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ARTIFICIAL INTELLIGENCE IN VIDEO GAMES: STATE OF THE ART AND FUTURE POTENTIAL

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Abstract:

Since the beginnings of video games as a creative medium over seven decades ago, artificial intelligence (AI) has played an integral role. However, this form of AI differs significantly from what the general public perceives it to be, as well as from standard definitions found in relevant academic disciplines like data science and machine learning. Recent advancements in these areas—such as the rise of large-scale language models and generative algorithms—have led to convergence between these distinct understandings. As a result, novel possibilities for innovation and creativity emerge in the realm of interactive media. The present article explores the current state-of-the-art and near-future developments in AI-driven gaming technologies. It also addresses key questions: How did video game AI evolve prior to the advent of machine learning? Can newer forms of AI, including machine learning and generative systems, supplant traditional approaches, or will they complement them instead? Do each type have specific uses that set them apart? Finally, what broader implications do these evolving methodologies hold for interactive entertainment moving forward?

Keywords: video games, interactive media, interactive storytelling, AI

Introduction

The evolution of video games and computer science has been closely interconnected throughout history. Advances in computing technology enabled the creation of increasingly sophisticated video games, which required substantial computational resources. These demands drove improvements in graphic capabilities and processor performance, leading to the expansion of consumer markets. Newer algorithms optimized for complex but efficient physical simulations rapidly became widely implemented, giving rise to modern features such as real-time ray tracing and interactive object-based environments.

In recent years, rapid advancements in artificial intelligence (AI) have brought cutting-edge machine learning techniques into mainstream use, accessible not only to major studios but also small independent developers. This accessibility raises intriguing questions about the role AI might assume in shaping the future landscape of video games. Our investigation seeks to analyze the contemporary state of AI in gaming, delve into the connections between AI in this domain and its parent discipline, and cautiously forecast its short-term trajectory based on a thorough examination of existing technical strengths and constraints.

1. Definition of "AI" in Video Games

To comprehensively discuss the current state and future directions of artificial intelligence (AI) in interactive media, it is essential to define AI within the context of both data science and video game development. Specifically, we must clarify historical conceptions of AI among game designers, its current functional roles, and how these align with broader technological and research perspectives sharing the same terminology.

Within the domains of computer science, data science, and particularly AI-focused research, the term "artificial intelligence" encompasses multiple meanings depending on usage and operational principles. From a rigorous mathematical perspective, AI represents a universal function approximator: a mathematical algorithm, frequently grounded in machine learning, capable of emulating any unknown mathematical function provided with sufficient resources and training samples. According to the Universal Approximation Theorem (Hornik, Stinchcombe & White, 1989), this capability underpins two broad categories of AI: generative AI, known today for generating high-quality media outputs comparable to human-produced content, and analytical AI, utilized extensively for predicting intricate phenomena ranging from meteorology to financial market fluctuations.

Conversely, within the video game industry, AI has historically signified something entirely different. Until recently, it primarily denoted an autonomous agent (Aelbrecht et al., 2023)—an entity within the game's virtual environment governed by an internal algorithm and interacting dynamically with the game world and players. Such agents usually manifest visually through 3D models or sprites (two-dimensional images), navigate freely within the game space, and execute generalized behaviors unbound to particular locations or sequences. Unlike the abstract approximations prevalent in data science, video game AI traditionally lacked reliance on machine learning or adaptability, instead relying on static predetermined rules and simple conditional logic for virtual character operations.

2. Functional Types of AI in Video Games

Artificial intelligence (AI) has been subject to widespread speculation and uncertainty regarding its potential and capabilities. To evaluate its true value accurately, it is necessary to define the precise functions it performs within video games. While all share similar foundational principles, traditional "static" AI systems vary considerably in the roles they undertake, each requiring different levels of behavioral complexity, autonomy, and adaptability. Because these systems depend heavily on developers who manually construct, test, and refine their behavioral models, their functionality and sophistication from the player's perspective are inherently limited.

Modern trainable or "dynamic" AI systems, on the contrary, possess the ability to learn and perform a wide spectrum of complex tasks independently. Without needing extensive human involvement, they can handle diverse scenarios, expanding the horizons of what's achievable in comparison to rigid, predefined algorithms. However, dynamic agents come with their own set of limitations rooted in the architecture and training procedures employed in today's machine learning technologies.

