Q3 2024

GenAI in Gaming Industry Report

HARTMANN
METAVERSE VENTURES

Contents

Welcome to the first edition of the AI in Gaming Industry Report. In this report, we'll dive into the latest developments and news, including:

- The most recent announcements and breakthroughs.
- Notable fundraising rounds and investments in AI gaming startups.
- Summaries of cutting-edge academic papers and industry studies.

For this quarter's feature story, we look at the emerging trend of AI co-pilot for developers. From GitHub Copilot to Anysphere's Cursor, these AI-powered assistants are changing how games are coded.

Whatever your role—a game developer, an industry executive, an investor, or a casual observer eager to get a handle on what the future of gaming might look like in the context of AI—this report is designed to serve as your quick and up-to-date briefing.

Daniel Derzic

Analyst, Hartmann Metaverse Ventures

In The News

July

-Xbox's AI Gaming GM predicts AI adoption will significantly improve games.

-WPP partners with NVIDIA to create generative 3D worlds.

-Duolingo launches new AI features, including Adventures mini-games and Video Calls.

-Electronic Arts has over 100 active AI projects in development. The CEO is enthusiastic about generative AI's potential.

-Bourne Digital releases "Square Enix AI" book detailing AI use in game development.

-Activision Blizzard incorporates AI in game creation and sells AI-generated microtransactions. They've also released the Call of Duty: Warzone Caldera dataset for academic use.

-Nintendo's president states that the company has no plans to use generative AI in its games.

-Nintendo's president states that the company has no plans to use generative AI in its games.

-AI games developer Series Entertainment acquires Pixelberry Games for an undisclosed amount.

-Sloyd now offers real-time text-to-3D capabilities.

-Naklecha released factorio-automation-v1 on X.

August

-Activision released the Call of Duty: Warzone Caldera data set for academic use.

-PETA releases VR AI game When They Came For Us.

-NeoFables released AI-generated VR storytelling in Quest Web Browser.

-Palworld studio CEO wants to keep "a healthy distance from technological advancements".

-Stability AI releases fast 3D asset generation model.

-Amazon Games CEO said that the game industry needs AI to speed up the development workflow and cut out the dull parts of game development.

-Exists launched platform to create 3D games from text prompts.

-PS5 Pro AI upscaling & game boost can improve over 8,000 games.

-Nvidia ACE will debut in 2025's Mecha Break.

-Zibra AI unveils ZibraVDB, an AI-powered tool compressing OpenVDB files up to 100 times.

-nunu.ai agent May beat the Pokemon Emerald record.

September

-Tencent unveiled GameGen-O, the first diffusion transformer model to generate open-world video games.

-Roblox announced an open-source AI tool for creating 3D environments.

-Altera introduced Project Sid, simulating over 1000 truly autonomous agents.

-Winking Studios launched GenMotion.AI, an application for creating high-quality animations using text prompts.

-The voice actor for Mass Effect's Shepard, expressed concerns about AI in gaming.

-Kinetix launched a $1M AI-UGC Fund and won Pocket Gamer's Best AI Games Tech Award 2024.

-Street Fighter 6 introduced AI rivals that mimic players' fighting styles using match data.

-SAG-AFTRA signed an interim agreement with 80 games to ensure AI protections.

-Nintendo's Shigeru Miyamoto reaffirmed the company's commitment to originality, stating they won't use AI.

-Krafton announced that InZOI will only use its own assets or copyright-free material for its AI.

-Sony plans to use AI to enhance game production quality while reducing time and costs.

-NCSoft aims to release a new game featuring AI-powered characters in 2025.

Investments

	Company	Raised	Investors
July	BITMAGIC	$4M	Korea Investment Partners Co., Ltd. · SUPERCELL · SSV GAME VENTURES
	VOLLEY	$55M	Alumni Ventures · Lightspeed · alexa fund · ADVANCIT · WAVERLEY CAPITAL · BITKRAFT · boostVC · Gaingels · Y Combinator · CATALYST · CAUSEWAY · M12 · Riverside Ventures
	Omnic.AI	$1.1M	Unpopular Ventures · the mini fund · EX VENTURES
	ICONIC	$4M	Deepwater Asset Management · FOV VENTURES · HodlCo · Interface
	X&Immersion	$1.1M	Clint CAPITAL
	grand	$3M	EARLYBIRD | DIGITAL EAST · LATUN
	ECHO CHUNK	$1.4M	A16Z GAMES / speedrun
	Artificial Agency	$16M	FlyingFish · bdc · KAYA · TOYOTA VENTURES · RADICAL VENTURES · TIRTA
	CLOUT KITCHEN	$4.45M	A16Z GAMES / speedrun · peak xv · AppWorks · ANTLER · hustle fund · FOUNDERS LAUNCHPAD · ORVEL
August	nuno.ai	$2M	A16Z GAMES / speedrun · Y Combinator · boostVC
	REFORGED LABS	$3.9M	dcm · Y Combinator · epakon capital · Goodwater · PHOENIX · ASYMMETRY
	FRVR	$12.7M	Iberis CAPITAL · INDICO · LINCE Capital · HIRO CAPITAL
	PENTAGON GAMES	$6M	animoca brands · BINANCE LABS · HYPEREDGE CAPITAL · NfX · polygon · Republic · SPARTAN · TESS VENTURES · YIELD GUILD GAMES
September	Crackle	$1.7M	WonderCircle · AC Ventures · SUNICON · VC · Misfits
	campfire	$4M	FundersClub · Y Combinator
	World Labs	$230M	andreessen horowitz · NEA · RADICAL VENTURES · Adobe Ventures · AMD · databricks · NVentures · Salesforce Ventures · Shinrai Investments
	qodo	$40M	VINE VENTURES · tlv partners · SUSA VENTURES · Square Peg · ICON · FIRESTREAK
	SERIES	$28M	NETFLIX · DELL Technologies CAPITAL · andreessen horowitz · BITKRAFT · F4 Fund

