WYOMING COMPUTING SYMPOSIUM

DATA ANALYTICS & COMPUTING ADVANCES FOR DRONE APPLICATIONS

SPONSORED BY:

UW School of Computing & UW College of Engineering and Physical Sciences Electrical Engineering and Computer Science

Wyoming Union, Laramie, WY | September 19th & 20th, 2024

Agenda & Program

Thursday, September 19

7:30 am Beverages & Light Breakfast Available — Main Stage

8:00 am Opening Remarks — Main Stage

Parag Chitniss, *VP for Research and Economic Development – University of Wyoming*

8:15 am Keynote Address — Main Stage

Matthew Burgess, *Geospatial Analyst and UAS Operator – USGS National UAS Project Office*

9:15 am Break

9:30 am Lightning Talks — Main Stage

Sean Field, *Assistant Professor – School of Computing, Anthropology – University of Wyoming*

Riley Knoedler, *Ecologist – WEST, Inc.*

James Amato, *Assistant Research Professional – School of Energy Resources – University of Wyoming*

Mike Killean, *Deputy Director – UW Advanced Research Computing Center (ARCC)*

Ramesh Sivanpillai, *Instructional Professor – School of Computing – University of Wyoming*

10:00 am Break

10:15 am Presentations — Main Stage

Travis Bingham, *Administrative Sergeant – Sublette County Sheriff's Office*

Ben Koger, *Assistant Professor – School of Computing, Zoology & Physiology, Haub School – University of Wyoming*

Ethan Greenawalt, *Officer – Laramie Police Department*

Hamid Jafarnejad Sani, *Assistant Professor – Mechanical Engineering – Stevens Institute of Technology*

11:15 am Poster Session — Exhibit Hall

View Poster Presenter Information

12:00 pm	Governor's Luncheon	Luncheon Hall

Featuring an address from **Governor Mark Gordon** entitled **The Cowboy State Economy: Technology, Innovation, and Enterprise.**

Introductions from UW President **Ed Seidel** and School of Computing Director **Gabrielle Allen.**

Boxed Lunches provided.

1:30 pm	Presentations	Main Stage

P. Subashini, *Professor – Computer Science – Avinashilingam Institute for Home Science and Higher Education for Women*

Jun Chen, *Associate Professor – Electrical & Computer Engineering – Oakland University*

2:20 pm	Break	
2:30 pm	Panel Discussion	Main Stage

Disaster Response & Environmental Impact
Moderator: **Michael Kirby**, *Professor – Mathematics, Computer Science – Colorado State University*

Panelists:

- **Sean Castaneda**, *PhD Student, Civil and Architectural Engineering, University of Wyoming*
- **Peter Nelson**, *Associate Professor, Civil and Environmental Engineering, Colorado State University*
- **Melissa Reynolds**, *Professor, Department of Chemistry, Colorado State University*
- **Maddy Zimmerman**, *UAS Specialist, University of Vermont Spatial Analysis Lab*

3:30 pm	Closing Remarks	Main Stage
3:45 pm	Poster Session, Industry Expo, UAV Exhibition	Exhibit Hall

Aerial Solutions of Wyoming

USGS

UW Advanced Research Computing Center

UAV Exhibit from UW School of Computing, School of Energy Resources

Poster Session

Friday, September 19

7:30 am	Beverages & Light Breakfast Available	Main Stage
8:00 am	Opening Remarks	Main Stage

Melissa Reynolds, *Faculty Director - Campus Research Cores Facilities, Office of the Vice President for Research – Colorado State University*

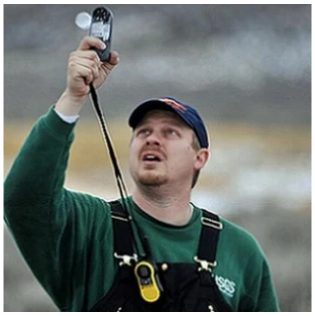
8:15 am	Keynote Address	Main Stage

Donna Delparte, *Associate Professor – Geosciences – Idaho State University*

9:30 am - 12:30 pm	Workshops & UAV Demos	Multiple Locations

View Workshop & Demo Information

Keynote Addresses



Matt Burgess

Geospatial Analyst and UAS Operator – USGS National UAS Project Office

Can a Hobby Turn into a Career?

