Abstract

Problem and objectives: Artificial Intelligence (AI) has become a crucial force with significant implications for the U.S. Navy. Machine learning (ML) stands as the very backbone of AI, infusing it with the remarkable ability to autonomously identify patterns and predict future outcomes. However, a workforce deficit in AI threatens to hinder its potential for the Navy. This project, ML4Math focusing on high school ML education, aligns with the Navy's objective to harness AI's capabilities, amplifying national security and technological supremacy. Nonetheless, integrating ML into high school education faces challenges: ***Disparities in Access and Diversity***. Students from underserved backgrounds often lack access to, or interest in, in advanced extracurricular activities or specialized elective courses involving ML. ***Complex Nature of ML***. ML involves intricate algorithms, complex data analysis, and nuanced concepts that can overwhelm young learners. ***Limited Information on Naval STEM Programs and Careers***. Many students are unaware of the opportunities that ML expertise can offer within the Navy, leading them to overlook the possibility of pursuing AI careers in the Navy.

The University of Florida (UF), Naval Surface Warfare Center Panama City Division (NSWC PCD), and Bay District Schools (BDS), serving over 5,000 military dependents and 69.6% of students receiving free/reduced lunch, are collaborating to establish the ML4Math program. This program has two main objectives: 1) to integrate ML into high school mathematics education in an engaging and seamless way. This approach will reach a much larger audience especially since high school math is a universal requirement. It holds particular promise for underserved students who often lack access to, or interest in, AI relevant after school programs, clubs, camps, or computing courses and 2) to expose students to NAVY STEM and potential AI education and career paths.

Technical approaches: Grounded in the concreteness fading theory, we will develop the ML4Math curricula and the ML4Math Playground, a no-code interactive platform designed to engage students in active learning of complex STEM subjects. The curriculum modules will integrate standards-aligned math and ML with elements from pop culture, social media, and culturally relevant themes to engage high school students, especially those from underserved backgrounds. By leveraging resources from NSWC PCD and BDS, ML4Math will reach military dependents and underserved students, promoting engagement in NAVY STEM initiatives.

Anticipated outcomes: (1) To advance the community's understanding of facilitating students' ML learning within a K-12 core subject such as mathematics; (2) To amplify diversity, participation, and interest in Navy STEM and careers in the realm of AI at an early stage, influencing over 24 teachers and 600 students (~70% are military dependents and other underserved students); (3) Enhance students' knowledge, engagement, and attitude towards math and ML through hands-on, applicable, and enjoyable integration; and (4) Provide a sustainable solution through effective, reusable, and standards-aligned curriculum and technology to support seamless ML integration in K-12 contexts.

Potential impact on DoD capabilities: (1) AI Workforce Development. Early exposure to ML can help in nurturing a generation of young minds with a foundational understanding of ML, ultimately enhancing national security. (2) Diversity, Equity, and Inclusion. Integrating ML in K-12 education can help address the disparities in access to ML education, leading to a more diverse and inclusive workforce. (3) Partnerships. ML4Math capitalizes on the partnership with Naval offices and military-connected schools, fostering stronger collaborations between the DoD, educational institutions, and the community partner and leading to shared resources, knowledge exchange, and collaborative problem-solving.