiency and accuracy. Currently, the main methods for evaluating player satisfaction and game mood are remarket research and internal testing data. The risk of game information leakage exists with these technologies, which are costly in terms of manpower and resources. This work examines the state of artificial intelligence in software testing, game creation, and emotion perception based on experience with these three fields. Additionally, it demonstrates how feasible it is to forecast player emotions in game testing with AI methods. AI testing reduces manpower and material expenses for testing while guaranteeing total game confidentiality before release. Additionally, by lessening the impact of human subjective factors, it increases test accuracy.

Conclusion

Artificial intelligence has been widely applied in the video game industry for a long time. Despite the criticism, generative AI is a new tool for game creators to have in their toolkit because it is expected to

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revolutionise the market. Machine learning, computer vision, and other AI technologies enhance in-game NPC behaviour and offer more varied gaming environments. Gamers can play multiplayer games with these NPCs if they'd rather not wait for other human players. Here, the machine learning technologies study the player's previous techniques and talents and modify gaming to match their approaches. With the widespread usage of voice chat, which allows for real-time communication between players in online games, natural language processing techniques are becoming more and more significant. The use of AI in game testing and quality assurance has ushered in a new era for the gaming industry. As we explore the potential of technologies like generative artificial intelligence, we could expect more innovative and captivating gaming experiences. In the future, artificial intelligence will power video games by enhancing emotional cognition in game testing for quality assurance.

Generative AI will be very beneficial to the gaming industry since it will enable them to create personalised content for their players. Large corporations will invest more in AI solutions based on natural language prompts than in complex programming. The significant resource needs involved in creating and integrating 3D models into video games provide another significant challenge for the industry. Therefore, using generative AI may save time and resources. It will expedite the production of game prototypes and decrease the testing duration. In a similar vein, programmers use generative models, like NVIDIA's Get3D aid, to create 3D models from text prompts. OpenAI's Point-E tool generates 3D point clouds instantly and is easy to include into 3D work environments.

References

Alam, A. (2022, April). A digital game based learning approach for effective curriculum transaction for teaching-learning of artificial intelligence and machine learning. In 2022 International Conference on Sustainable Computing and Data Communication Systems (ICSCDS) (pp. 69-74). IEEE.

Asensio, J. M. L., Peralta, J., Arrabales, R., Bedia, M. G., Cortez, P., & Peña, A. L. (2014). Artificial intelligence approaches for the generation and assessment of believable human-like behaviour in virtual characters. Expert Systems with Applications, 41(16), 7281-7290.

Carbone, J. N., Crowder, J., & Carbone, R. A. (2020, December). Radically Simplifying Game Engines: AI Emotions & Game Self-Evolution. In 2020 International Conference on Computational Science and Computational Intelligence (CSCI) (pp. 464-472). IEEE.

Cheng, J. H., & Li, J. Q. (2021). Game testing based on artificial intelligence emotional cognition. In Advances in Materials Science and Engineering (pp. 704-709). CRC Press.

Elor, A., & Song, A. (2020, November). isam: Personalizing an artificial intelligence model for emotion with pleasure-arousal-dominance in immersive virtual reality. In 2020 15th IEEE International Conference on Automatic Face and Gesture Recognition (FG 2020) (pp. 572-576). IEEE.

Ertel, W. (2018). Introduction to artificial intelligence. Springer.

Fernández, E. M. (2012). A Psychoanalyst Artificial Intelligence Model in a Computer Game (Doctoral dissertation, Universitat Politècnica de Catalunya. Escola Tècnica Superior d'Enginyeria de Telecomunicació de Barcelona. Departament de Teoria del Senyal i Comunicacions, 2012 (Enginyeria Electrònica))

Li, L., Lin, Y. L., Zheng, N. N., Wang, F. Y., Liu, Y., Cao, D., ... & Huang, W. L. (2018). Artificial intelligence test: A case study of intelligent vehicles. Artificial Intelligence Review, 50, 441-465.

Perez-Liebana, D., Liu, J., Khalifa, A., Gaina, R. D., Togelius, J., & Lucas, S. M. (2019). General video game ai: A multitrack framework for evaluating agents, games, and content generation algorithms. IEEE Transactions on Games, 11(3), 195-214.

Powell, J. (2019). Trust Me, I'ma chatbot: how artificial intelligence in health care fails the turing test. Journal of medical Internet research, 21(10), e16222.

Roohi, S. (2022). Advances in AI-assisted Game Testing.

Roohi, S., Takatalo, J., Guckelsberger, C., & Hämäläinen, P. (2018, April). Review of intrinsic motivation in simulation-based game testing. In Proceedings of the 2018 chi conference on human factors in computing systems (pp. 1-13).

Russell, S. J., & Norvig, P. (2010). Artificial intelligence a modern approach. London.

Shank, D. B., Graves, C., Gott, A., Gamez, P., & Rodriguez, S. (2019). Feeling our way to machine minds: People's emotions when perceiving mind in artificial intelligence. Computers in Human Behavior, 98, 256-266.

Yannakakis, G. N., & Togelius, J. (2018). Artificial intelligence and games (Vol. 2, pp. 2475-1502). New York: Springer.

Zheng, Y., Xie, X., Su, T., Ma, L., Hao, J., Meng, Z., ... & Fan, C. (2019, November). Wuji: Automatic online combat game testing using evolutionary deep reinforcement learning. In 2019 34th IEEE/ACM International Conference on Automated Software Engineering (ASE) (pp. 772-784). IEEE.