

CAPCO

AI IS REDEFINING WHO CAN BE A SOFTWARE DEVELOPER

AI-ASSISTED CODE GENERATION WILL HAVE PROFOUND IMPACTS ON PRODUCTIVITY, INNOVATION AND ECONOMICS. IS YOUR FINANCIAL INSTITUTION READY TO TAKE ADVANTAGE?



INTRODUCTION: FROM PROGRAMMER'S COMPANION TO PROGRAMMER'S REPLACEMENT?

Unexpectedly rapid advances in artificial intelligence (AI), machine learning (ML) and neural networks are accelerating software development at such a fast rate that IT departments could be entering a new era of software productivity and innovation by mid-decade.

The latest proof point: GitHub Copilot, introduced this summer by Microsoft. Think of Copilot as something akin to a developer-partner. As the developer writes code, Copilot jumps in to suggest alternative line completions or multiple lines – “autocomplete” for programmers. But more than that, Copilot can offer up complete methods, boilerplate code, whole unit tests, and even complex algorithms.

Of course, all the air was sucked out of the AI community last fall when OpenAI released ChatGPT, which users have made headlines with by creating term papers, songs, and that coders have begun to use for fixing bugs. The momentum continued February 6 when Google unveiled its competitor, Bard.¹

According to a GitHub survey of Copilot developers, the assistance nearly halved coding time in some areas and raised work satisfaction by reducing tedious work. “For the first time in the history of software, ”according to GitHub,² “AI can be broadly harnessed by developers to write and complete code.”

Copilot, and similar AI models like Amazon's CodeWhisperer and DeepMind's AlphaCode, are the next step up from simpler programming tools that are included in widely used integrated development environments. Built on large language models (LLMs) and trained on massive code repositories, they imitate the brain's neural networks in helping programmers program. In truly novel demonstrations, these AIs can even produce executable code or instructions from human speech and natural-language phrases.

But these “developers' assistants” are just the beginning. The ultimate potential: replace the definition of who is a developer. AI technology will empower non-programmers using natural language to give an AI-assisted program a list of requirements to be automatically coded into a final product.

This shift in how custom software is developed – democratized away from highly specialized, highly paid specialists toward less specialized, tech generalists – will have profound positives for IT departments in financial institutions that begin planning for the transition quickly. Benefits for firms that can ride these forces adroitly will include falling development costs and faster innovation delivery.

A more intoxicating prospect, however, is that, for the first time, software development is accessible to a new generation of creators who don't have to devote years learning arcane programming languages, syntax rules, or testing routines. Expect an explosion of creativity as artists, engineers, and scientists, express themselves through computers and other digital devices that they can program directly.

Many tech experts contend this transition is a decade or more in the future. A more likely timeline, however, starts to emerge in two or three years when continuing advances in AI-assisted programming allow organizations to create code more quickly and with greater innovation at significantly less cost.

Organizations that fail to acknowledge this shift in software development will be passed in the market by more agile competitors, unable to attract top talent or make breakthrough products quickly enough.

CURRENT STATE: THE DEVELOPER'S BEST FRIEND

We are advancing on that goal much faster than was thought even two years ago. Already, AI-assisted development tools are being trained on billions of lines of anonymized code patterns to guide programmers on best tools and solutions for any situation. The tools fill the role of a tech lead, providing guidance, performing common tasks, and conducting code review and validation.

AI-assisted development is in common use today in several areas:

Code development

AI-based programming assistants like Kite and Codota help developers with code compilation and debugging.

Automated testing

Using automated test programs such as Eggplant and Testsigma, developers significantly reduce the need for constant checking of their work for bugs and syntax errors, speeding coding time.

Vulnerability detection

Security smarts built into development tools check code as it is written searching for security vulnerabilities.

FUTURE STATE: THE COMMODITIZATION OF SOFTWARE DEVELOPMENT

More advanced AI programming tools are now being developed for prime time including OpenAI's Codex and Google's AlphaCode. Their aim is to help non-programmers write code using natural-language commands, e.g., "Shrink the image to 500 pixels wide." But the assistance doesn't stop there as these AIs also suggest additional blocks of code based on what the developer has authored previously in the codebase or what other developers have authored in other public codebases in similar use cases. Furthermore, these instructions can be generated into a wide variety of programming languages including Java, Python, and Dart and allow the developer to transliterate between them in real time.

Improvements in AI, ML, and neural networks are driving rapid advances in this capability. New developments that we see getting much smarter over the next three years include:

State your intentions

AI-aided software needs precise instruction to understand the intent of the developer, but human language is often shrouded in ambiguity and cultural context. Enter TiCoder, an interactive technology unveiled in August by Microsoft and university researchers that allow a computer to query a programmer for clarification of ambiguities before generating code. They claim the code generates code with 90.4% consistency to user intent.³

Find the best solution

In making coding suggestions for developers, DeepMind's AlphaCode generates tens of thousands of lines of alternative code and testing for the best solution.

You ought to be in pictures

A dozen companies already offer text-to-video⁴ services that give website owners the power to inexpensively create videos from text on their sites. Is the time far away when a studio creates a product by feeding ideas to an AI video generator? After all, Jason Allen took a first place ribbon⁵ for a painting submitted at the Colorado State Fair in August. Surprise! He created the piece using Midjourney⁶, an artificial intelligence program that can turn text descriptions into images.

