REPPERGER RESEARCH INTERN PROGRAM

RESEARCH PROJECT #: AFRL-RHW-25-08

Predictive Knowledge Exploration Guided through Multimodal Sources

PROJECT DESCRIPTION: Within the Air Force we have repositories of data specific to our domain that require a certain degree of sensitivity, particularly mission planning documents and online posts indicating extremist behavior. Due to the sensitive nature of this data, current multimodal AI models being developed, such as predictive modeling, vision large language models, and retrieval-augmented generation, are ineffective for our needs and will never meet the high threshold of confidence and accuracy the Air Force requires if left to progress without our needs in mind. We propose to utilize these recent developments and research in our sensitive domain leveraging customized dialog systems and generative modeling to propose new mission plans or predict early extremist behavior with a clear measurable confidence, thus relieving manpower and potentially preventing harmful actions coming to fruition all while maintaining sensitivity and confidence in our results.

LEARNING OBJECTIVE: Students will learn to guide research at the forefront of the field. With close mentorship from 3 experts in their field and a team of 4 additional experts to seek guidance from, each with 3-40 years of research experience, students will gain hands-on experience researching and implementing models in active research areas including, but not limited to Large Language models, Computer Vision, Natural Language Processing, Stochastic Modeling, and Knowledge Graphs. Student interns will participate in a collaborative environment to navigate research challenges, intelligibly defend their methodologies, and author a paper on their findings.

ACADEMIC LEVEL: Masters; Doctoral

DISCIPLINE NEEDED:

- Computer Science

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

RESEARCH MENTOR: Emily Conway, M.S.
Applied Mathematics, California State University, 2019

Ms. Conway is a Research Mathematician in the Human Language Technology Team of the Human Effectiveness Directorate in the Air Force Research Laboratory at Wright Patterson AFB. Ms. Conway received a MS in Applied Mathematics from the California State University, Long Beach. Her research interests include Large Language Models (LLMs), Reinforcement Learning (RL), and Knowledge Graphs (KGs).

RESEARCH MENTOR: Geremy Gwinnup, D. Eng.
Computer Science, Johns Hopkins University, 2023

Dr. Jeremy Gwinnup is a Senior Research Computer Scientist in the Human Language Technology Team of the Human Effectiveness Directorate at Wright-Patterson AFB in Dayton, OH. He received his D. Eng in 2023 from Johns Hopkins University, with a research focus on Multimodal Natural Language Processing via study with the Center for Speech and Language Processing. His research interests include multimodal machine translation and large-scale language models with an emphasis on how to adapt these models and systems to Air-Force relevant domains.

RESEARCH MENTOR: Grant Erdmann, Ph.D.
Mathematics, University of Minnesota, 2003

Dr. Grant Erdmann is a Senior Mathematician in the Human Language Technology team of the Human Effectiveness Directorate at Wright-Patterson AFB. He received his Ph.D. in Mathematics in 2003 from the University of Minnesota, with focus in applied mathematics and optimization. His research interests include optimization, speech synthesis, and topological data analysis.

The material was CLEARED on 09 Nov 2023; Case Number: AFRL-2023-5724.