To delineate the boundaries of dynamic AI's applicability and develop a clearer vision of its prospective impact on the gaming industry, we must begin by defining the predominant functions and behavioral models currently served by traditional algorithms, alongside their respective limitations.

Passive Mobs

Static AI algorithms are often associated with mobile entities in virtual reality games, sharing the same spatial plane as players. These entities include animals, machinery, vehicles, and sprites. Their behavior often mimics randomness, simulating natural movements such as grazing or roaming. Their interactions with in-game objects are typically minimally scripted. In simulation-heavy genres like survival games, sandbox experiences, or evolutionary simulators, procedural mechanics are tied to environmental factors. This includes activities such as hunting prey, evading predators, or gathering food. While these interactions may seem complex, they are essentially structured around primitive trigger mechanisms. For example, a creature might graze, hunt, flee, or hide, changing states based on timers, proximity to the player, or availability of food. This simplification is necessary to ensure predictable reactions, as these algorithms struggle to handle scenarios outside the designer's intent, leading to inconsistent or faulty responses when faced with anomalies. Examples include a fish swimming endlessly toward a barrier blocking its path to food, a physics-based robot trying to walk while incapacitated, or a racing car continuously revving its engine while stuck in a ditch.

Enemies

Comparable to passive mobs, enemy AI differs in its responsiveness to player actions and frequent competition within the same mechanical framework. Behavioral requirements differ greatly depending on the game genre. For example, titles centered around defeating waves of mindless creatures demand little more than pathfinding algorithms, while strategic fighters call for highly evolved opponents capable of competing evenly with humans using balanced skills and vulnerabilities. Restrictions imposed by static algorithms limit the diversity of confrontations experienced by players. Instead, the observed behavior results from a calculated mix of advantages and disadvantages crafted by developers to offset the superior problem-solving abilities and exploitation tactics employed by human players. Sophisticated enemy AI in close-combat games might feature artificially reduced reaction times or immunity to environmental obstacles, while police cars in pursuit can instantaneously recover from crashes but avoid ramming players head-on.

Companions

Functionally analogous to enemies in offensive capabilities and mobs in segmented behaviors, companions represent subordinate virtual agents responding to player directives. They change modes of operation upon receiving commands and execute basic actions, such as following the protagonist or reaching specified destinations. Cognitive faculties of these assistants are deliberately confined, relegating higher-level decision-making responsibilities to the player. This arrangement enables developers to focus on enriching the surrounding environment rather than enhancing individual agent intelligence.

Understanding these categorical distinctions reveals that the principal constraint—lack of adaptability and subsequent behavioral simplicity—is perfectly aligned with the introduction of dynamic algorithms tailored for resolving open-ended, unpredictable challenges. Before exploring potential benefits of dynamic AI within traditional gaming contexts, it is vital to examine the inner workings of machine learning and highlight its intrinsic barriers.

3. Principles of Operation and Limitations of Trainable Algorithms

Modern AI systems can generally be divided into two broad categories based on their mode of operation: unsupervised and supervised learning, as broadly outlined by Gillis (2023). This distinction proves critical when analyzing not only technical aspects but also legal challenges facing AI in game development. Both types act as "function approximators": algorithms that iteratively refine their outputs through trial-and-error processes to approximate a target function they are intended to replicate. Consider, for instance, generative AI—recently highlighted by cases like AI-generated imagery (Roose, 2022)—which attempts to produce media content. Whether dealing with mathematical equations or artistic creations, these algorithms approach problems similarly: they strive to reproduce desired outputs.

Supervised learning, characteristic of most generative AIs, involves presenting the AI with a challenge accompanied by a known solution. Training datasets provide abundant examples of successful outputs (e.g., paintings). Here, the objective is twofold: enable the AI to replicate familiar examples and infer generalizable rules to generate derivative works. Its greatest asset is simultaneously its largest drawback: although adept at mimicry when ample training data exists, supervised AI struggles profoundly when tackling unfamiliar tasks beyond its area of specialization. It lacks the capacity to conceptualize or invent novel ideas absent direct exposure to exemplars.