My keynote presentation will introduce the audience to my journey as an uncrewed systems professional, address drone applications as well as data analytics and computing, and provide insight and tips for developing a career with uncrewed systems.

Bio: *Matt Burgess is a Geographer at the National Unmanned Aircraft Systems Project Office in the Geosciences and Environmental Change Science Center.*

Donna Delparte

Associate Professor – Geosciences – Idaho State University

Skies the Limit! Exploring the potential of drones, data, and machine learning for environmental applications

Drones, when equipped with an ever-increasing range of lightweight and efficient hyperspectral, multispectral, thermal, and LiDAR sensors are generating a wealth of data that is timely, efficient, and typically at a resolution that is extraordinary for geospatial analysis. This talk will cover the challenges of processing these large datasets and showcase examples of how machine learning can harness drone data to provide insights to solve complex environmental challenges.

Bio: *Dr. Donna Delparte, is a Professor in the Department of Geosciences at Idaho State University. Dr. Delparte is a certified FAA remote pilot and has over 13 years of experience flying fixed-wing and multicopter UAS with payloads including hyperspectral, multispectral, and LiDAR sensors to acquire imagery for natural resource management, agriculture, geohazards, and conservation research. Her expertise leverages machine learning and AI through open-source python and R toolkits to conduct advanced image analysis of these high resolution, large datasets. Her recent research focus is using UAS imagery for detecting thermal heat stress in plants and river systems, advanced machine learning such as YOLO for object detection in UAS imagery, spectral analysis for crop threats, and gaming engine technology for visualization of complex landscape processes. Dr. Delparte teaches in ISU's Masters of Geographic Information Sciences program - her courses include graduate and undergraduate courses in: remote sensing, GIS, and uncrewed aerial systems (UAS) for conservation and resource management applications.*

Talks

Travis Bingham

Administrative Sergeant – Sublette County Sheriff's Office

sUAS Traffic Crash Reconstructions (10 minutes)

Unmanned Aerial Vehicles (UAVs) have revolutionized numerous industries, offering unparalleled perspectives and data collection capabilities. In the context of crash investigations and crime scene reconstruction, drones provide investigators with the ability to capture high-resolution aerial imagery, generate precise 3D models, and document scenes with unprecedented accuracy and efficiency. The Sublette County Sheriff's Office Drone team has been around since October 2019 and provide multiple disciplines of Public Safety with UAS technology. This presentation for requested data and UAS explores the integration of UAV technology in drone crash investigations and crime scene reconstruction, highlighting the methodologies, challenges, and advancements in the field. We will discuss local case uses where drones have been deployed to reconstruct crash sites and crime scenes, illustrating how aerial data is processed and analyzed to create detailed reconstructions.

Attendees will gain insights into the latest tools and software used for drone-based scene reconstruction, as well as best practices for deploying UAVs in complex environments. By the end of this session, participants will have a comprehensive understanding of how drones can be effectively utilized to enhance investigative outcomes and improve the accuracy of reconstructions.

Ben Koger

Assistant Professor – School of Computing, Zoology & Physiology, Haub School – University of Wyoming

Efficient and accurate spatio-temporal population monitoring of mobile Pacific salmon using drones and computer vision (10 minutes)

