Machine Learning for Motor Control

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MathWorks

BREAK THROUGH TECH

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We’re excited to be your Challenge Advisors!

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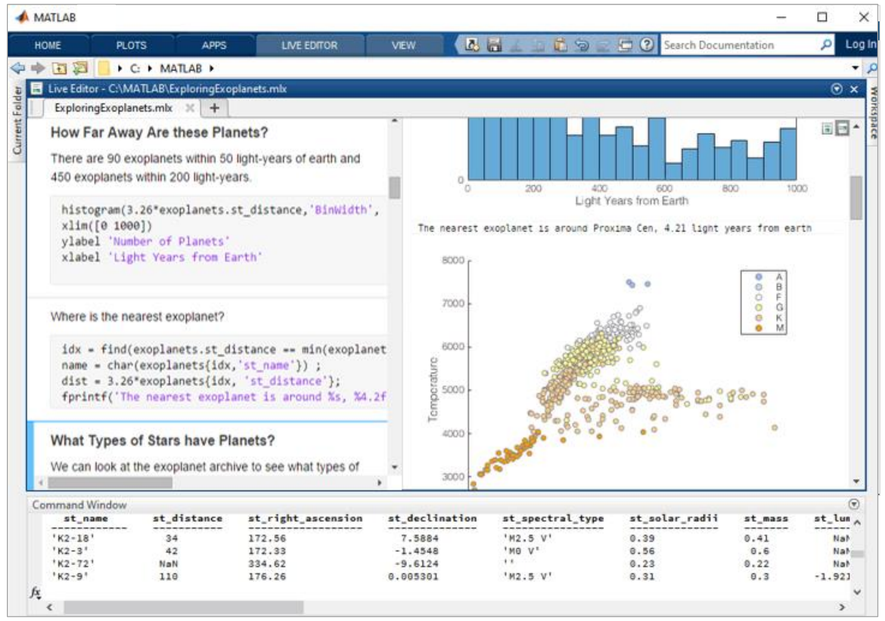

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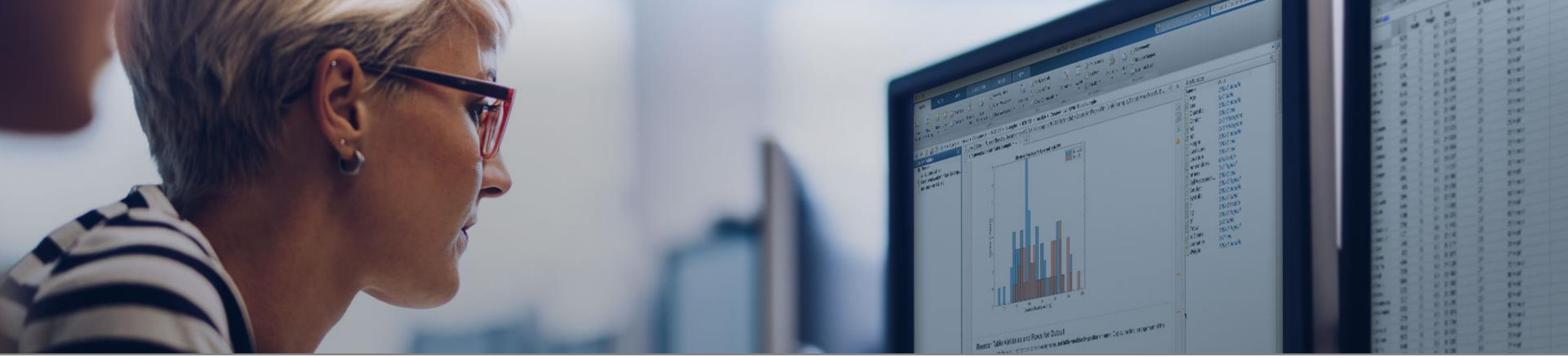

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Millions of engineers and scientists worldwide use MATLAB and Simulink.