Unsupervised learning diverges from this paradigm, introducing distinct advantages and trade-offs. In this scenario, the desired outcome remains unspecified or altogether unknown. Unsupervised AIs excel in control tasks, such as optimizing robotic locomotion. Writing an explicit control algorithm for a multi-jointed walking robot entails considering hundreds or thousands of variables and programmed behaviors. Alternatively, developers delegate this complexity to an AI, which learns incrementally through iterative trials. By focusing on beneficial adjustments, the AI systematically improves its performance over successive iterations. However, as noted by Prince-Tritto and Ponce (2024), the exponential increase in complexity poses a significant hurdle. Each additional variable amplifies the challenge of identifying optimal solutions, imposing steep demands on neural network architectures, computational resources, and time investment. Addressing overly complex problems may necessitate simplifying objectives or reconfiguring the learning setup to prevent failure or inadequate solutions.

Both supervised and unsupervised AIs encounter difficulties when managing secondary attributes of their outputs. Producing artwork or mastering motor control falls relatively straightforwardly within their purview. Yet, specifying nuanced details—forcing the AI to render a portrait depicting exactly two arms and two legs in a prescribed posture, or compelling a robot to maintain proper alignment while executing a maneuver—demands painstaking refinement of both the task and the neural network's learning parameters. Consequently, training sessions involve exhaustive preprocessing, with finalized versions undergoing rigorous testing and optimization. Once deployed, these AIs lose their ability to learn dynamically during runtime, necessitating periodic updates and retraining cycles whenever modifications or additions arise.

4. State of the Art of Artificial Intelligence as a Precursor to Video Game AI

Over the past decades, AI and specifically machine learning remained largely marginalized, reserved for research-focused and specialized areas of software development. Nevertheless, several key advancements propelled the field into the limelight, attracting intense media coverage and public fascination. These advancements not only demonstrated AI's enhanced proficiency in handling diverse tasks but also produced visually stunning proofs of concept that resonated strongly with the general public. Among these were AI-generated media—spanning text, images, voices, animations—as well as intelligent personal assistants capable of interpreting and replying to spoken commands fluently. Machine learning also facilitated groundbreaking scientific discoveries, including protein folding simulations and biologically inspired structural engineering.

Technically speaking, these breakthroughs rest on three pivotal discoveries in the realm of machine learning:

1. **Deep Learning**: Introduced by researchers like Sarker (2021), this technique equips neural networks with the ability to construct hierarchically organized relationships and uncover patterns mirroring how biological brains process sensory input.
2. **Large Language Models**: As illustrated by studies such as Minaee et al. (2024), these AI architectures generate coherent and context-sensitive responses by drawing insights from immense datasets encoding human-like linguistic patterns.
3. **Actor-Critic Methods**: Developed by Lillicrap et al. (2015), these unsupervised learning strategies allow neural networks to acquire competency in continuous-output control tasks through iterative trial-and-error processes. Unlike simpler classification tasks, these methods support incremental adjustments, enabling smooth progression towards goals—like adjusting acceleration force rather than merely switching between discrete states.

It is worth noting that the third item on this list—actor-critic methods—receives scant mention in mainstream media. Public discussion tends to gravitate toward sensationalized themes such as AI-generating content, intellectual property disputes, debates on the validity of AI-created art, and fears of unemployment in creative industries. Moreover, up until recently, most applications of unsupervised learning were concentrated on pragmatic back-end processes, serving as auxiliary tools for designing and training advanced robotic systems. These include anthropomorphic and animal-like robots exhibiting fluid, reactive movements paired with sophisticated self-correction mechanisms and robust pathfinding algorithms.

Within the sphere of video games and interactive media, such algorithms primarily manifested in prototype projects or experimental sandbox environments. These setups permitted users to teach basic 2D virtual models to move, walk, or accomplish simple tasks like picking up objects. Although rarely considered true games, these prototypes acted more as instructional tools promoting education in data science or scientific communication.

Notwithstanding the limited visibility of actor-critic methods, supervised learning has seen somewhat broader adoption within the gaming sector. Text-based interactive narratives driven by AI—acting as virtual narrators—are becoming increasingly prominent. Players contribute prompts, and the AI generates corresponding storylines. Input formats span brief instructions, detailed descriptions, or comprehensive paragraphs. Some enthusiasts even embrace these experiences as collaborative writing ventures.