All of these startups raised $415.1 million this quarter, with World Labs ($230 million), Volley ($55 million), and Qodo ($40 million) leading the way. Investments support companies developing AI-driven game creation tools, social gaming platforms, narrative generation systems, and AI-enhanced game distribution channels.

The Latest Research

The GameNGen Doom project, a groundbreaking AI engine that allows neural networks to simulate playable video games, was probably the most talked-about story this quarter.

The AI imitates games like Doom with such accuracy that it is nearly impossible to distinguish between authentic gameplay and simulation, thanks to diffusion-based models similar to those used in image generation. However, the project still faces several challenges, including high computational requirements and the need for large amounts of training data. Despite these challenges, it demonstrates AI's growing ability to understand and reproduce complex game mechanics and visuals.

Researchers presented VIDEOGAMEBUNNY, a specialized AI model for understanding game content.

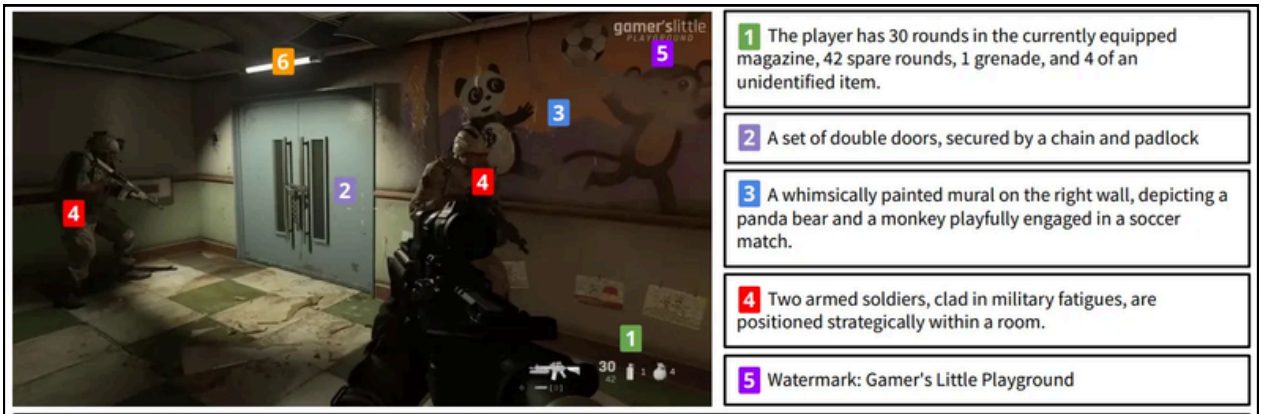


Figure 5. Sample information extracted for the image-to-JSON dataset by Gemini-1.5-Pro. Each sample contains detailed information ranging from minor details to high-level descriptions, such as: 1 player inventory, 2 3 details about the environment, 4 non-player characters, 5 the screenshot's watermark, and 6 lighting.

Trained on a diverse dataset of over 185,000 images from 413 games, this model outperforms larger, general-purpose AIs in game-specific tasks such as identifying game elements, understanding mechanics, and spotting glitches.

To bridge the gap between AI understanding and player interaction, Rao et al. studied the dynamics of human players collaborating with AI-powered non-player characters (NPCs) in a custom Minecraft game.

Figure 1: Key steps of the collaborative quest: a) talk to Elena (left image); b) build path to island (center image); c) help Alaric (right image)

Using GPT-4 for natural interactions, the study found promising potential for engaging gameplay and mutual assistance, which is especially beneficial to new players. However, it also revealed significant limitations in AI's understanding of 3D environments and real-time game states, resulting in inconsistent NPC behavior and spatial awareness.

Moving from understanding to creation, Zhang et al. presented a text-to-game engine capable of creating playable role-playing games (RPGs) from simple text descriptions. The "Zagii" engine uses advanced AI models to create game stories, characters, and visuals in real time.