Ecological monitoring is challenging but fundamental to natural resource management and conservation. Ecosystems change both over seasons and over decades, making data that spans relevant scales of time and space vital yet rare. Creating such long-term datasets requires years of focus, funding, and human effort. New, automated methods, enabled by advances in imaging and machine learning, allow researchers to observe ecosystems at vastly larger scales than previously possible, enabling long-term monitoring in novel environments and expansion of existing datasets. However, these new techniques generally differ from the observation process and protocols of human observers. Consequently, incorporating new methods into existing monitoring efforts is complicated; the relationship between new and old data products must be quantified, and new methods must produce data in formats and units interpretable by existing data users such as resource managers. We present a method using imaging drones, combined with deep learning-driven image processing and mapping techniques, to efficiently monitor a series of Alaskan sockeye salmon nesting ponds that contribute to the world's largest wild salmon fishery. Researchers, including some of these authors, have monitored a subset of these ponds, and the larger watershed, for decades using ground-based observation methods, resulting in a long time series of salmon abundance estimates at index sites. But, because of the required human effort, only a fraction of potential spawning habitats have been monitored. We demonstrate that our method provides data similar to previous decades-long human monitoring (i.e., sex-specific counts per pond several times each season) but at higher frequency (daily) and at additional spawning areas, as well as novel information about habitat use patterns and movements. We discuss the importance of maintaining this dataset going forward and the implications and practicalities of efficiently monitoring many more habitats across this and other critical salmon habitats in the future.

Ethan Greenawalt

Officer – Laramie Police Department

Drone Use in Law Inforcement (10 minutes)

The integration of unmanned aerial vehicles (UAVs), commonly known as drones, into law enforcement operations, represents a transformative advancement in modern policing. This abstract will focus on UAV's role in enhancing surveillance, crowd management, and crime scene analysis. Drones offer real-time aerial perspectives that significantly improve situational awareness, allowing for more effective monitoring of large events and high-risk situations. They also facilitate detailed inspections of crime scenes and accident sites with minimal disruption, enhancing evidence collection and analysis. Despite their potential, the use of drones does have multiple concerns from the public which include: Personal privacy, data security, and regulatory compliance. Addressing these challenges requires a balanced approach that incorporates policies and community engagement to ensure ethical and legal use while maximizing operational benefits.

Hamid Jafarnejad Sani

Assistant Professor – Mechanical Engineering – Stevens Institute of Technology

Security-Aware Perception, Decision-Making, and Control for Autonomous Multi-UAV Systems (20 minutes)

Autonomous unmanned aerial vehicles (UAVs) powered by artificial intelligence (AI) are becoming ubiquitous in modern society. The increasingly sophisticated AI algorithms in control and perception loops of UAVs are susceptible to new forms of prediction, deception, and disruption targeting these algorithms. This talk addresses theoretical and experimental approaches for security-aware control, perception, and decision-making in multi-UAV systems (e.g., swarms of UAVs) in adversarial settings, where UAVs operate in uncertain and dynamic environments under partially observable. We divide this complex problem into three interconnected components and address them using three complementary attack and defense frameworks: (1) vison-based perception under adversarial perturbations in dynamic environments, (2) multi-agent learning and cooperation under partial state observations in adversarial settings, and (3) attack-resilient distributed detection and control framework for networked systems. To realize, integrate, and evaluate the proposed approaches, we use a testbed for multi-UAV simulations and experiments.

The second part of the talk focuses on UAV applications in aerial 3D scanning. 3D site models can be used in various civilian and military applications, such as infrastructure inspection and mapping a disaster zone to aid with search and rescue missions. However, the success of these methods heavily depends on the quality of the viewpoints used, and the lack of data in some areas can lead to gaps in the 3D model. In UAV applications such as inspection, surveillance, 3D modeling, and mapping, optimal viewpoint selection is crucial for information gain and operational efficiency. Typically, a pilot manually sets waypoints or employs standard planning methods like circular paths. The need for multiple flight missions to complete a 3D model makes the process time-consuming and even impractical in some cases (e.g., in hazardous and hard-to-reach locations), especially considering the limited flight time of UAVs. Additionally, current practices generally require human intervention to define a nominal trajectory for the robots, which adds to the complexity of the task, particularly when multiple UAVs are used for the task. This talk presents an approach for optimizing the UAV’s trajectory for collecting optimal Next-Best View (NBV) for 3D reconstruction models. Unlike traditional methods that rely on predefined criteria or continuous tracking of the 3D model’s development, our approach leverages reinforcement learning to select the NBV based solely on single camera images and the relative positions of the UAV with the reference points to a target.