5. Potential of Trainable AI in Game Development

Summarizing the preceding sections, classical static algorithms in games necessitate enormous effort and meticulous planning to achieve rich, adaptive dynamics and versatile narratives responsive to player choices. These algorithms risk catastrophic malfunctions in unpredictable scenarios, mandating extreme caution to prevent disastrous bugs. Efforts to introduce complex worlds incorporating dynamic storytelling or realistic NPCs often stumble, as exponential growth in development time clashes with impending deadlines, leaving incomplete or compromised features intact. Conversely, dynamic or trainable AI appears to mitigate these challenges. These systems can efficiently address intricate problems and demonstrate adaptability to varied circumstances. However, they entail training costs and compute-intensive operations, rendering them less trustworthy in unfamiliar terrains, albeit demonstrating graceful recovery mechanisms when encountering errors.

Consider, for instance, a walking robot tripped by slick surfaces—it exhibits a human-like tumble followed by deliberate efforts to regain equilibrium. Such realistic failures pale in comparison to static AI agents, which persistently ram into walls for extended periods before resetting abruptly.

We must again distinguish between supervised and unsupervised learning modalities. Unsupervised algorithms learn directly from environmental feedback, assuming control of NPCs to orchestrate seamless interactions with game physics. Imagine scenarios where bosses collapse dramatically under player attacks, transforming momentarily staged cutscenes into emergent gameplay opportunities.

Or envision predatory wildlife tracking prey purely through sensory cues, disregarding cheats embedded in game code. Vehicles, too, might adopt sophisticated maneuvers during pursuits, while enemies strategically utilize cover and coordinate tactical maneuvers in concert with teammates.

Theoretically, universally applicable AI agents capable of executing disparate tasks across diverse contexts have been postulated (Farr, 1999). Dubbed "metagame players," these algorithms promise exceptional scalability but face severe practical impediments, surpassed in efficiency by custom-built counterparts whose finetuning consumes disproportionate effort.

Supervised learning introduces another dimension, notably enhancing narrative-rich games. Envision NPC dialogues powered by Large Language Models (LLMs), yielding nuanced conversations contingent on myriad variables: prior player actions, conversational histories, attire, reputations, and interpersonal dynamics. Beyond mere scripted exchanges, such AIs could deliver nearly infinite permutations of dialogue, perhaps even parsing player utterances via speech recognition. Extending this concept, AI-controlled avatars could populate massively multiplayer online games, augmenting player populations during peak events or bolstering immersion by consistently adhering to assigned personas.

Although feasible in theory, practical implementation remains sparse. Despite substantial strides and adequate elapsed time since landmark AI advancements, AI remains largely confined to background utilities, such as graphics optimization, in commercial games. Meanwhile, adjacent industries, like mobile assistants and generative tools, eagerly embrace AI frontends. What accounts for this discrepancy?

6. Limitations of Trainable AI in Game Development Applications

The tech industry and gaming sector have maintained a mutually beneficial partnership. Growth in consumer demand fueled advancements in computer hardware, improving computational power across sectors, exemplified by the utilization of graphics cards originally developed for realistic in-game lighting, now instrumental in machine learning applications. Thus, given such fertile grounds for synergy, why has AI struggled to penetrate video games meaningfully, particularly in user-experience dimensions?

To unpack this question and anticipate whether the current landscape will shift substantially in the foreseeable future, we must differentiate between supervised and unsupervised learning paradigms:

For supervised learning models—media generators and natural-language processors—their underrepresentation in games largely reflects a dearth of compelling use cases and deficiencies in sporadic implementations. As Burke (2023) highlights, while these AIs can improvise dynamically and adapt to player input, they are prone to generating inaccuracies, irrelevance, or bizarre extrapolations from ambiguous prompts. For instance, an LLM might acquiesce a player's assertion of vanquishing a powerful villain with a single blow, destabilizing narrative coherence. Integrating such models therefore necessitates intensive developer supervision, eroding cost-efficiency and compromising the scale advantage of constructing boundless virtual worlds. Further compounding the issue, these AIs tend to favor safe, formulaic outputs, diluting the emotional resonance and uniqueness essential for engaging dialogue. Consequently, their suitability for narrative-centric roles is severely constrained.

Interactive storytelling games employ LLMs, such as AI Dungeon, showcase these pitfalls vividly. While entertaining, their narratives often devolve into vapid, meandering sequences punctuated by humorously absurd moments born from misinterpretation of player inputs. Hence, LLMs' viability is currently limited to ancillary NPC roles, enhancing mundane dialogue with minimal narrative significance. However, even this modest contribution risks losing novelty swiftly and engendering fresh complications. As Totilo (2024) notes, implementing sophisticated dialogue-based interactions reliant on cloud infrastructure incurs escalating expenses, posing financial strain for enduring game projects.

