0.1 Cover Sheet: Solicitation 22-586

- Requested start date: February 1st, 2024, requested proposal duration: 5 years

- Related Letter of Intent (LOI): None

- Related preliminary proposal: None

- Prime organization: Whittier College

- Primary place of performance:

    - Organization name: Whittier College
    - Country: United States of America
    - Street address: 3406 E. Philadelphia Street
    - City: Whittier
    - State: California
    - ZIP Code: 90602

- Other federal agencies: None

- Other information: Antarctic fieldwork

0.2 Project Summary: Solicitation 22-586

Title: Translation of Machine Learning and Additive Manufacturing for a Diverse Scientific and Defense Workforce

Abstract (Intellectual Merits): Radio-frequency (RF) phased-array systems optimized with machine learning have become powerful tools in science and engineering. Recent progress in phased-array radar development has applications in particle astrophysics, polar research, and defense. Phased-array systems are comprised of RF antennas working in tandem to boost received signal sensitivity, and to actively scan transmitted signals without moving parts. There are, however, at least two barriers that impede phased-arrays from enhancing future science and engineering projects. First, the computational electromagnetism (CEM) properties of RF systems are designed with proprietary software that does not interface with common machine learning software. Second, RF systems are manufactured using standard machine tools, which drives up costs. We propose to create an open-source CEM and additive manufacturing ecosystem capable of 3D-printing phased array systems with conductive filament. If successful, this research will reduce costs, boost sensitivity, and lower barriers to entry in a wide range of scientific contexts, including IceCube Gen2 (radio), CReSIS, and Office of Naval Research (ONR) defense projects. This research has been supported by the ONR on a small scale, and recent results and publications indicate it is time to increase the scope of research and production.

Abstract (Broader Impacts): Whittier College is a Title-V Hispanic Serving Institution (HSI), with a proud tradition of providing access to higher education to cohorts of students from Spanish-speaking and traditionally under-represented backgrounds in Southern California and beyond. Studies conducted by our Bayard Rustin Fellows indicate that our diverse students experience a variety of difficulties in introductory STEM courses. Further, we have learned from inclusivity and STEM workshops hosted by the Cottrell Scholars Network that, in order to boost the success of diverse students, we must emphasize student dignity and self-efficacy such that all students belong and flourish in our courses. Within this context, we propose to create a free, bilingual (Spanish and English) mobile application that introduces STEM concepts within a digital environment that welcomes new students. Further, our application will use machine learning techniques to adapt to individual students, and provide insights to optimize instructor performance. Members of our community share experiences of translating mathematics problems into Spanish before solving them. Our application would both welcome such members of our community into STEM by presenting new exercises in the first language of the user. Finally, we propose two new bilingual lecture series to enhance community engagement with Whittier College and physics and engineering research. First, we propose to create a bilingual physics lecture series, hosted at Whittier College and other community venues, that presents physics research to bilingual audiences. Second, we propose a series of bilingual undergraduate recruiting events designed to welcome new students and their families into the Whittier College community.

Translation of Machine Learning and Additive Manufacturing for a Diverse Scientific and Defense Workforce

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Whittier College
Whittier, CA

May 18, 2023

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Chapter 1

Project Description

Dear Friends,

Things. [1]

Things.

Bibliography

[1] J. Haidt, "Two incompatible sacred values at american universities." Lecture In the Hayek Lecture Series at Duke University, 2016.