P. Subashini

Professor – Computer Science – Avinashilingam Institute for Home Science and Higher Education for Women

Explainable, physics aware data driven deep learning for drone data analysis (20 minutes)

Integration of explainable AI (XAI) and physics-aware models in data-driven deep learning for drone data analysis aims to enhance the interpretability, reliability, and effectiveness of AI systems. This approach combines the strengths of traditional physics-based models with modern data-driven techniques, ensuring that the AI models not only perform well but also provide understandable and physically consistent results. Combining explainable AI with physics-aware, data-driven deep learning improves the drone data analysis. This research ensures that AI models are not only accurate but also understandable and consistent with known physical laws, making them invaluable tools in applications like agriculture, disaster management, and infrastructure inspection. This talk will cover the above mentioned topic with case studies.

Jun Chen

Associate Professor – Electrical & Computer Engineering – Oakland University

Coordination of multi-agent systems through reconfigurable MPC and decentralized RL (20 minutes)

Embedded AI and control have been proven to be key enablers to improve the efficiency and intelligence of autonomous systems. However, the scalability of existing algorithms for large-scale systems remains unsolved. This talk focuses on the recent development of reinforcement learning and model predictive control, with a special focus on their applications in electric vehicles and autonomous vehicles.

This talk will be divided into two parts. The first part will focus on autonomous vehicle platooning control, where the reconfigurable model predictive control will be applied to reduce the computational load while achieving system-level optimization. The second part will focus on decentralized multi-agent reinforcement learning for coordination of multi-agent systems.

Lightning Talks

Sean Field

Assistant Professor – School of Computing, Anthropology – University of Wyoming

An "Everything Bagel" Approach for UAS Applications in Archaeology (5 minutes)

Data availability is an inherent challenge in archaeology; the distribution of archaeological sites, artifacts, and features is unknown, and our data is often incomplete. These challenges ultimately compound error in our interpretation of past human behavior. To combat these challenges, photogrammetry, LiDAR, satellite data, and machine learning are being integrated in a multi-sensor, multi-method approach that aims to rapidly classify and identify archaeological sites (e.g., large residential structures), features (e.g., architectural components within structures), and artifacts (e.g., ceramics). Initial results from recent surveys in the U.S. Southwest suggest the feasibility of using drones and advanced data processing to produce robust datasets of archaeological materials at multiple scales. While early outcomes highlight the promise of machine learning in UAS-based archaeological survey, they also caution its utility as an interpretive agent.

Riley Knoedler

Ecologist – WEST, Inc.

A Custom Drone for Bat Monitoring (5 minutes)

Western EcoSystems Technology, Inc. (WEST), in partnership with Persimia LLC, has developed a custom uncrewed aircraft system (UAS) equipped with thermal cameras and acoustic detectors to monitor bat populations. In addition, WEST has developed artificial intelligence algorithms to automate data processing and efficiently detect birds and bats in the collected thermal footage. These algorithms combine data augmentation, deep learning, and object tracking to identify portions of video that contain birds or bats. The identified video clips are then passed to biologists for final review. Using this process, the time required for manual footage review decreased by 92%, and we maintained a greater than 80% detection probability of bats. Paired with the acoustic detections from the custom UAS, this method enables estimation of trends in bat species composition and abundance. While this method was developed and tested at wind energy facilities, it is transferable to other types of facilities and environments.

James Amato

Assistant Research Professional – School of Energy Resources – University of Wyoming

Navigating Blue UAS and NDAA Compliance (5 minutes)

In the rapidly evolving landscape of unmanned aerial systems (UAS), compliance with government regulations is paramount for both security and operational efficacy. This talk will delve into the intricacies of Blue UAS and NDAA (National Defense Authorization Act) compliance, offering a comprehensive overview of the regulatory frameworks and their implications for UAS deployment. The talk will provide practical guidance on navigating these regulatory requirements, including best practices and potential challenges.

Mike Killean

Deputy Director – UW Advanced Research Computing Center (ARCC)

Empowering Research with Computational Resources (5 minutes)

A brief overview of the UW Advanced Research Computing Center and the services it can provide.