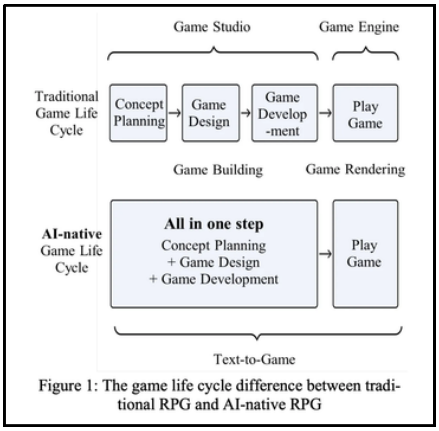


Figure 1: The game life cycle difference between traditional RPG and AI-native RPG

With 803 games generated and over 60,000 gameplay sessions logged, this technology demonstrates its ability to democratize game production, making it more accessible and efficient.

Complementing the text-to-game approach, the Sketch2Scene system represents another leap in AI-assisted game development.

This unique application turns simple doodles into realistic, interactive 3D game worlds. Sketch2Scene's ability to automate the production of terrain, objects, and textures has the potential to streamline game world creation.

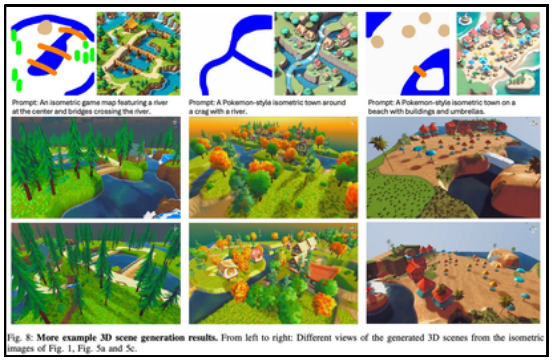


Fig. 8: **More example 3D scene generation results.** From left to right: Different views of the generated 3D scenes from the isometric images of Fig. 1, Fig. 5a and 5c.

Researchers developed an AI system to evaluate and improve video game tutorials, addressing the crucial aspect of player onboarding.

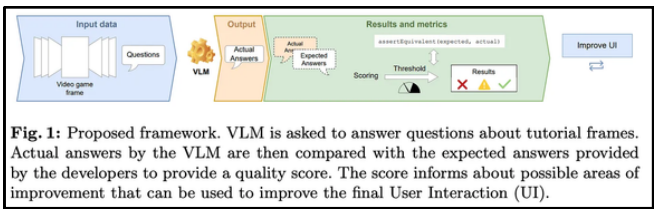


Fig. 1: Proposed framework. VLM is asked to answer questions about tutorial frames. Actual answers by the VLM are then compared with the expected answers provided by the developers to provide a quality score. The score informs about possible areas of improvement that can be used to improve the final User Interaction (UI).

The technology uses Vision-Language Models (VLMs) to evaluate tutorial screenshots and identify possibly confusing or unclear instructions. Tested on a tower defense game, this method promises to improve tutorial quality while eliminating the need for intensive human playtesting.

The Rise of AI Co-Pilots

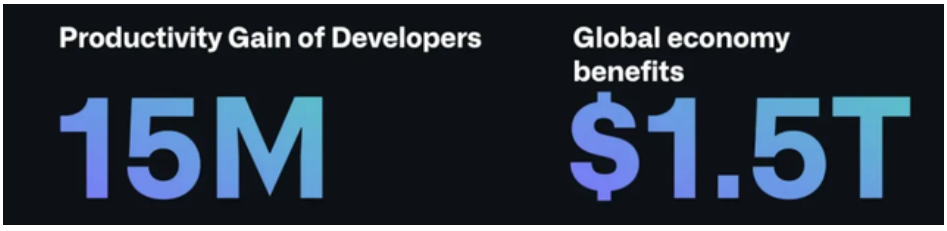
When we think of AI in games, we tend to think of improving the gameplay – more intelligent enemies, more realistic environments, or personalized content.

However, another 'wave' is gaining momentum and is focused on solving problems present in software development itself.

Stack Overflow's data from the 2022 developer survey reveals that 63% of the respondents spend more than 30 minutes daily searching for answers or solutions to such problems. This indicates that one would have spent 333 to 651 hours per week searching for answers on behalf of a team of 50. This inefficiency reduces the output and small-scales the overall project performance to the extent of compromising developers' morale and productivity.

AI co-pilots are built for these inefficiencies and are designed to alter how developers code. A significant milestone was reached in June 2021 when GitHub launched a preview of its AI-powered programming aid, GitHub Copilot. This tool, which uses AI to suggest code when a developer starts typing, quickly became popular. Microsoft's latest quarterly earnings report reveals GitHub Copilot's remarkable growth: 1.3 million paid accounts (up 30% quarter-over-quarter), adoption by 77,000 companies, and over 1.5 billion lines of code generated daily. Currently, Copilot produces more revenue than GitHub had in all of 2018, adding $2bn in annual revenue run rate to GitHub's revenue and 40% of the service's growth.