Another class of supervised learning involves generative AIs specializing in visual media production, such as illustrations and animations. As Salian (2021) illustrates, these technologies have already been applied to generate game assets, e.g., background textures, skyboxes, and landscapes. These implementations offer marginal advantages over repetitive texture generation—imagine every street corner displaying the same shop facade. However, they represent mere technical enhancements, saving human labor but contributing negligible innovation to the medium. Generating animal models procedurally, for instance, yields improvements over crude static algorithms combining random body parts. Still, the root issue persists: while differing superficially, these outputs retain a uniform aesthetic identity. Ultimately, AI-generated outputs reflect the specificity of their input prompts, which parallels feeding seeds into static algorithms. As emphasized by Tshilidzi (2024), a significant obstacle hindering AI's maximal utilization lies in its declining effectiveness when addressing increasingly granular requests. Although capable of producing impressive, intricate outputs, tailoring these precisely to specific criteria constitutes a distinct skill, occasionally proving insurmountable. Amidst rising cultural saturation, distinguishing AI-generated media from human creations grows ever easier, marked by their uniquely generic stylistic traits.

Unsupervised learning, meanwhile, compounds complexity as tasks grow more intricate. Currently, one of the most celebrated instances of an AI achieving metagame-level efficacy is Badia et al.'s (2020) project from Google DeepMind. Like comparable initiatives, it restricts its scope to Atari games due to their comparative simplicity and consistency. Studies by Mnih et al. (2015), van Hasselt et al. (2015), and Wang et al. (2015) trace back to the surge in reinforcement learning circa 2015–2016. Subsequent advancements have plateaued, underscoring the gap between theoretical ambitions and practical constraints. Metagame-level players fail to translate effectively into control tasks outside the Atari suite, struggling with protracted, layered, or temporally dense/sparse challenges pervasive in gaming genres demanding split-second reflexes and decision-making.

Mirroring supervised learning, this field has witnessed substantial strides. Current AIs can master isolated tasks—walking, grasping objects, piloting vehicles—but coordinating multiple simultaneous actions remains prohibitive. Scaling these feats necessitates carefully calibrated training regimes and environments, requiring expertise often beyond the reach of smaller studios lacking dedicated specialist teams. Even with expert guidance, the effort invested frequently exceeds traditional alternatives, such as static algorithms or non-mechanical animations. Beyond niche AI-dominated games like evolution simulators or artificial-life sandboxes, these algorithms presently fail to deliver the depth and variability expected of virtual-world denizens.

7. Ethical and Legal Challenges Facing AI in Game Development

Artificial Intelligence has come under increasing criticism as numerous technologies in the field have raised concerns about harming the creative community. As Manh-Toan outlines in his 2024 article titled “Regulating Generative AIs: (Re)Defining Video Games as Cultural Products,” machine learning algorithms frequently employ databases for training or harvest information indiscriminately from the web. These datasets often contain unauthorized or stolen artistic works. Even when blanket permissions exist, using them to train AI effectively amounts to plagiarism. According to Manh-Toan's analysis, widespread adoption of these technologies risks contaminating the video game industry with subpar, derivative content. Developers might resort to AI-generated materials—scripts, narratives, character models, concept art—to expedite production.

This phenomenon, however, is neither unprecedented nor exclusive to AI. The video game industry has long grappled with plagiarism and low-effort releases. Browsing platforms like Steam reveals countless titles featuring appropriated graphics sourced from readily available templates. While these games proliferate, platforms implement measures to minimize their negative impact on ecosystems. Repetition and generic content have also characterized open-world games since their inception, and procedural generation techniques predate modern generative AI. Nevertheless, we acknowledge

Manh-Toan's argument that generative algorithms exacerbate these issues, introducing unique ethical dilemmas related to plagiarism. Generative AI inherently violates ethics unless express consent is obtained from original creators.

We posit that, parallel to procedural generation, generative algorithms will fill similar technological gaps but remain constrained by inherent limitations. Their applications will likely remain confined to generating landscapes, textures, crowd elements, radio chatter—repetitive elements cumbersome to create en masse. Instead of supplanting human-generated content with AI-derived copies, AI will likely emerge as an adjunct method for procedural generation, albeit with attendant ethical reservations.