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Fortune: 2021 Global 500 auto companies
FlightGlobal: 2020 Top 100 aero companies*

*Excluding companies that are subject to embargos, sanctions, or other controls

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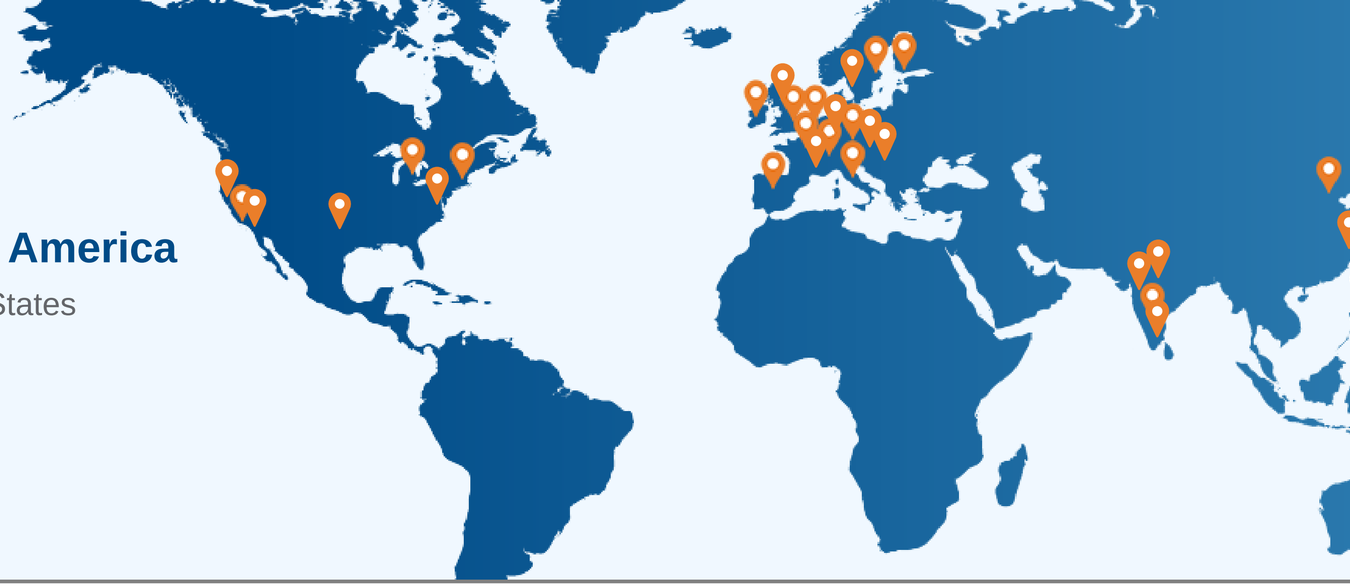

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AI Studio Challenge Project Overview

CHALLENGE SUMMARY

Motor control is one of the core skillsets in robotics and electrification areas which are becoming more and more widely used in the industry. Currently, many industrial motor applications are driven by classical and robust control-based methods. In this project, you will implement **Machine Learning-based motor control methods** as an alternate pathway to overcome the real-world challenges.

Project Goals and Outcome

YOUR TEAM'S OBJECTIVE

Conventional control approaches are effective when the system can be modelled predictably. It can be difficult to predict system nonlinearities due to motor parameter changes caused by aging and temperature variation.

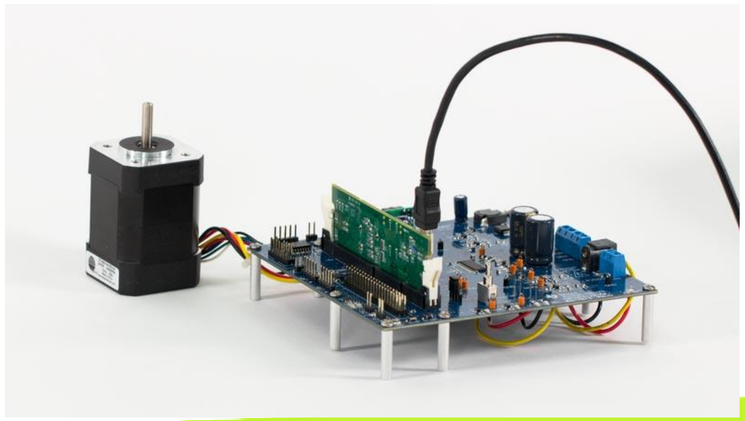
- Define application-specific pipeline: systems, data, controls and simulation
- Study machine learning models for classification and regression tasks
- Deploy ML models in close-loop systems (software and hardware)
- * Use of reinforcement learning in motor control applications

DESIRED OUTCOMES

Develop and evaluate workflows that demonstrates controller design and optimization using classical control theory and machine learning-based approaches.