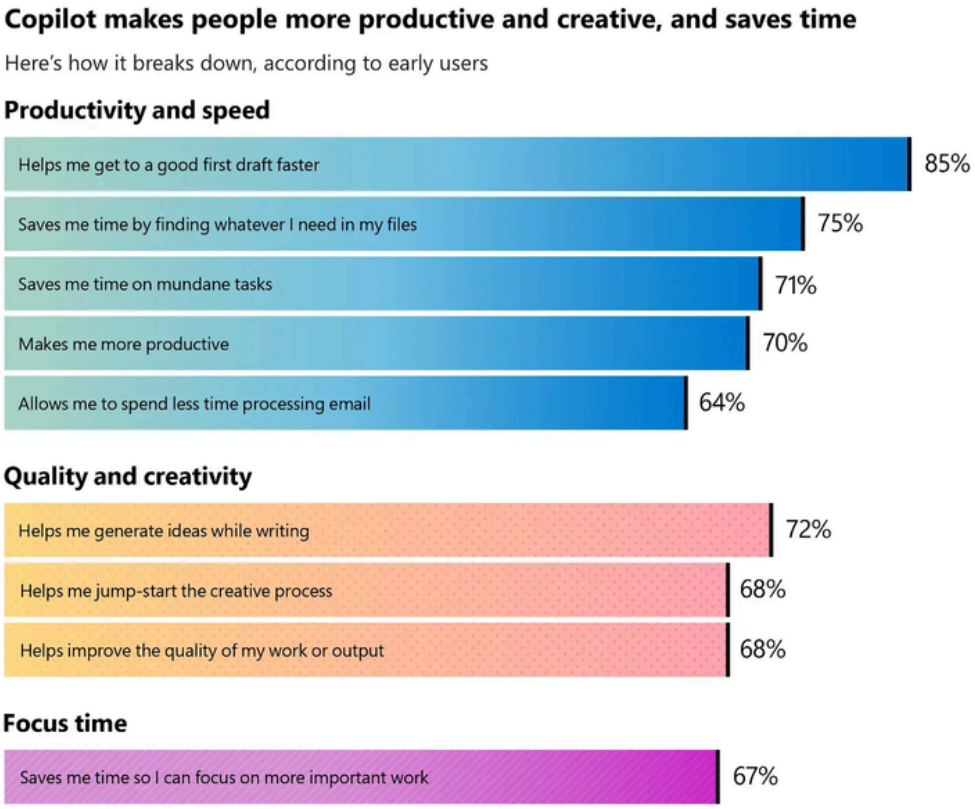
Research shows that AI services that enhance developers' efficiency could grow the global economy by $1.5 trillion in 2030.



The Stanford AI Index Report emphasizes the influence on developer productivity and happiness:

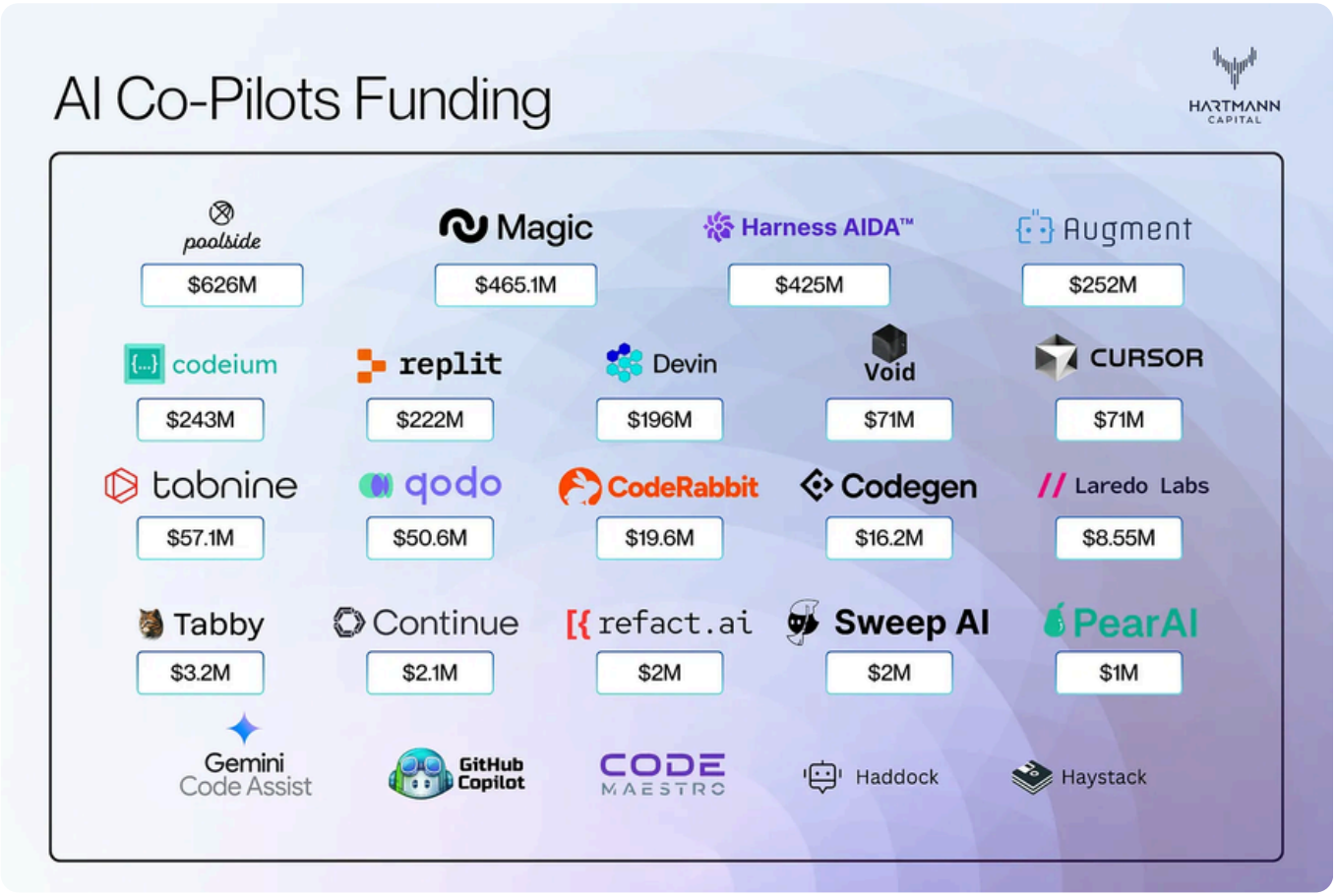
- 88% of engineers report enhanced productivity
- 74% find themselves engaged in more rewarding work
- 88% noticed a marked increase in task completion speed
- 8% higher overall success rate in task completion
- Tasks are completed 56% faster (reduction from 161 minutes to 71 minutes)

