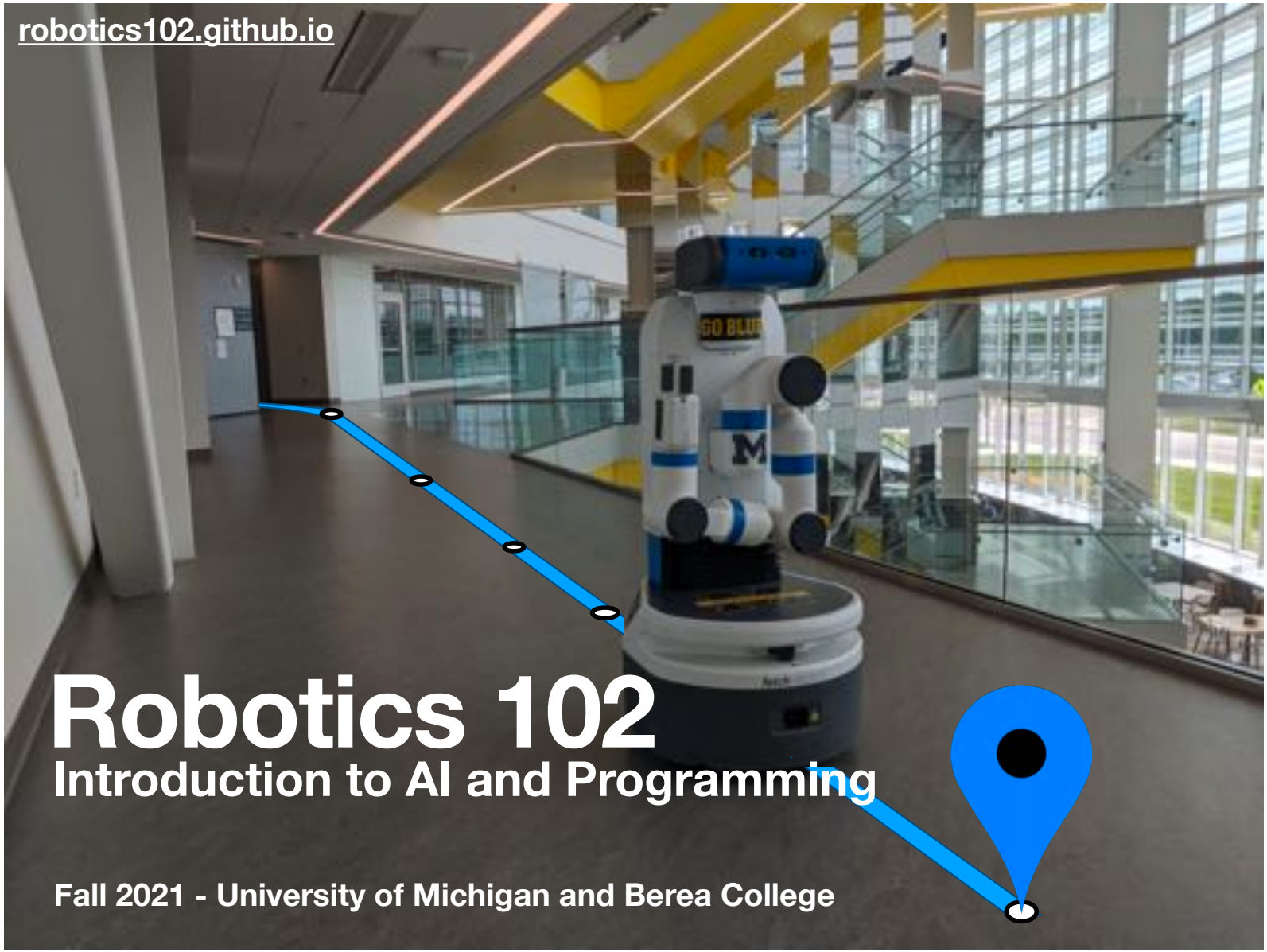
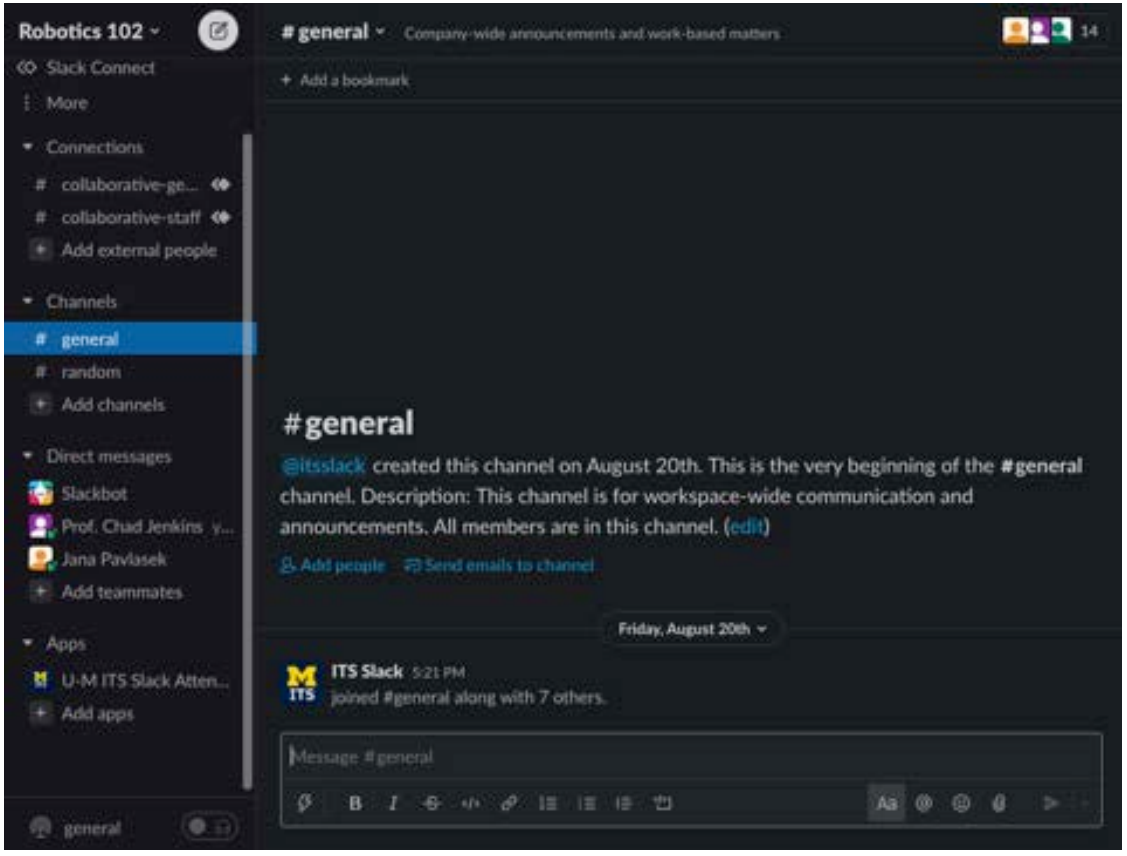

