CS 499 Journal 5-1 Thompson  
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Part One:

In this journal entry, I will delve into two emerging trends that are shaping the future of computer science in distinct yet impactful ways: Quantum Computing and Artificial Intelligence (AI). Quantum computing, though still in its early stages, promises to revolutionize how we approach complex problem-solving and computation, offering breakthroughs in fields like cryptography and drug discovery. On the other hand, AI, already deeply integrated into various industries, continues to drive advancements in automation, data analysis, and decision-making. While these trends operate at different levels of maturity, both are poised to redefine the boundaries of technology, influencing how we develop, interact with, and rely on computational systems. By exploring these two trends, I aim to highlight their significance, potential impacts, and relevance to my future career in computer science.

1. What relevance does each trend have?

Quantum Computing

Quantum computing is a significant advancement in computer capability. Its significance comes from its capacity to handle issues like intricate simulations and optimization jobs that conventional computers are now unable to handle because of resource limitations. For example, the well-known quantum algorithm Shor's algorithm has the potential to factor big numbers tenfold faster than conventional techniques, which puts current encryption techniques to the test. According to McKinsey, quantum computing has the potential to drastically speed up advancements in fields such as drug development, material science, and encryption (The emergence of quantum computing, n.d.). This relevance extends into industries that rely on solving complex problems, suggesting that as the technology matures, it will enable breakthroughs in areas previously constrained by the limits of classical computing.

Artificial Intelligence (AI)

AI’s relevance stems from its ability to simulate human intelligence through machine learning and neural networks, allowing for automation and increased efficiency across industries. Specifically, AI technologies like deep learning algorithms are revolutionizing areas such as image and speech recognition, decision-making, and personalized recommendations. AI has become integral to healthcare, where it is used in diagnostic tools, and in finance, where it enhances fraud detection and risk assessment. According to Salminen (2024), AI is also driving advances in automation, making repetitive tasks more efficient and expanding capabilities into complex decision-making through predictive analytics and natural language processing (Salminen, 2024).

2. What effects will each trend have on computer science?

Quantum Computing

Quantum computing will cause a fundamental shift in the field of computer science. It will require the development of entirely new algorithms, frameworks, and possibly even programming languages designed specifically for quantum processors. Quantum methods such as Grovers search algorithm demonstrate this already, offering a quadratic speed-up over conventional algorithms for unstructured search issues. Cryptography is one of the traditional areas of computer science that will need to change to take into consideration the capability of quantum systems. In particular, the creation of quantum-safe cryptographic algorithms would be required if existing encryption techniques like RSA become outdated (The growth of quantum computing, n.d.). Furthermore, the integration of quantum computing will likely lead to hybrid systems that combine classical and quantum computational models, reshaping the landscape of computational problem-solving.

Artificial Intelligence (AI)

AI continues to reshape the foundations of computer science by emphasizing data-driven approaches and machine learning. The transition from traditional rule-based programming to systems that learn and adapt from data is one of the most significant changes AI has introduced. With advancements in neural networks and deep learning, software development is increasingly focused on developing models that require vast amounts of data and computational power, rather than static codebases. AI is pushing the boundaries of human-computer interaction and is fostering collaboration across various fields such as neuroscience, psychology, and economics. The evolution of AI has also necessitated new algorithms, tools, and frameworks like TensorFlow and PyTorch, which have become essential in machine learning development (Salminen, 2024).

3. What effects will each trend have on people, workers, and consumers?

Quantum Computing

While consumers may not immediately experience the effects of quantum computing, its long-term impact will be transformative. In the healthcare sector, for example, quantum computing could enable personalized medicine by simulating drug interactions at the molecular level, leading to more effective treatments. Workers in technology fields will need to adapt to new quantum programming languages, such as Qiskit and Cirq, and develop an understanding of quantum mechanics and algorithms. Additionally, as quantum computers evolve, businesses must prepare for quantum-safe cybersecurity practices to protect sensitive information, given that current encryption techniques could become vulnerable to quantum attacks (The rise of quantum computing, n.d.).

Artificial Intelligence (AI)

AI is already making a significant impact on consumers, from personalized online experiences to AI-driven customer support. In the workplace, AI is expected to continue automating repetitive tasks, allowing workers to focus on higher-value activities such as decision-making and creative work. However, AI's increasing automation also raises concerns about job displacement in industries where machines can fully replace human labor, such as manufacturing and logistics. In sectors like healthcare, AI's predictive analytics and diagnostic capabilities are already improving patient outcomes, making treatment plans more accurate and personalized (Salminen, 2024). Additionally, AI is driving innovation in public services, including transportation and smart cities, improving efficiency and sustainability.