Ethical considerations may morph into legal constraints. As per Shumakova et al. (2023), several legislative proposals aim to regulate generative AI to safeguard artists' intellectual property rights. Existing AI tools and training databases could consequently become legally suspect or impermissible. This creates substantial risks for creators aiming for sustained relevance, potentially exposing them to prolonged litigation threats (Walsh, 2023).

8. Possible Solutions to Making AI a Generally Viable Tool in Game Development

Beyond the aforementioned low-end applications, such as landscape or background generation, for AI to become a genuinely useful tool for artistic expression in interactive media, it must undergo substantial enhancements in both performance and organizational complexity. More advanced methodologies that incorporate neural networks as modular components within larger dynamic systems are needed. For instance, coupling AI-generated virtual animal models with unsupervised learning algorithms accounting for anatomical characteristics (e.g., mouth shapes indicating carnivorous versus herbivorous diets) and other physically determined parameters could yield sufficiently synergistic results. However, these hypothetical models would still necessitate training for each new unique configuration, highlighting the urgent need for improved computational power and reduced training timelines. Real-time adaptation to player actions and speech remains a daunting challenge, as most consumer-grade AI products rely on pretrained models hosted remotely in the cloud.

Specifically targeting interactive storytelling and the use of AI as a narrator, a radical transformation in operational principles is essential to match the standards of human-authored narratives. Instead of replicating human-made media by predicting plausible next steps, such AIs should transcend these limitations: they must improvise, envision novel plot developments, and interpret layers of complexity—all of which hinge on a deeper comprehension of their own output. Essentially, they must exhibit artistic expression. Although seemingly implausible, this goal is technically attainable. Pairing generative models with unsupervised learning and assigning AI the task of crafting surprising, meaningful narratives while educating it on storytelling fundamentals—including themes, subtexts, and dramatic irony—could theoretically foster a creative process akin to that experienced by human writers. This mirrors the aspirations of storytellers: to delight and engage audiences while cultivating a signature style and conveying a distinctive message.

Conclusion

Artificial intelligence has achieved remarkable strides in recent years, enabling the production of media with unique advantages over human artists, namely speed, complexity, and sheer quantity. These advantages carve out specific, albeit limited, roles for AI as a developmental tool. In video game development, AI surpasses static algorithms in tasks like procedural generation but offers little else beyond marginal improvements. While capable of enhancing procedural outcomes, AI fails to unlock previously unfeasible opportunities to the extent demanded by industry expectations. Progress in AI must address critical challenges: organizational complexity, self-sufficiency, and authentic artistic expression. Nevertheless, specific niches—interactive storytelling, ecosystem simulations, and sandbox environments—stand to gain significantly from even current AI capabilities, promising increased diversity and technical sophistication in forthcoming iterations.

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ИСКУССТВЕННЫЙ ИНТЕЛЛЕКТ В ВИДЕОИГРАХ: СОВРЕМЕННОЕ СОСТОЯНИЕ И БУДУЩИЙ ПОТЕНЦИАЛ

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Аннотация:

С момента появления видеоигр как средства творчества более семи десятилетий назад искусственный интеллект (ИИ) играл важную роль. Однако эта форма искусственного интеллекта существенно отличается от того, как ее воспринимает широкая общественность, а также от стандартных определений, найденных в соответствующих академических дисциплинах, таких как наука о данных и машинное обучение. Недавние достижения в этих областях, такие как появление крупномасштабных языковых моделей и генеративных алгоритмов, привели к сближению этих различных понятий. В результате в сфере интерактивных медиа появляются новые возможности для инноваций и творчества. В настоящей статье рассматриваются современные разработки в области игровых технологий, управляемых искусственным интеллектом, и перспективы на ближайшее будущее. В ней также рассматриваются ключевые вопросы: Как развивался искусственный интеллект в видеоиграх до появления машинного обучения? Могут ли новые формы искусственного интеллекта, включая машинное обучение и генеративные системы, вытеснить традиционные подходы или же они будут дополнять их? Есть ли у каждого типа специфические области применения, которые отличают их друг от друга? Наконец, какие более широкие последствия имеют эти развивающиеся методологии для продвижения интерактивных развлечений в будущем?

Ключевые слова: видеоигры, интерактивные медиа, интерактивный сторителлинг, ИИ