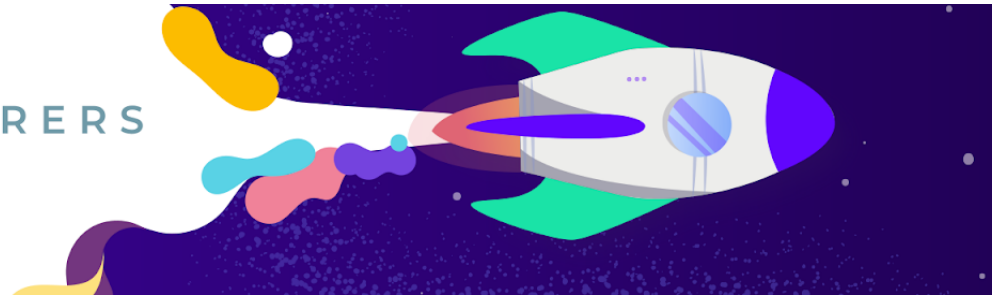
NGI EXPLORERS

Exceed your limits.
Become the BEST.

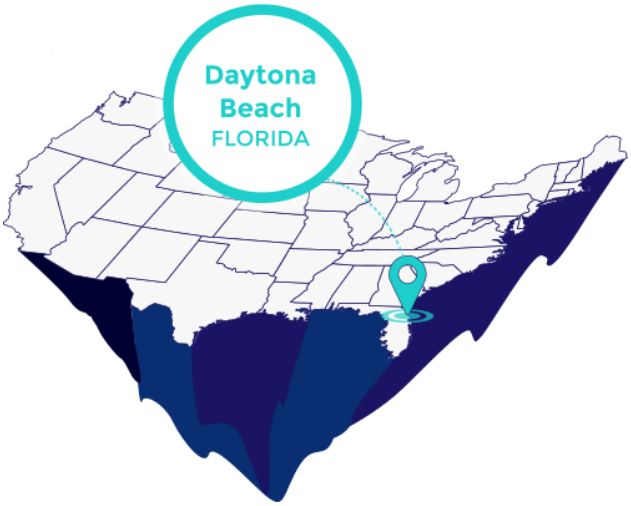


EMBRY-RIDDLE
Aeronautical University

Embry-Riddle Aeronautical University

Department of Electrical, Computer, Software, and Systems Engineering

Security and Optimization for Networked Globe Laboratory



daytonabeach.erau.edu @EmbryRiddle

Embry-Riddle Aeronautical University is the world's largest and most respected university specializing in aviation and aerospace, with over 130,000 graduates around the globe.

The **Department of Electrical, Computer, Software, and Systems Engineering (ECSSE)** work on — and even develop — the technologies that make air and space flight possible. From navigation and control systems to the electroluminescent dimming of the windows in a 787 airliner, these technologies involve embedded computers like those found in mobile phone and flight control systems.

The mission of the Security and Optimization for Networked Globe Laboratory (SONG Lab) is to advance research and education through discovery and innovation at the confluence of cybersecurity, privacy, artificial intelligence, and internet of things.

READY FOR:

OPEN IDEAS

x6 CHALLENGES

Researchers
Innovators

3 / 6 months

A NGI initiative

NGI Explorers Program, part of the NGI Initiative

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 825183.

Partners

CHALLENGE #5 - ERAU-IOT-01

→ Internet of Dependable and Controllable Things

GOALS

Develop enabling technologies towards a vision of an "Internet of Dependable and Controllable Things" while preserving the enormous potential benefits.

DETAILS

IoT devices sense and communicate information, and in some cases act upon that information. Their rapid emergence brings the promise of important new benefits to consumers and opportunity for huge economic growth. However, it also presents important challenges in security, safety, and privacy.

SKILLS REQUIRED

Fundamental concepts of wireless communication; 802.11 standards and protocols; Linux networking concepts; Software-defined networking concepts; Linux kernel development; C/C++, Python.

Researchers	
Innovators	
AI	**Blockchain**
Big Data	**IoT**
5G	**Cybersecurity**
Cloud/Edge	Interactive
Hyper- connectivity	Human Internet

A NGI initiative

NGI Explorers Program, part of the NGI Initiative

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 825183.

Partners

CHALLENGE #6 - ERAU-LEARN-02

→ Verifiable Reinforcement Learning

GOALS

Reinforcement learning and sequential decision-making have been revolutionized in recent years thanks to advancements in deep neural networks. One of the most recent breakthroughs was accomplished by the AlphaGo system and its victory over the world Go champion. However, even in this impressive system, the learned agent performed sub-optimal actions that puzzled both the Go and the reinforcement learning communities. Such failures in decision-making motivate the need for methods that can provide (statistical) guarantees on the actions performed by an agent. We are interested in establishing such guarantees in both discrete and continuous systems where agents learn policies, or action plans, through experience by interacting with their environment.

DETAILS

Some problems of interest in this domain include, but are not limited to the following:

- Decision-making in partially observable Markov Decision Processes.
- Satisfying probabilistic guarantees on the behavior of a learned agent when approximate value functions (i.e. neural networks) are used to measure utility.
- Control of hybrid systems resulting from the discretization of continuous space induced by a given set of behavioral specifications. Such specifications are typically defined by a temporal logic such as computation tree logic and linear temporal logic.
- Decision-making in adversarial stochastic games.
- Reinforcement learning as a constrained optimization problem wherein expected long-term rewards are to be maximized while satisfying bounds on the probabilities of satisfying various behavioral specifications.