Ramesh Sivanpillai

Instructional Professor – School of Computing – University of Wyoming

Identifying epiphytes with deep learning methods. (5 minutes)

This presentation will highlight the collaborative research between UW School of Computing and Amrita University aimed at identifying epiphytes in images acquired by drones using deep-learning algorithms. This work focused on training students

Poster Session

Shannon Albeke

Sr Research Scientist – WyGISC, School of Computing – University of Wyoming

The ability to estimate total plant biomass at the landscape scale is a critical component for accurate assessments of the ecohydrological implications of climate change in arid environments. The use of allometric scaling to predict water storage and productivity of columnar cacti has been suggested as an efficient method to quantify the ecohydrological impacts. The measurements include photosynthetic surface area and stem volume. However, measurement of many individual plants at the landscape scale can be exceedingly time-consuming and potentially inaccurate. Our experiment aimed to compare hand-measured and remotely sensed (DJI Mavic Pro UAS or Pixel 6 mobile phone) above ground stem surface area and volume estimates for five saguaro and five organ pipe plants located in Punta Chueca, Mexico. We hypothesized individual plant measurements estimated via photogrammetric methods would be lower than the same hand-measured estimates due to the often-irregular shape of columnar cacti stems. Our results demonstrate remotely sensed stem volume and surface area estimates are comparative, and perhaps superior, to hand-based measurements of columnar cacti. In general, measurements from the two methods were quite similar, with the photogrammetric method values being lower than hand measurements for nine of ten volume (μ = 0.0132 m3 difference) and eight of ten surface area (μ = 0.264 m2 difference) estimates. We found a species-specific trend in volume estimation (remote – hand) in which overestimation increased linearly with plant height for saguaro but was unbiased for organ pipe. Additionally, image capture methods were approximately three times more rapid, and required fewer people to collect, than hand measurements for the same plants. Our work demonstrates the validity of remotely captured estimates of stem structural traits for columnar cacti. Future work includes image capture using gridded flight patterns over larger areas instead of circular patterns around individual plants as well as 3-D Convolutional Neural Network (CNN) machine learning methods for automated object extraction and estimation of shoot structural traits.

Krishnaveni Marimuthu

Assistant Professor – Computer Science – Avinashilingam Institute for Home Science and Higher Education for Women

Smart Runway Safety: AI-Driven Detection of Foreign Object Debris for Drone Imagery

Aviation security has been more focused on reducing the hazards connected with Foreign Object Debris (FOD) on airport pavements, which could pose serious threats to aircraft safety during take-off and landing, potentially resulting in costly damage or catastrophic accidents. Conventional FOD detection systems, including radar, infrared technology, and stationary cameras, have shown shortcomings, notably in terms of accuracy and radar's high false-positive rates when detecting tiny debris. The current (FOD) detection system in India has significant drawbacks since it does not employ drone images. This indicates significant limitations in the nation's aircraft safeguards. This proposed method aims to detect FOD using drone-captured images and effective artificial intelligence techniques for Indian scenarios. The method incorporates deep learning algorithms to evaluate a large number of images captured by drones by classifying into specific categories such as paper, metal, bolts, plastic, and plastic bottles. The proposed design is made to function under a variety of lighting conditions, such as bright sunlight and cloudy conditions. The training process uses a number of data augmentation methods, such as rotation, scaling, and color modifications, to improve the resilience of the model. Transfer learning is used to optimize the model, taking use of pre-trained networks to increase detection accuracy and efficiency. By automating FOD identification using this novel technique, the proposed method aims to significantly increase runway safety and operational efficiency, providing an accurate way to reduce the probability of debris-related aviation disasters.

V.V. Sajith Variyar

Assistant Professor – Amrita Center for Computational Engineering and Networking – Amrita University

