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Poster Abstracts

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Cecilia Alm Rochester Institute of Technology (NRT Program Poster)

Title: AWARE-AI NSF Research Traineeship Program

Abstract: AWARE-AI trainees experience convergent AI research guided by faculty in research tracks and career-enhancing activities that address skills and knowledge beyond traditional graduate AI curricula. The poster presents an overview of the AWARE-AI program, discusses recent evaluation outcomes including skills and knowledge gains, and highlights trainees' research projects and program achievements. We also introduce an international mobility partnership with ML Labs in Dublin.

Cedric Bone Rochester Institute of Technology

Title: Human Factors in an Interactive Machine Learning System

Abstract: Interactive machine learning (IML) is a paradigm that combines machine learning algorithms with human intelligence to create a more efficient learning process. In IML, considering both the algorithmic and human factors involved are essential for creating an effective system. While there has been extensive research on the algorithmic factors, studying human factors in IML system development has received less attention. In particular, considering cognitive load is essential when designing systems that humans interact with since cognitively intensive tasks can adversely impact the user experience and, in the context of IML, may also affect training, leading to reduced system performance. The focus of this study is to determine the effect of collaboration and system controllability on participant cognitive load and model performance in an IML labeling system. This study uses an IML system that links a long short-term memory (LSTM) model to a named entity recognition (NER) labeling interface. Preliminary analysis indicates that pair-based collaboration may not impact cognitive load or model performance. Conversely, the controllability of the system may impact cognitive load, but not model performance.

Erin Clark Cleveland State University

Title: Electrode sleeve for cervical spinal cord injuries

Abstract: Every year there are 250,000 to 500,000 new spinal cord injuries worldwide. In the US alone there are about 18,000 new traumatic spinal cord injuries each year. People with cervical spinal cord injuries struggle to perform activities of daily living like dressing, brushing their teeth, or eating independently. Functional electrical stimulation (FES) is currently used to increase upper extremity movement and function. However, individually placing electrodes is very time-consuming and variable. The goal of the electrode sleeve is to decrease the time for set up, reduce muscle fatigue, and improve repeatability.

Claire Foley Cleveland State University

Title: Boundary Smashing - Liminal Space as a Vehicle for Transdisciplinarity

Abstract: Transdisciplinary research presents an opportunity to address complex societal issues and create new knowledge through transcending disciplinary boundaries. However, disciplinary differences can be barriers to transdisciplinarity – getting stuck is common. The Boundary Smashing Model of Transdisciplinarity conceptualizes an approach for “unsticking” transdisciplinary research. Developed by a team of social scientists through observations of a collaborative human-machine systems project, the model argues that boundary smashing allows teams to exist temporarily in a zone without traditional structure, allowing for true collaborative action. The model describes boundary smashing as a shift from boundary-preserving disciplinary states to generative metaphors, anticipatory learning, and more sensemaking.

Brandon Kelly Clemson University

Title: Manufacturing Dataflow in Future Factories

Abstract: With manufacturing operations no longer limited to a single assembly line or factory, tracking information between each step has become paramount. Additionally, a mixture of human and robotic actions is needed as assembly lines become more complex. In cases such as medicine, the consequences of mistakes can become even more severe. As such, a model production environment was proposed, and test fixtures were constructed to evaluate data flow in a manufacturing environment and human-robotics interaction. The test setup allowed for further investigation of these ideas while also utilizing current industry standard tools.

Matthew Krugh Clemson University (NRT Program Poster)

Title: NSF THINKER: A New National Model for Integrated Education Technology-Human INtegrated Knowledge, Education and Research

Abstract: The THINKER (Technology-Human INtegrated Knowledge, Education and Research) program is an integrated graduate-level curriculum exploring the concept of integrating the human element to the emerging smart and digital manufacturing landscape.

Emily Kuang Rochester Institute of Technology

Title: Crafting Human-AI Collaborative Analysis for Usability Evaluation

Abstract: AI is increasingly used in usability analysis, where UX evaluators review test recordings to identify usability problems. However, most AI systems rely on fully automated approaches, which can lead to distrust. In my dissertation, I explore AI as a tool to assist rather than replace human judgment. Through an international survey, we examined the current practices and challenges faced by UX evaluators, revealing an opportunity for AI assistance. We then investigated the collaborative work between UX evaluators and AI, using either non-interactive visualizations or interactive conversational assistants (CAs). This research aims to identify interactions and representations that foster productive and trusting collaborations with AI.

Michelle Marji University of Wisconsin–Madison

Title: The Effects of Synchrony on Trust in Human Robot Interaction

Abstract: Research on synchronous movement and trust has not been well tested in human-robot collaborations. We predict that when humans move synchronously with a robot, they will feel greater trust and liking towards the robot. To test this idea, participants will complete a task synchronously or asynchronously with a robotic arm. Then, participants will report their feelings about the robot via surveys. Finally, participants will play a game that will assess their trust in the robot in a new task. This work is currently being developed and piloted.

