

Building a Productive AI-Assisted HPC Software Ecosystem

The Need for a Community-Driven Approach

11-20-2024

Scientific Software and the People Who Make It Happen:
Building Communities of Practice



Harshitha Menon

Emerging Horizons: The Intersection of LLMs and Programming

Forbes

Rapid Advances In Artificial Intelligence And No Code Tools Are Enabling A Creative Revolution

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NEWS | 08 December 2022

Are ChatGPT and AlphaCode going to replace programmers?

OpenAI and DeepMind systems can now produce meaningful lines of code, but software engineers shouldn't switch careers quite yet.

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The New York Times

It's the End of Computer Programming as We Know It. (And I Feel Fine.)

WIRED

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Deepmind's AI Is Learning About the Art of Coding

AlphaDev has made small but significant improvements to decades-old C++ algorithms. Its builders say that's just the start.

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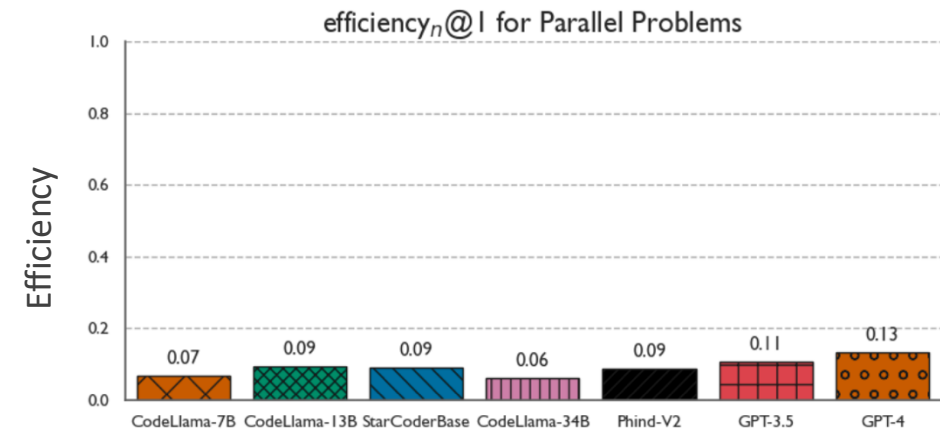
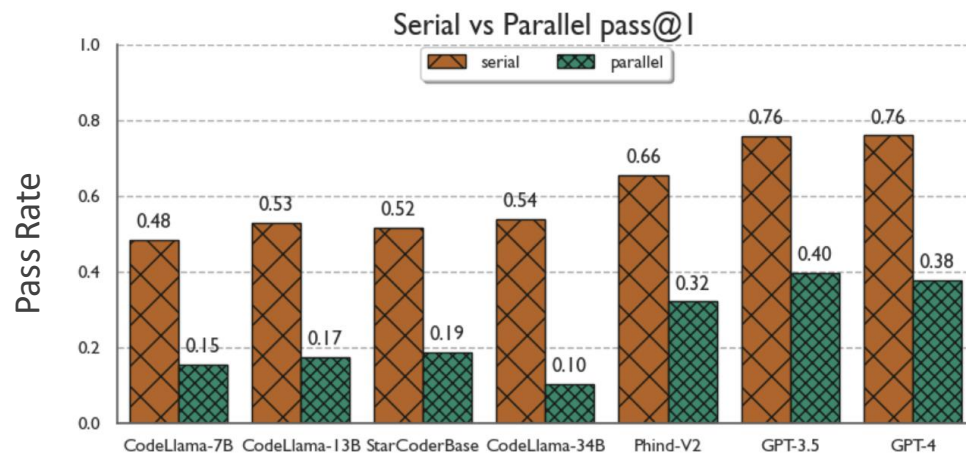
Faster sorting algorithms discovered using deep reinforcement learning

Forbes

How Generative AI Will Change The Jobs Of Computer Programmers And Software Engineers



Can Large Language Models Write HPC Code?



Nichols et al. 2024

- HPC codes are more complex
- HPC codes are poorly represented in LLMs' training corpora, resulting in incorrect responses
- LLMs process source code primarily as text and lack knowledge about parallel programming model
- LLMs are not explicitly trained for code performance

LLMs struggle to generate correct and performant HPC code.

Harnessing the power of LLMs for HPC code development requires



**Improving LLMs'
Effectiveness in HPC
Domain**



**Trustworthy and
Verifiable LLM**



**Integration with existing
HPC tools**

There are open problems at all levels and tackling it requires community efforts

Deep Learning Frameworks: System experts to optimize LLMs for HPC systems

Models: Development of models tailored for HPC needs, such as addressing low-data domain issues, large context, and ensuring grounding

Datasets: Joint efforts to curate and share HPC relevant code datasets essential for training

Code Representation: Exploring other code representations and additional modalities

HPC Tools Integration: Integrating a variety of HPC tools with LLMs to provide feedback

Evaluation: Establishing common evaluation benchmarks and frameworks

Trustworthiness: Designing methods to ensure explainability and trustworthiness of LLMs

Fostering community and sharing knowledge

In today's rapidly-evolving landscape, we need collaborative community effort to accelerate the pace of innovation and democratize access to these advanced tools



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