**Presenting Virtually*

Epiphyte Identification in UAV Acquired Images Using Deep Learning Algorithms

Advancements in AI-based data analytics and computing frameworks have led to the creation of intelligent applications that automate processes for identifying targets in datasets. UAVs are used to acquire images of epiphytes which grow in areas that are difficult to access. These images are acquired with complex background, uneven lighting inside the canopy, and presence of other vegetation. We evaluated four Deep Learning (DL) algorithms – UNet, DRUNet, Pix2PIx, and TransUNet – for identifying epiphytes in these aerial images acquired in Costa Rica. Each algorithm, designed to handle minimal training samples, were trained with < 90 aerial images. UNet predicted images had higher Intersection over Union (IoU) scores while TransUNet predicted images had higher IoU scores. Rest of the models struggled to handle images acquired low-light and shaded conditions or under presence of other background vegetation. All 4 models prioritized local over global features impacting accuracy on smaller, heterogeneous dataset. Also, these networks lacked effective fusion of features for improving predictions from fewer samples and focusing on the important regions in the input images. To address these limitations, we proposed a Multi-Branch Dual Attention Segmentation Network. This novel architecture includes dedicated branches for global and local feature extraction and employs spatial and channel attention mechanisms to focus on key regions. The proposed model had 5% higher IoU values for close-range images, 48% higher for low-light conditions, and 68% higher cropped images compared to TransUNet. The proposed model demonstrates potential for processing images of different quality for identifying vegetation.

Clifford White

Graduate Student – Anthropology – University of Wyoming

Quantifying the Labor Costs in Archaeological Settlements Using Drone Imagery

In the 10th through 12th centuries, people began to settle in the Truso Valley, located in the Caucasian Mountains in northern Georgia. During this time, people constructed villages consisting of densely aggregated dryland stone buildings and multi-story towers, some of which are associated with large agricultural field systems containing a series of layered terraces. The size of villages and their accompanying field systems suggest considerable labor costs during the intensified medieval settlement of the Truso Valley. Using high-resolution, photogrammetrically derived point clouds, and a manual classification approach, we quantify the volume of masonry/stone used to build the architectural and agricultural features, enabling a more accurate understanding of the human labor costs of settlement, subsistence, and defense of the Truso Valley.

Mohammad Irfan Uddin

Graduate Student – Electrical Engineering and Computer Science – University of Wyoming

Low-power On-board AI Drone Control Using Spiking Neural Networks (SNN)

Spiking neural network (SNN) a type of artificial neural network that are designed to mimic the human brain and communicate through spikes. Unlike traditional neural networks that process information continuously, SNNs process information in the form of spikes or pulses. SNNs utilize neuron models like the Leaky Integrate-and-Fire (LIF) model and learning rules like Spike-Timing-Dependent Plasticity (STDP). Compared to analog ANNs, SNNs use sparse binary spikes that saves energy for drones in energy-limited tasks. The event-driven nature of SNNs enables faster response times, critical for dynamic environments. SNNs process information only when spikes occur, reducing computational load. By leveraging the unique strengths of SNNs, we can achieve more autonomous, precise, and energy-efficient drones, revolutionizing the capabilities of unmanned aerial systems.

EunYeol Kim

PhD Student – Electrical and Engineering – Colorado State University

Processing Large Remote Sensing Observations in HPC

Extensive research is underway using machine learning and big data across various fields. Weather radar is one of the research fields that has been widely adopted machine learning and big data. Radar observations can cover up to 200km in range with 150m spatial resolution and scan every few minutes temporal resolution. Machine learning application on weather radar research requires several years of radar observations for training and involves significant big data processing. Efficiently processing big data is essential in remote sensing applications, as radar observations cover a wide spatial domain with high temporal resolution. This paper presents the processing of big radar data using supercomputer Expanse from San Diego Supercomputer Center. Expanse features three types of nodes, each specialized for different tasks: computing, GPU acceleration and large memory. The compute nodes are equipped with two 64-core AMD EPYC 7742 processors and 256GB of DDR4 memory. The GPU nodes contain dual 20-core Intel Xeon 6248 processors and four NVIDIA V100 GPUs. The memory nodes contain four 2TB large memory modules with two 64-core AMD EPYC 7742 processors. In total, Expanse contains 728 compute nodes with 93184 cores, 52 GPU nodes with 208 NVIDIA V100 GPUs and 247TB of total memory. The supercomputer Expanse was used for radar data processing tasks such as quality control and gridding of radar observations and machine learning applications in radar research. 6 C-band dual polarization radars collected 25TB of observations over a span of 25 years in United Arab Emirates (UAE). The observations in this period were used to evaluate the performance of radar data processing. The performance of radar data processing on Expanse was compared to that of a computing server at Colorado State University.