SKILLS REQUIRED

A basic understanding of Reinforcement Learning.

Researchers	
Innovators	
AI	**Blockchain**
Big Data	**IoT**
5G	**Cybersecurity**
Cloud/Edge	Interactive
Hyper- connectivity	Human Internet

A NGI initiative

NGI Explorers Program, part of the NGI Initiative

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 825183.

Partners

CHALLENGE #7 - ERAU-DATA-03

→ Data-Efficient Machine Learning

GOALS

This topic focuses on the investigation and development of data-efficient machine learning methods that are able to leverage knowledge from external/existing data sources, exploit the structure of unsupervised data, and combine the tasks of efficiently obtaining labels and training a supervised model. Areas of interest include, but are not limited to: Active learning, Semi-supervised learning, Learning from "weak" labels/supervision, One/Zero-shot learning, Transfer learning/domain adaptation, Generative (Adversarial) Models, as well as methods that exploit structural or domain knowledge.

Furthermore, while fundamental machine learning work is of interest, so are principled data-efficient applications in, but not limited to: Computer vision (image/video categorization, object detection, visual question answering, etc.), Social and computational networks and time-series analysis, and Recommender systems.

DETAILS

Many recent efforts in machine learning have focused on learning from massive amounts of data resulting in large advancements in machine learning capabilities and applications. However, many domains lack access to the large, high-quality, supervised data that is required and therefore are unable to fully take advantage of these data-intense learning techniques. This necessitates new data-efficient learning techniques that can learn in complex domains without the need for large quantities of supervised data.

SKILLS REQUIRED

A basic understanding of Machine Learning.

Researchers	
Innovators	
AI	**Blockchain**
Big Data	**IoT**
5G	**Cybersecurity**
Cloud/Edge	Interactive
Hyper- connectivity	Human Internet

A NGI initiative

NGI Explorers Program, part of the NGI Initiative

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 825183.

Partners

CHALLENGE #8 - ERAU-MATH-04

→ Mathematical Theory for Advances in Machine Learning & Pattern Recognition

GOALS

This research topic is focused on the development of theoretical mathematics with applications to machine learning and pattern recognition with a special emphasis on techniques that admit sparse, hierarchical or parallelizable numerical methods. Research may be performed in, but not limited to: sparse PCA, generalized Fourier series, low-rank matrix approximation and compressed sensing.

DETAILS

To alleviate the effects of the so-called 'curse of dimensionality', researchers have developed sparse, hierarchical and distributed computing techniques to allow timely and meaningful extraction of intelligence from large amounts of data. As the amount of data available to analysts continues to grow, a strong mathematical foundation for new techniques is required.

SKILLS REQUIRED

A basic understanding of Machine Learning and Pattern Recognition.

Researchers	
Innovators	
AI	**Blockchain**
Big Data	**IoT**
5G	**Cybersecurity**
Cloud/Edge	Interactive
Hyper- connectivity	Human Internet

A NGI initiative

NGI Explorers Program, part of the NGI Initiative

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 825183.

Partners

CHALLENGE #9 - ERAU-TRAIN-05

→ Methods for Adapting Pre-Trained Machine Learning Models

GOALS

The purpose of this topic will be to develop novel methods for fusing and building ensembles of pre-trained machine learning models that are task agnostic and can more closely mimic the agility that humans possess in the learning process. This topic is particularly interested in exploring and evaluating architectures and methods that involve the fusion of Convolutional Neural Networks (CNNs) or other deep learning methods. CNNs have been one class of learning algorithm that have greatly improved accuracies over numerous application domains, including computer vision, text analysis, and audio processing. Additionally, another area of interest includes methods that explain the numerical impacts of training examples on the models being learned. In other words, novel methods that conceptually describe what an algorithm is learning. Both being able to explain the impact of specific examples on the learning process and building novel algorithms and architectures for fusion of pre-trained models will support the realization of more adaptable learning methods.

DETAILS

Numerous machine learning algorithms have recently made remarkable advances in accuracies due to more standardized large datasets. Yet, designing and training an algorithm for large datasets can be time-consuming and there may be other tasks or activities for which less data exists. There is a large body of work showing the performance benefits of fusing models for the same task. Hence, the ability to adapt and fuse pre-trained models has the advantages of fewer data requirements and decreased computing resources.

SKILLS REQUIRED

A basic understanding of Machine Learning.

Researchers	
Innovators	
AI	**Blockchain**
Big Data	**IoT**
5G	**Cybersecurity**
Cloud/Edge	Interactive
Hyper- connectivity	Human Internet

A NGI initiative

NGI Explorers Program, part of the NGI Initiative

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 825183.

Partners

CHALLENGE #10 - ERAU-CYBER-06

→ Data Science for Cybersecurity and Privacy

GOALS

Topics of interest include advances in data analytics techniques for assessing, predicting, and enhancing aspects of systems and human behavior that are relevant to security and privacy; this includes applications, tools, and infrastructures at the level of individual systems, organizations, and social networks.

DETAILS

Also of interest are advances in statistical and computational methods relevant to secure computational infrastructure for data science (e.g., secure and/or privacy-aware management, retrieval, analytics, and publishing of structured or unstructured data).

SKILLS REQUIRED

A basic understanding of Cybersecurity and Data Analytics.

Researchers	
Innovators	
AI	Blockchain
Big Data	**IoT**
5G	**Cybersecurity**
Cloud/Edge	Interactive
Hyper- connectivity	Human Internet

A NGI initiative

NGI Explorers Program, part of the NGI Initiative

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 825183.

Partners