REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHW-26-05

High-Accuracy Speech Interpretation for Command and Control via Multi-Stage AI Pipelines

PROJECT DESCRIPTION: Within Air Force Command and Control (C2) environments, operators must process high-tempo audio communications where accuracy is mission-critical. Standard Automated Speech Recognition (ASR) systems often fail to meet the required accuracy threshold in these high-noise, domain-specific contexts, and natural language of an operator must be considered before generating output. We propose to engineer a speech interpretation pipeline to overcome these limitations. The system will orchestrate a workflow using a dockerized ASR via ZeroMQ utilizing an advanced model (e.g., Whisper) to significantly improve transcription accuracy. The refined text will then be fed into a custom-trained ML.NET model for Natural Language Understanding (NLU) to interpret operator intent and generate structured commands for the battle management software, thus increasing operational speed and reducing human error in critical decision-making loops.

LEARNING OBJECTIVES: Students will learn to architect, build, and validate a complete, mission-relevant AI system from end to end. With close mentorship from experts in back-end development, systems engineering, speech processing, and applied machine learning, students will gain hands-on experience in: real-time systems engineering, message-based architectures (ZeroMQ), multi-model AI workflows, applied Natural Language Processing (NLP) with ML.NET, and quantitative systems evaluation (measuring latency and Word Error Rate). Student interns will participate in a collaborative environment to navigate research challenges and intelligibly defend their architectural decisions.

ACADEMIC LEVEL: Master's**;** Doctoral

DISCIPLINES NEEDED: Computer Science; Computer Engineering

RESEARCH LOCATION: Wright-Patterson Air Force Base, Dayton, Ohio

RESEARCH MENTOR: Michael Lambert
Bachelor's in Computer Science, Wright State University, 1995

Michael Lambert is a Research Computer Scientist at the Crew Systems Integration Lab (CSIL) at Wright-Patterson AFB. He specializes in developing and deploying human-machine teaming solutions that directly enhance Warfighter operational capabilities. His work at CSIL focuses on innovative software architectures and leading collaborative development teams to deliver impactful technologies for defense applications.

RESEARCH MENTOR: Brian Ore
Master's in Electrical Engineering, Wright State University, 2007

Mr. Brian Ore is an Electronics Engineer in the Human Effectiveness Directorate at the 711th Human Performance Wing, Air Force Research Laboratory. He has over 20 years of research experience in the speech processing field, over which time he has worked to develop technologies for speaker recognition, speech recognition, text-to-speech synthesis, and spoken language translation.

Photo courtesy of the Air Force Research Laboratory