AI co-pilots increase efficiency and improve job happiness, allowing engineers to focus on more challenging and gratifying areas of their work.



What Can Copilot's Earliest Users Teach Us About Generative AI at Work?

Investors and founders have noted all of these benefits. As depicted in the graphic below, the market for AI-powered development tools is quickly developing, with considerable investment going into both startups and established organizations.

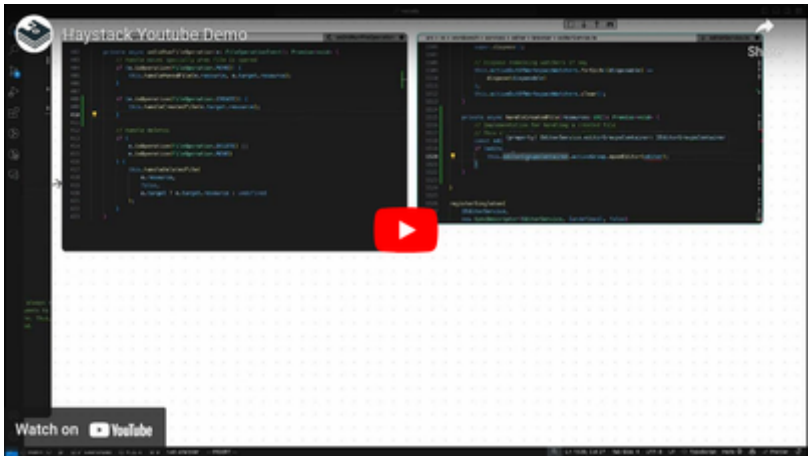


With an overall funding of $2.73 billion across multiple ventures, it's evident that the race to produce the most effective AI co-pilot is on. Poolside, a prime example of this trend, recently announced a staggering $500 million fundraising to accelerate its progress toward artificial general intelligence (AGI). Poolside believes that software development will be the first field where AI outperforms humans, and they've created a new approach called Reinforcement Learning from Code Execution Feedback (RLCEF) to help AI improve its coding abilities. They aim to democratize software development, enabling anyone to create complex software without coding knowledge. Let's look at the basic capabilities of these co-pilots and how they might be deployed.

How does it work

Co-pilots for coding leverage machine learning models trained on large code repositories to generate real-time contextual suggestions. As programmers type, the AI analyzes the codebase and provides code snippets to help enhance and extend the written code.

Let's take Cursor, for example. It is a fork of Visual Studio Code that adds advanced AI capabilities to a familiar interface for most developers. As you can see, Cursor can produce code on demand and even build an application's entire framework. Developers can communicate with the AI in plain English about their code.