Kareemat Melaiye Cleveland State University

Title: Dissolvable Staples and Delivery Device

Abstract: The development of the Dissolvable Staples and Delivery Device aims to solve the problem regarding current standards of care in skin graft surgeries, which require a second procedure to remove the staple, since they do not degrade within 7-10 days. The final solution consisted of a degradable staple composed of beeswax and gelatin, along with a device that deploys these staples.

Joshua Murray Clemson University

Title: Hardware-in-the-Loop Engine Testing to Rapidly Evaluate the Impact of Vehicle Design Choices

Abstract: Testing automobiles to maximize their human-centeredness and ensure the highest positive societal impact is limited by a tradeoff between fidelity and cost. High-fidelity full vehicle prototypes are costly, whereas cheaper simulations seldom capture all real dynamics. Hardware-in-the-Loop (HIL) testing is a compromise where tests are conducted with part of the vehicle in real hardware and the rest simultaneously in simulation. In this work, a HIL system was developed with communication between a vehicle model in Simulink and a physical engine. The HIL system can rapidly test many vehicle configurations and evaluate factors such as fuel economy, emissions, and drivability.

Bilge Mutlu/Mya Schroder University of Wisconsin–Madison (NRT Program Poster)

Title: INTEGRATE - Integrating Robots into the Future of Work

Abstract: INTEGRATE, short for “Integrating Robots into the Future of Work,” is a National Science Foundation Research Traineeship (NRT) program developed to provide a unique academic environment to enrich the training of graduate students in STEM disciplines, including computer science, engineering, psychology, and economics, to address fundamental research challenges in realizing the integration of robots into the future of work at the micro, systems, and macro scales.

Calvin Nau Rochester Institute of Technology

Title: A Graph Attention Model to Solve the Kidney Exchange Problem

Abstract: The Kidney Exchange Problem (KEP) optimizes the exchange of kidneys between non-compatible patient-donor pairs and altruistic non-directed donors. Exact approaches maximize the weighted number of exchanges. However, a disparity exists between the objective value obtained during optimization and realized during implementation. Presented is a scalable graph attention model for optimizing the KEP capable of using a multi-dimensional feature set as input. The graph attention model for the KEP is compared to exact approaches. The significance of the approach is two-fold; (1) extending attention-based optimization approaches to directed, sparse graphs and (2) enabling novel approaches to fairness and failure-aware KEP optimization.

Michael Peechatt Rochester Institute of Technology

Title: Modality Dropping Strategies For Perception Inspired Robustness

Abstract: This affective computing work addresses confusion modeling with a novel training strategy. We introduce a set of modality dropping strategies that simulate the partial perception of sensory data and evaluate its influence on a heavily multimodal dataset, consisting of speech transcripts and individualized confusion annotations from human subjects. We leverage a custom 1D-CNN which ignores dropped values when updating gradient weights. We utilize OpenAI's pre-trained text-embedding-ada-002 model for the speech transcripts and fuse it with sensor data for use in confusion modeling. Experimental results suggest that modality dropping at training can promote robustness, matching performance to on complete data.

Mahanthesh Ramchandra Cleveland State University

Title: Robot Assistance Feeding Platform for Self-Feeding

Abstract: Eating and drinking is an essential part of everyday life. And yet, there are many people in the world today who rely on others to feed them. In this work, we present a prototype robot-assisted self-feeding system for individuals with movement disorders. The system is capable of perceiving, localizing, grasping, and delivering non-compliant food items to an individual. We trained an object recognition network to detect specific food items, and we compute the grasp pose for each item. Human input is obtained through an interface consisting of an eye-tracker and a display screen. The human selects options on the monitor with their eye and head movements and triggers responses with mouth movements.

Rodney Sanchez Rochester Institute of Technology

Title: Online Image Out of Distribution Detection for Reinforcement Learning through Familiarity and CAUTION

Abstract: Deploying machine learning methods in the field is severely limited by out-of-distribution (OOD) scenarios. This concern is compounded in reinforcement learning methods, due to the necessity to train while deployed and how the OOD is represented. This work provides a taxonomy of OOD types in reinforcement learning environments, breaking them down into Markov Decision Process (MDP), Cosmetic, and combined. Furthermore, we introduce Familiarity Online Out of Distribution Detection (FOOODD), a dual predictor random network distillation (RND) method that produces a pseudo-count for state environmental distributions and agent training distributions that permits detecting OOD instances. We also demonstrate that a scheduling method, CAUTION, can modify the agent's sensitivity to environmental changes. We tested our OOD detection method in adaptable RL environments such as MINIGRID and METAARCADE. MINIGRID and METAARCADE were selected due to their ability to change visual parameters (e.g., color palettes) and dynamic parameters (e.g., agent speed). MINIGRID was also used to test the ability to detect the OOD change in a partially observable MDP. Finally, the Robot Operating System (ROS) Gazebo library was used to simulate a local environment with a robot, where MDP, Cosmetic, and Combined OOD changes were made to test the developed method. Finally, the method was evaluated with a real-world robot to determine how well the agent can detect the OOD changes. Our results demonstrate that FOOODD creates a more accurate measurement of OOD when compared to baseline RND. Specifically, FOOODD is better at detecting MDP OOD, is less sensitive to cosmetic changes, and outperforms in POMDP environments.