4. How does each trend align with your goals or interests for your career?

Quantum Computing

Although quantum computing is still in its early stages, its long-term potential excites me. My interest in algorithmic problem-solving aligns with quantum computing's unique ability to handle complex, high-dimensional problems. I find quantum algorithms fascinating, such as the quantum Fourier transform, because they can handle some problems tenfold quicker than classical ones. As quantum computing becomes more accessible, I see myself pursuing a career in quantum software development, focusing on leveraging quantum systems for tasks such as data processing and optimization. This trend directly aligns with my goal of contributing to the future of computing and advancing problem-solving capabilities.

Artificial Intelligence (AI)

AI directly aligns with my current career aspirations. I am particularly interested in machine learning and AI-driven technologies, and the field offers numerous opportunities to innovate in data science, natural language processing, and automation. The increasing adoption of AI across industries excites me, and I see myself working on projects that leverage AI to improve business operations or create smarter, more personalized consumer experiences. AI’s versatility and constant evolution make it a perfect fit for my interest in dynamic and impactful technologies.

5. Which course objectives have you met thus far, and which ones still need to be met?

I have made great progress thus far toward a number of course objectives. I have successfully designed and evaluated computing solutions by applying algorithmic principles to various problems, which aligns with the outcome of developing solutions that adhere to computer science standards. I have also gained experience in delivering professional-quality communications, such as writing technical reports and giving presentations, that are tailored to different audiences and contexts.

But there are still some things I need to work on. Even though I've used a few cooperation techniques, I still need to work on honing my capacity to foster environments that value other points of view, especially while working on joint projects. Furthermore, I'm still working to improve my security thinking, especially in terms of knowing how to foresee and address any flaws in software architecture. As both quantum computing and AI raise significant security concerns, this remains a critical area of growth. Lastly, while I have begun to explore innovative tools and techniques in AI and machine learning, I plan to deepen my knowledge of cutting-edge technologies, such as quantum computing, to better align with industry-specific goals and future innovations in the field.

Conclusion

In conclusion, quantum computing and AI represent two key trends that will shape the future of computer science, albeit in different ways. Quantum computing offers the promise of revolutionizing industries by solving previously unsolvable problems, while AI is already transforming how we interact with technology and conduct business. Both trends align with my passion for innovative, impactful technologies, and by staying informed and developing relevant skills, I aim to contribute meaningfully to these exciting developments in the field.

References

The rise of quantum computing. McKinsey & Company. (n.d.). <https://www.mckinsey.com/featured-insights/the-rise-of-quantum-computing>

Salminen, M. (2024, May 21). 41 AI statistics and trends in 2024. Hostinger Tutorials. [https://www.hostinger.com/tutorials/ai-](https://www.hostinger.com/tutorials/ai-statistics?gad_source=1&gclid=CjwKCAjwx4O4BhAnEiwA42SbVNHuzZSj5S569se9j5P42L2Y_ohz591FLuRAifxHuyefRY8j3tpVlxoC0jkQAvD_BwE)statistics?gad\_source=1&gclid=CjwKCAjwx4O4BhAnEiwA42SbVNHuzZSj5S569se9j5P42L2Y\_ohz591FLuRAifxHuyefRY8j3tpVlxoC0jkQAvD\_BwE   
  
  
Part Two:

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| Checkpoint | Software Design and Engineering | Algorithms and Data Structures | Databases |
| Name of Artifact Used | 3D Modeling and Scene Design from CS 330 (Computational Graphics and Visualization) | Backend Services with Data Structures from CS 320 | Database Project from CS 340: Using MongoDB for Animal Rescue |
| Status of Initial Enhancement | Update in the visuals of the 3D scene transitioning from OpenGL to Blender a more industry standard tool. | Improvements in data structure efficiency, focusing on optimizing hash maps for quicker lookups. | Experimenting with indexing and aggregation techniques to handle larger datasets. |
| Submission Status | Back on a good pace just need to work spend more time with it as it as a learning curve with some features for beginner users are | Initial improvements are underway, but not submitted yet. | Still researching and making changes, no submission yet. |
| Status of Final Enhancement | Currently, I am working on finalizing textures and adding in small animations within blender for final submission | Continuing with algorithm optimizations for runtime efficiency final touches. | Clearing errors for now but then should be ready to submit soon after. |
| Uploaded to ePortfolio | Not yet uploaded. | Not yet uploaded. | Not yet uploaded. |
| Status of Finalized ePortfolio | Enhancements are finishing up so the ePortfolio will be uploaded soon | Enhancements are finishing up so the ePortfolio will be uploaded soon | Enhancements are finishing up so the ePortfolio will be uploaded soon |