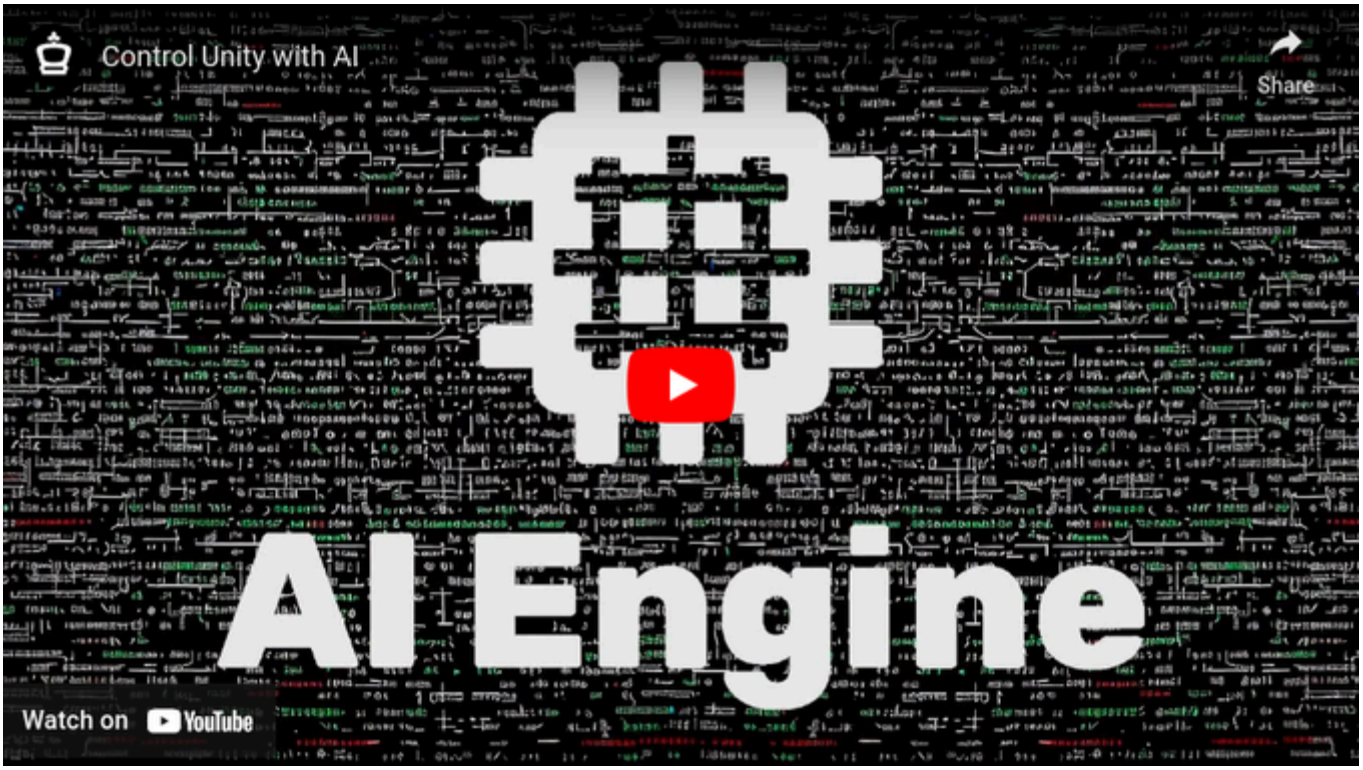


Another fascinating VSCode fork is the Haystack Editor, a 2D digital whiteboard-based IDE that dynamically generates code connections as you navigate and edit files.

Game Engine Integrations

Integrating AI-powered editors into game engines is gaining momentum. For Unity, Prithvi Bisht's Medium article provides a step-by-step guide on how to use Cursor AI with Unity. Unity Code Assist Lite, a free Visual Studio plugin with over 50,000 installations, provides improved code completion, in-line visuals, and AI-powered support.

Moreover, there's also an in-engine plugin available on the Unity Asset Store that allows developers to control the Unity Editor using AI commands directly within the engine. This tool enables you to set up scenes, configure GameObjects, adjust project settings, generate scripts, and create textures simply by typing tasks. With features like full undo operations and detailed execution history, it significantly enhances workflow efficiency and flexibility for Unity projects.



Meanwhile, Unreal Engine developers are looking into tools like Bluepy, a plugin that uses OpenAI's API to produce Blueprint nodes from natural language inputs. Bluepy allows developers to describe the required functionality directly within the Blueprint graph, and the AI constructs the necessary nodes and connections.

But this is only the tip of the iceberg. Game creation involves unique challenges that differ from regular software development. These include complex physics, custom pathfinding, day-night cycles, and multiplayer networking. Large codebases can be intimidating for new team members, and tight deadlines necessitate quick onboarding and delivery while remaining consistent with the existing design.

Startups like Code Maestro are developing solutions beyond traditional co-pilots. These tools offer customized assistance for game-specific tasks, from AI behavior design to multiplayer debugging, while creating interactive knowledge bases to streamline onboarding.

Code Maestro's capability includes legacy code and custom engines, and local hosting provides data security, which is critical for protecting intellectual property.

However, the impact of these AI assistants on game production remains to be seen. We'll be keeping a careful eye on how these technologies fit into existing workflows and whether they can live up to the promise of more efficient development processes and creative gaming experiences.

Current Limitations and Future Potential

GitHub Copilot's output often requires extensive testing and verification. A study found that 40% of AI-generated code contained vulnerabilities in high-risk scenarios.

Developers like Darren Horrocks worry that relying too much on AI can lead to a misunderstanding of core ideas and encourage lazy development methods.

Intellectual property and ethical considerations include the possibility of disclosing proprietary code and creating content that duplicates protected work.

Tools like GitHub Copilot and ChatGPT lack the deep integration required for complicated coding activities, especially in game development sectors where platform-specific optimizations and interdependencies between code components are crucial.