IMPLICATIONS FOR ORGANIZATIONS AND IT DEPARTMENTS

The maturing of AI-assisted development over the next few years will have profound impacts not only on how companies develop software but on how IT departments manage that process.

For one thing, by making software development more accessible to those without coding skills, companies can begin to address the current shortage of developer talent – 1 million vacancies in the US. AI-assisted software will make average programmers more efficient and productive. Most likely to feel the pinch from those efficiencies are the top-tier developers who earn salaries of \$500,000 and more. Sure, there will always be a market for the best of the best – just not nearly as many of them.

For IT departments, the challenge will be how to rethink software development using new methodologies and workflows. Technologists will be recruited less on their coding skills and more on their ability to visualize and verbalize actions that the AI-based programming software can understand and implement.

To give executable natural-language instructions to a computer, technologists will need to understand the semantics, concepts, and logical sequences of foundational programming, even if they don't write in computer code – at least until the technology matures even more.

WHAT SHOULD COMPANIES DO NOW TO PREPARE?

One thing your organization should not do is nothing. Now is the time to begin planning for the transition to AI-assisted programming. Hires you make, partners you add, and technology choices you decide on today will be key contributors to the bottom line by mid-decade. Some factors to consider include:

- Guard against the natural inclination to use these new tools as just cost-cutting mechanisms. Focus on their ability to speed innovation and time to market, and to develop organizational agility. For example, in automating programming tasks, look

for opportunities to shift talented technologists to more customer-facing projects or skunkworks projects.

- As more programming responsibility shifts from humans to algorithms, plan to mitigate the downsides of AI, such as built-in bias, security holes, and a shortage of efficient AI programmers.
- Although retraining will help, there is little doubt that automation comes with some amount of human dislocation. Anticipate how your organization will handle culture clashes and worker unease.

NEXT STEPS

Late in 2022 Google acknowledged project “Pitchfork”,⁷ code that can write, maintain, and repair itself without human intervention. It has yet to publicly showcase its work, but clearly progress in AI-powered automated code generation is speeding up, not slowing down. In some ways it feels like 2014 when a famous Go expert predicted⁸ it would take an AI program at least a decade of training to defeat a Go master. We all know what happened in 2016 when IBM's AlphaGo used deep learning to dethrone Lee Sedol.⁹

Good risk management practice is to plan for scenarios that, even if they have a low likelihood of hitting soon, nevertheless would be devastating to experience without preparation. Even executives who don't believe in climate change should be planning for the possibility that waves will eventually be lapping at the front door of corporate headquarters.

Artificial intelligence-aided programming is a complicated, fast-moving, opportunity that can create a more efficient and competitive business. Look for partners starting today to help assess your organization's readiness to take advantage of this trend.

REFERENCES

1. Catherine Thorbecke. "Google unveils its ChatGPT rival." February 7, 2023. CNN. <https://www.cnn.com/2023/02/06/tech/google-bard-chatgpt-rival/index.html>
2. Thomas Dohmke. GitHub blog no title. June 21, 2022. <https://github.blog/2022-06-21-github-copilot-is-generally-available-to-all-developers/>
3. Shuvendu Lahiri, Aaditya Naik, Georgios Sakkas, Piali Choudhury, Curtis von Veh, Madan Musuvathi, Jeevana Priya Inala, Chenglong Wang, Jianfeng Gao. "Interactive Code Generation via Test-Driven User-Intent Formalization." August 2022. Microsoft. <https://www.microsoft.com/en-us/research/publication/interactive-code-generation-via-test-driven-user-intent-formalization/>
4. Lando Loic. "The 9 Best AI Video Generators (Text-to-Video)." July 29, 2022. MakeUseOf.com. <https://www.makeuseof.com/best-ai-video-generators-text-to-video/>
5. Sarah Kuta. "Art Made With Artificial Intelligence Wins at State Fair." September 6, 2022. Smithsonian Magazine. <https://www.smithsonianmag.com/smart-news/artificial-intelligence-art-wins-colorado-state-fair-180980703/>
6. Stephan Talty. "What Will Our Society Look Like When Artificial Intelligence Is Everywhere?" April 2018. Smithsonian Magazine. <https://www.smithsonianmag.com/innovation/artificial-intelligence-future-scenarios-180968403/>
7. James Lopez. "Google's mysterious project "Pitchfork" exposed: teaching AI to write code." November 23, 2022. TechGoing. <https://www.techgoing.com/googles-mysterious-project-pitchfork-exposed-teaching-ai-to-write-code/>
8. Alan Levinovitz. "The Mystery of Go, the Ancient Game That Computers Still Can't Win." May 12, 2014. Wired. <https://www.wired.com/2014/05/the-world-of-computer-go/>
9. Wikipedia. https://en.wikipedia.org/wiki/Computer_Go

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Capco, a Wipro company, is a global technology and management consultancy focused in the financial services industry. Capco operates at the intersection of business and technology by combining innovative thinking with unrivalled industry knowledge to fast-track digital initiatives for banking and payments, capital markets, wealth and asset management, insurance, and the energy sector. Capco's cutting-edge ingenuity is brought to life through its award-winning Be Yourself At Work culture and diverse talent.

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