Electric motor control is critical in the global trend of electrification

Motor control algorithms regulate speed, torque, and other performance characteristics, often for precision positioning. Evaluating control algorithms using simulation is an effective way to determine the suitability of electric motor controller designs and reduce the time and cost of algorithm development before committing to expensive hardware testing.



Explore multiple ML approaches

- Start with supervised learning and simpler machine learning models
- Reinforcement learning (based on deep learning approach) is the state-of-art approach
- Learn about classic methods

Datasets overview

We will start from the public dataset and predict based on specific parameters

- Produce synthetic data from physical modeling approach
- Collect field data from hardware setup

https://github.com/mathworks/MATLAB-Simulink-Challenge-Project-Hub/tree/main/projects/Machine%20Learning%20for%20Motor%20Control

Helpful libraries

Python

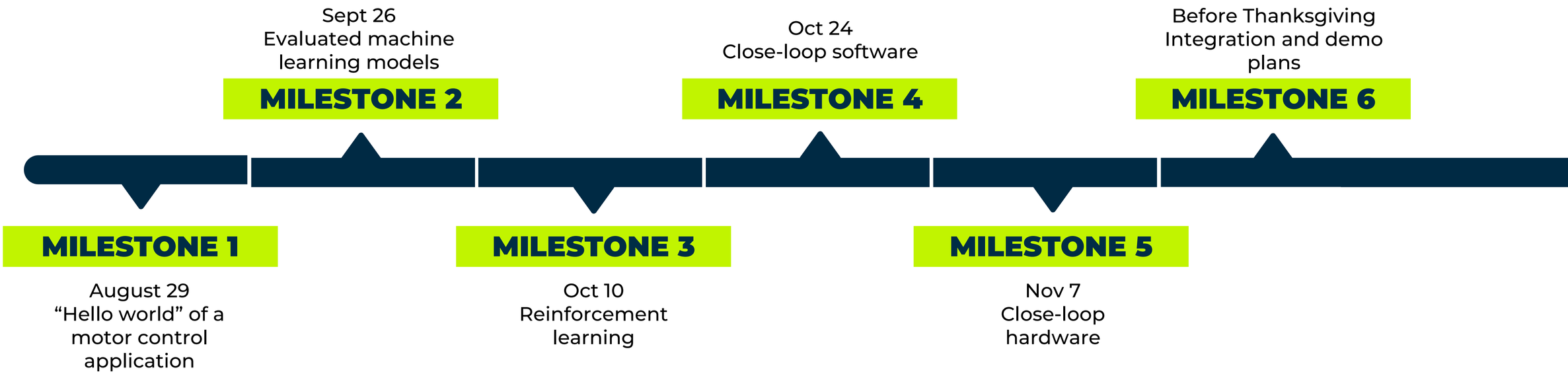
- Machine learning: pandas, scikit-learn
- Reinforcement learning: PyTorch
- Use of ONNX for model exchange

MATLAB

- Toolboxes: Deep learning
- Simulink
- Use of mat files and import/export

Project milestones and timeline

These are the milestones for your Challenge Project. They are roughly aligned to the CRISP-DM process you learned about in your ML Foundations course.



How we'll work together this semester

Check-in meetings	• Morning or lunch hours
Reporting	• Weekly huddle update (agile)
Communication	• Work email with 12-hour turn-around time
Tools and platforms	• GitHub, MATLAB (optional)
Other project norms	• Summary report on milestones with contribution from every team member

How to get started

Here’s what I suggest for your immediate next steps. I’ll follow up on your progress and help address any challenges in our next check-in meeting:

Review these slides and note down questions

I’ll email you a copy of this deck to store in your Google Drive project folder. Review it as a team and note down any questions you’d like to discuss in our next meeting.

Complete your “Project Scope and Deliverables”

As a team, work on this required Break Through Tech assignment before and during your Sept 7th Maker Day. We’ll review it in our next meeting.

Questions?

What questions do you have?

Anything I can help clarify?

What are you most excited about?

Anything you’re unsure about?