Research indicates that these techniques have variable success rates. ChatGPT generated accurate code for 65.2% of problems, followed by GitHub Copilot (46.3%) and Amazon CodeWhisperer (31.1%). Even the best-performing tool fails to produce accurate code in over one-third of circumstances.

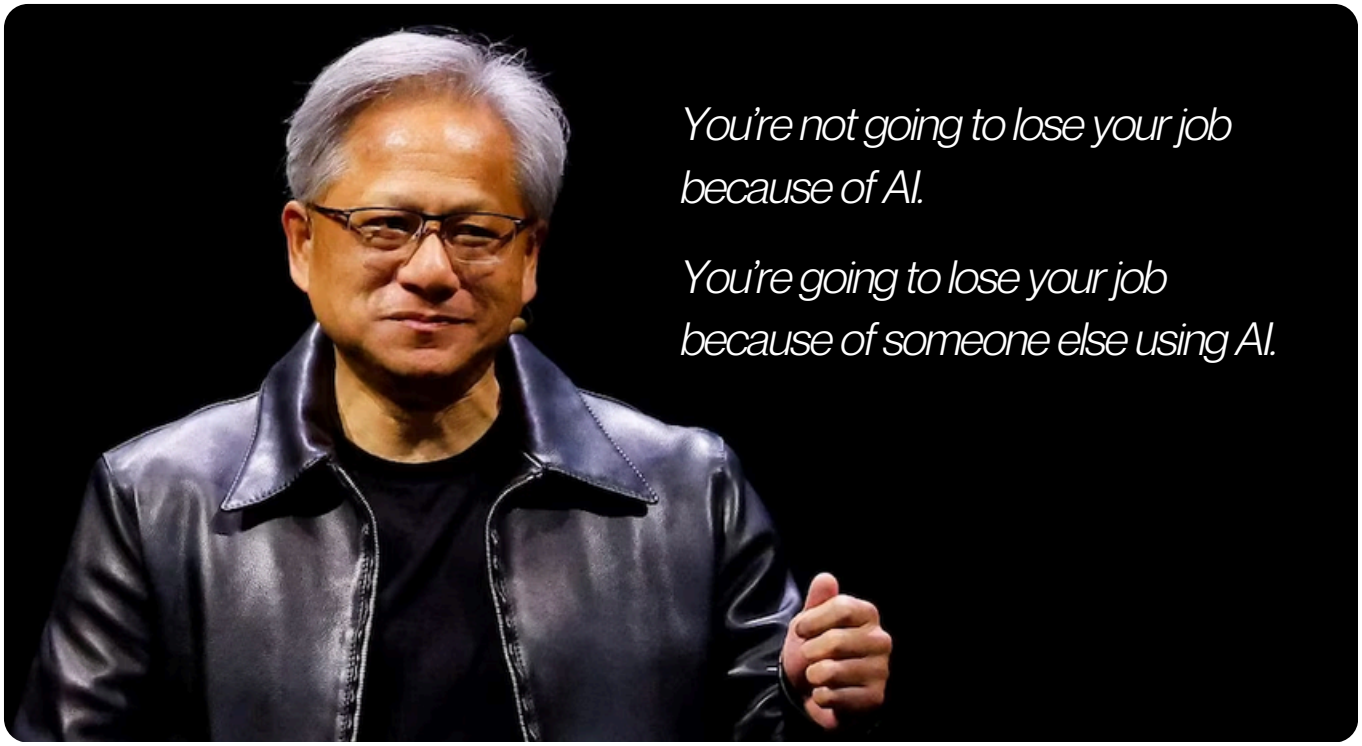
Furthermore, these tools' performance is strongly reliant on input quality. Without clear descriptions, their usefulness suffers dramatically.

On the other hand, OpenAI's new 'o1' series demonstrates considerable advancements in reasoning, maths, and coding abilities. These models outperform GPT-4 on complicated tasks, scoring 83% on International Mathematics Olympiad qualifying exams and achieving the 89th percentile in Codeforces coding competitions.

Conclusion

While AI models are improving and co-pilots help write some of the code, they do not replace the need for experienced coders. Human oversight is still required to ensure code correctness, maintain security, and manage large-scale projects. Developers that adopt and use these AI tools will have a significant advantage in an increasingly competitive sector.

As NVIDIA's CEO Jensen Huang said:



HARTMANN
METAVERSE VENTURES

Disclosures

Hartmann Capital GP II, LLC & Hartmann Capital GP IV, LLC (collectively the "General Partner") is not registered as an investment adviser with the Securities and Exchange Commission or any state's securities commission. However, Hartmann Capital, LLC (the "Investment Manager" and together with the General Partner, the "Firm") has filed as an exempt reporting adviser under the "venture capital adviser exemption" with the Securities and Exchange Commission. The limited partnership interests (the "Interests") in Hartmann Metaverse Ventures I, LP & Hartmann Metaverse Ventures II, LP, (collectively the "Fund") are offered under a separate private offering memorandum (the "Offering Memorandum"), have not been registered under the Securities Act of 1933, as amended (the "Securities Act"), nor any state's securities laws, and are sold for investment only pursuant to an exemption from registration with the SEC and in compliance with any applicable state or other securities laws. Interests are subject to restrictions on transferability and resale and may not be transferred or resold except as permitted under the Securities Act and applicable state securities laws. Investors should be aware that they could be required to bear the financial risks of this investment for an indefinite period of time.

