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CS – 499: Computer Science Capstone

08/03/2025

**5 – 1 Journal: AI and ML**

Artificial Intelligence (AI) and Machine Learning (ML) are two of the most transformative trends in today’s technological landscape, each holding significant implications for innovation and industry. AI refers to the broader concept of machines being able to carry out tasks in a way that we would consider “smart,” while ML is a subset of AI that involves algorithms learning from data to make decisions or predictions. The significance of AI lies in its ability to automate complex processes, enhance decision-making, and improve efficiency across sectors such as healthcare, finance, transportation, and customer service. ML, on the other hand, is crucial for enabling systems to continuously improve and adapt without explicit reprogramming, leading to smarter applications like personalized recommendations, fraud detection, and predictive maintenance. Together, these trends are driving the future of intelligent systems, offering unprecedented opportunities for innovation and competitive advantage.

AI and ML are fundamentally reshaping the field of computer science by introducing new paradigms for problem-solving, system design, and software development. AI is expanding the scope of computer science beyond traditional rule-based programming to include intelligent systems capable of reasoning, perception, and natural language understanding. This shift is leading to advancements in areas such as robotics, human-computer interaction, and autonomous systems. ML, as a core driver of AI, is changing how data is used, emphasizing the importance of data-driven models and statistical techniques over conventional algorithms. As a result, computer scientists are increasingly focusing on areas like data engineering, model training, and algorithm optimization. Together, these trends are pushing the boundaries of what computers can do, fostering innovation in research, and creating new opportunities and challenges in ethics, security, and computational power.

The rise of AI and ML is significantly transforming the experience of consumers, workers, and citizens by enhancing convenience, efficiency, and personalization. For consumers, AI and ML enable smarter products and services, from voice assistants and personalized recommendations to automated customer support, creating more intuitive and responsive experiences. For workers, these technologies are streamlining workflows, automating repetitive tasks, and enabling data-driven decision-making, which can increase productivity but also require new skills and adaptability. For citizens, AI and ML are being integrated into public services such as transportation, healthcare, and law enforcement, improving service delivery and policy implementation. However, these advancements also raise important considerations around data privacy, job displacement, and algorithmic bias, making it essential to balance innovation with ethical and regulatory oversight.

AI and ML strongly align with my career aspirations to work for the government or a space-focused organization, where advanced technologies play a critical role in national security, data analysis, and exploration initiatives. In the government sector, AI and ML are increasingly used to enhance cybersecurity, improve public services, and support decision-making through data-driven insights. In the space industry, these technologies are essential for automating spacecraft systems, analyzing astronomical data, and enabling autonomous navigation and robotics for planetary exploration. Gaining expertise in AI and ML will allow me to contribute meaningfully to complex, mission-driven projects that advance scientific discovery, public safety, and technological innovation on a national or global scale.

So far, I have achieved several key course outcomes, including demonstrating proficiency in applying computer science principles to design and develop software solutions, effectively using algorithms and data structures to solve complex problems, and communicating technical concepts clearly through documentation and presentations. I have also gained experience in conducting code reviews and implementing software engineering best practices. The remaining outcomes I aim to achieve involve further refining my ability to integrate emerging technologies, such as AI and ML, into real-world applications and deepening my understanding of ethical and societal considerations in computing. These remaining goals will help round out my skill set and prepare me for impactful work in government or space-related organizations.

# CS 499 Sample Exemplar Status Checkpoints for All Categories

## Status Checkpoints for All Categories

| **Checkpoint** | **Software Design and Engineering** | **Algorithms and Data Structures** | **Databases** |
| --- | --- | --- | --- |
| **Name of Artifact Used** | **Artifact name:** Floating 3D Cube  **Origin:** CS 330 Comp Graphics and Visualization | **Artifact name:** Floating 3D Cube  **Origin:** CS 330 Comp Graphics and Visualization | **Artifact name:** Floating 3D Cube  **Origin:** CS 330 Comp Graphics and Visualization |
| **Status of Initial Enhancement** | I’ve improved the software design by organizing the code with helper functions, clear naming, and better error handling to make it easier to read, reuse, and maintain. | I’ve made enhancements by making the ray tracing and shading work better and by using structs, vectors, and matrices to handle 3D scene data more efficiently. | I’ve improved the database by organizing scene data more clearly and making it easier to save, load, or update information used in the program. |
| **Submission Status** | Submitted and graded | Submitted and graded | Submitted and graded |
| **Status of Final Enhancement** | Feedback was received, and nothing more was done | Feedback was received, and nothing more was done | Feedback was received, and nothing more was done |
| **Uploaded to ePortfolio** | Not Yet Completed | Not Yet Completed | Not Yet Completed |
| **Status of Finalized ePortfolio** | Not Yet Completed | Not Yet Completed | Not Yet Completed |