Amit Garu

Graduate Student – University Of Wyoming

A large-scale deployment of drones will require multiple drones' collaboration with each other. Due to the uncertainty of the operating environment and possible hardware or software errors, communication between the drones could be dropped or delayed. The delay or missing of data will affect the achievement of the drone task, especially if they are working on real-time task. Studying the impact of those adversary situations and designing solutions allowing drones to tolerate them is therefore much needed. In this work, we model the above adversary situations as faults, denoted as consistency violating faults, and analyze the impact they could bring on several distributed algorithms.

Consistency Violation Fault (cvf) is a type of fault where a drone reads faulty data from its neighbors and updates its value based on it. By analyzing cvf, it helps us to understand how a fault in a drone for a specific topology affects overall stability of the distributed system (or multiagent system). The topology of a drone could be the placement of the drone in the system, and the density of neighbors it is connected and sharing data with. The analysis does not require physical implementation of the system; however, it can be done through a simulation program which simulates the possible states of the drones in the system. Each data point of the drone in the system can be simulated for its effect. When the cvf occurs, the drone updating its value can destabilize the system to some extent. Destabilizing the system means making the system move away from the objective function. The quantification of extent of the destabilization should be studied to look for ways of improvement in the system. This study's outcomes will make the distributed system of the drones more robust.

Workshops

Introduction to Machine Learning for Image Classification

Thurs Sept 19th, 9:30am - 10:45am
Agriculture Bldg. Room #316

Facilitators:

Michael Kirby, *Professor – Mathematics, Computer Science – Colorado State University*

David Kott, *Graduate Student – Mathematics – Colorado State Univesrity*

Connor Price, *PhD Student – Mathematics – Colorado State Univesrity*

This will be an introductory workshop on the application of machine learning tools to the image classification problem. There will be a 45 minute introduction to the basic techniques and tools to be applied. This will be followed by a 45 minute hands on session where participants will train their own models from scratch. Attendees will be introduced to machine learning in Pytorch. No previous experience with machine learning or programming in Pytorch is expected.

Register Now! **Workshop is limited to 20 seats, registering does not guarantee a seat.*

Why do robots love and hate AI? The fight between traditional and data-driven drone decision-making

Thurs Sept 19th, 11:15am - 12:30pm
Agriculture Bldg. Room #316

Facilitators:

Zejian Zhou, Assistant *Professor – Electrical Engineering &, Computer Science – University of Wyoming*

Chao Jiang, Assistant *Professor – Electrical Engineering &, Computer Science – University of Wyoming*

The control and decision-making algorithms are fundamental to the performance of all drone applications. However, the recent rise of artificial intelligence (AI) has significantly impacted the robotics decision-making landscape. As more AI-based decision-making algorithms are developed, the value and challenges of AI have become evident. The debate over whether to incorporate AI in robotics decision-making is increasingly prominent. In this workshop, the presenter will introduce traditional and AI decision-making algorithms and show their differences. The workshop is mainly designed for students at all levels. Hands-on opportunities will be provided but also expect the mainstream to be theoretical analysis.

Register Now! **Workshop is limited to 20 seats, registering does not guarantee a seat.*

UAV Demonstrations

Using Big, High-Precision Drones in Remote Places

Fri Sept 20th, 9:45am - 10:45am
University of Wyoming South Recreation Field (Google Maps)

Free bus service is available every 10 minutes from the Wyoming Union (Knight Hall Stop) to the East Parking lot. (UW Transit Express Route Map)

Facilitators:

Sean Field, Assistant Professor – School of Computing, Anthropology – University of Wyoming

In this demonstration, we will show you how to set up, operate, and conduct an RTK-enabled LiDAR survey in remote areas (i.e., places where you can't establish cell or internet service). Demo includes:

1. How to establish a local NTRIP connection using two Emlid GNSS receivers.
2. How to ensure proper communication between the receivers and a DJI Matrice 350 RTK drone.
3. How to conduct an automated LiDAR survey. The demonstration will take approximately 60 minutes and no previous experience in drone applications is required.