This presentation is being furnished to you on a CONFIDENTIAL basis to provide preliminary summary information regarding an investment in the Fund managed by the Firm and may not be used for any other purpose. Any reproduction or distribution of this presentation or accompanying materials, if any, in whole or in part, or the divulgence of any of its contents is prohibited. The information set forth herein does not purport to be complete and no obligation to update or otherwise revise such information is being assumed. It is meant to be read in conjunction with the Fund's Offering Memorandum prepared in connection herewith, and does not constitute an offer to sell, or a solicitation of an offer to buy, by anyone in any jurisdiction in which such an offer or solicitation is not authorized or in which the making of such an offer or solicitation would be unlawful. The information contained herein does not purport to contain all of the information that may be required to evaluate an investment in the Fund. The information herein is qualified in its entirety by reference to the Offering Memorandum, including, without limitation, the risk factors therein.

A prospective investor should only commit to an investment in the Fund if such prospective investor understands the nature of the investment and can bear the economic risk of such investment. THE FUND IS SPECULATIVE AND INVOLVES A HIGH DEGREE OF RISK. The Fund may lack diversification, thereby increasing the risk of loss. The Fund's performance may be volatile. There can be no guarantee that the Fund's investment objectives will be achieved, and the investment results may vary substantially from year to year or even from month to month. AS A RESULT, AN INVESTOR COULD LOSE ALL OR A SUBSTANTIAL AMOUNT OF ITS INVESTMENT. In addition, the Fund's fees and expenses may offset its profits. There are restrictions on withdrawing and transferring interests from the Fund. In making an investment decision, you must rely on your own examination of the Fund and the terms of the Offering Memorandum and such other information provided by the Firm to you and your tax, legal, accounting or other advisors. The information herein is not intended to provide, and should not be relied upon for, accounting, legal, or tax advice or investment recommendations. You should consult your tax, legal, accounting or other advisors about the matters discussed herein. The Fund's ability to achieve its investment objectives may be affected by a variety of risks not discussed herein. Please refer to the Offering Memorandum for additional information regarding risks and conflicts of interest.

No representations or warranties of any kind are made or intended, and none should be inferred, with respect to the economic return or the tax consequences from an investment in the Fund. No assurance can be given that existing laws will not be changed or interpreted adversely. Prospective investors are not to construe this presentation as legal or tax advice. Each investor should consult his or its own counsel and accountant for advice concerning the various legal, tax, ERISA and economic matters concerning his or its investment.

No person other than the Firm, and its Principal, has been authorized to make representations, or give any information, with respect to these membership interests, except the information contained herein, and any information or representation not expressly contained herein or otherwise supplied by the Principal in writing must not be relied upon as having been authorized by the Firm or any of its members. Any further distribution or reproduction of these materials, in whole or in part, or the divulgence of any of its contents, is prohibited.

An investment in the Fund has not been approved by any U.S. federal or state securities commission or any other governmental or regulatory authority. Furthermore, the foregoing authorities have not passed upon the accuracy, or determined the adequacy, of this document, the Offering Memorandum or limited partnership agreement associated with the Fund. Any representation to the contrary is unlawful.

Certain information contained in this document constitutes "forward-looking statements" which can be identified by use of forward-looking terminology such as "may," "will," "target," "should," "expect," "attempt," "anticipate," "project," "estimate," "intend," "seek," "continue," or "believe" or the negatives thereof or other variations thereon or comparable terminology. Due to the various risks and uncertainties, actual events or results in the actual performance of the Fund may differ materially from those reflected or contemplated in such forward-looking statements. The Firm is the source for all graph and charts, unless otherwise noted.

This document may present past performance data regarding prior/other investments, funds, and/or trading accounts managed by the Firm, and/or the Principal. This is presented solely for explanatory purposes. The Fund may face risks not previously experienced or anticipated by the Firm and/or the Principal, and therefore, prospective investors should evaluate the Fund on its own merits. Furthermore, there is no guarantee the Firm and/or Principal will be able to replicate the mandate, strategy, portfolio construction and risk management parameters reflected in their prior performance data. Market factors and unforeseen circumstances both internally and externally may result in a wide deviation from the returns reflected in the prior performance data, and there is no guarantee the Firm and/or Principal will be able to avoid and/or remediate such internal and external factors. PAST PERFORMANCE IS NOT INDICATIVE OR A GUARANTEE OF FUTURE RESULTS.

This document may also present "sample holdings" or "case studies" of a type of asset(s) the Fund may invest in or are expected to be typical of its holdings. Such "sample holdings" are not currently holdings of the Fund and are presented solely for explanatory purposes. Prospective Investors should not assume that such "sample holdings" will actually be purchased by the Fund when determining whether to make an investment in the Fund.