Eric Schearer Cleveland State University (NRT Program Poster)

Title: Human-Machine Systems for Physical Rehabilitation NSF Traineeship Program

Abstract: Trainees participate on three transdisciplinary teams that include people with lived disability experience according to the Integrated Knowledge Translation Principles for teaming with the disability community. Three objectives guide the project team's work. First is to create physical human-machine interaction technologies that improve individuals' abilities to access, engage with, and manipulate their physical, social, and sensory environments. Second is to understand human processing and communication and develop artificial processing and communication to allow people with limited sensorimotor function to engage in meaningful activities (e.g., self-feeding, grooming, cooking) in realistic environments. Third is to develop therapeutic agents that are engineered to treat organ defects at a cellular and tissue level. This novel, human-centered traineeship model includes users in design, development, and implementation of technologies, while expanding students' mindsets and skills to work interactively towards these goals.

Karthik Subramanian Rochester Institute of Technology

Title: Temporal and Spatial Aggregation Network for Emotion Estimation in Human-Robot Interaction: Evaluation of Real-time performance

Abstract: This study aims to validate an aggregation network previously created for estimating emotions like arousal and valence from sequences of images. It focuses on problems with current datasets that require labeling each frame individually. Traditional methods depend on detailed manual annotations for every frame, which is often not practical and can be very time-consuming. Our approach modifies existing datasets to allow the network to learn from sets of frames that share a single emotional label, instead of needing every frame to be labeled. Early results on adjusted datasets, such as 'AFEW-VA', show that the aggregation network can capture emotional changes over time better than traditional methods that look at each frame separately. The next step is to test this approach in real-world settings by comparing the network's estimates with people's self-reported emotions during interactions with robots. This approach could lead to a more practical and scalable way to measure emotions in dynamic environments like human-robot interactions.

Meredith Sutton Clemson University

Title: Impact of Visualizations and Framing on Decision-Making for Tradespace Exploration

Abstract: Tradespace exploration (TSE) describes the activity occurring early in the design process through which stakeholders explore a broad solution space in search of more-optimal alternatives. In doing so, these stakeholders attempt to maximize the utility of a chosen solution while understanding the tradeoffs and compromises that may be required to find an acceptable solution. Decision-making stakeholders can often find themselves working at odds and attempting to maximize vastly different objectives in the process. One way to rectify these contrasting viewpoints is to intentionally introduce a group problem framing. In this experiment, teams of students were presented with a TSE problem represented by morphological matrices and utility functions and asked to find the most optimal vehicle configuration from the constituent alternatives. Students worked through three problems in three conditions, simulating a conventional team decision-making approach, an antagonistic approach, and a group-framed collaborative approach.

Rajesh Titung Rochester Institute of Technology

Title: Personalized Federated Learning for Heterogeneous Behavioral Modeling

Abstract: Human multimodal behaviors are diverse and complex, making it difficult for a single centralized model to capture individual nuances. We analyze expressive emotive interactions in multimodal datasets, highlighting statistical heterogeneity among individuals. This motivates our focus on personalization using federated learning (FL), which integrates centralized and client models for shared and individualized behaviors, respectively. However, current FL research overlooks the heterogeneity of naturalistic interactions. To address this, we propose FedSession, a personalized federated learning strategy that models individual and paired interlocutor behaviors. FedSession outperforms existing PFL methods in accommodating heterogeneous data distributions.

Flanagan Waldherr Clemson University

Title: Examination of Human-Autonomy Teaming in Manufacturing

Abstract: Automotive manufacturing, particularly assembly, is presently seeing significant change driven by shifts toward personalization by manufacturers. This translates to increased variability faced by automotive assembly workers and, consequently, greater demands on those workers, with consequences including negative mental and physical health implications. Human-autonomy teaming offers a potential means of addressing this issue, with autonomous agents bearing some workload for their human counterparts while maintaining human capabilities in a manufacturing system. The work described seeks first to examine human interaction with autonomous systems in a manufacturing setting before pursuing novel directions in real-time workload estimation to improve communication in such teams.

Liqun Xu University of Wisconsin–Madison

Title: Towards Automated Physics-based Modeling: Fusion of Construction Equipment Data for Efficient Simulation

Abstract: Physics-based simulations are vital for autonomous construction equipment design, but model preparation is time-consuming due to mechanical and geometric data integration. Current methods for modular robots fall short for construction equipment. This paper presents an automated approach using a template library with hierarchy and joint templates, selecting templates based on equipment type. An LLM extracts and inputs unspecified joint data from technical specs. The 3D CAD model is converted to a Universal Scene Description (USD) model for data fusion, with users adjusting names and hierarchy. Our method reduces modeling time to 6% of manual methods while maintaining accuracy.