robotics102.github.io
Robotics 102
Introduction to AI and Programming
Fall 2021 - University of Michigan and Berea College

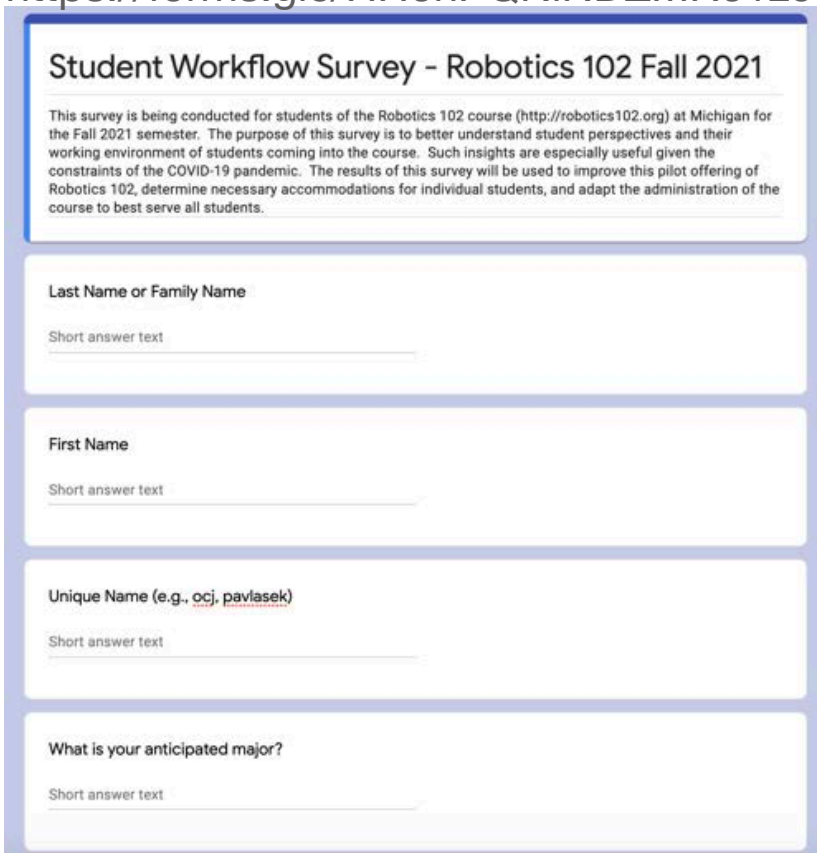
Two Action Items for Today

Two Action Items for Today

Join Robotics 102 Slack Workspace



Complete Student Workflow Survey
https://forms.gle/HH6nPQNiNDZMR61z9



First Class

Action items: Join *robotics102* slack team, Complete workflow survey

Introductions

Safety and Masking Policies

Autonomous navigation is all around!

The engine of AI: Graphs and graph algorithms

We are pioneers for robotics!

Course objectives and administrative overview

Flipped classroom: “Hello world!” Lecture will be posted soon

Upcoming projects: Project 0 (Calculator) assigned Aug 30, due Sep 20

Introductions

Let’s get to know each other

Prof. Chad Jenkins

Office Hours: MW 1-3pm Eastern, Robotics 2236

Michigan Robotics 102 Course Instructor

Faculty in Michigan EECS, PhD 2003 (Univ. Southern California)

Favorite song: Friday Morning by Khruangbin

Best use of robotics: Help care for our aging and disabled populations

Jana Pavlasek

Office Hours:

Michigan Robotics 102 Co-Instructor

4th year doctoral student in Michigan Robotics

Favorite musical artist: Busty and the Bass

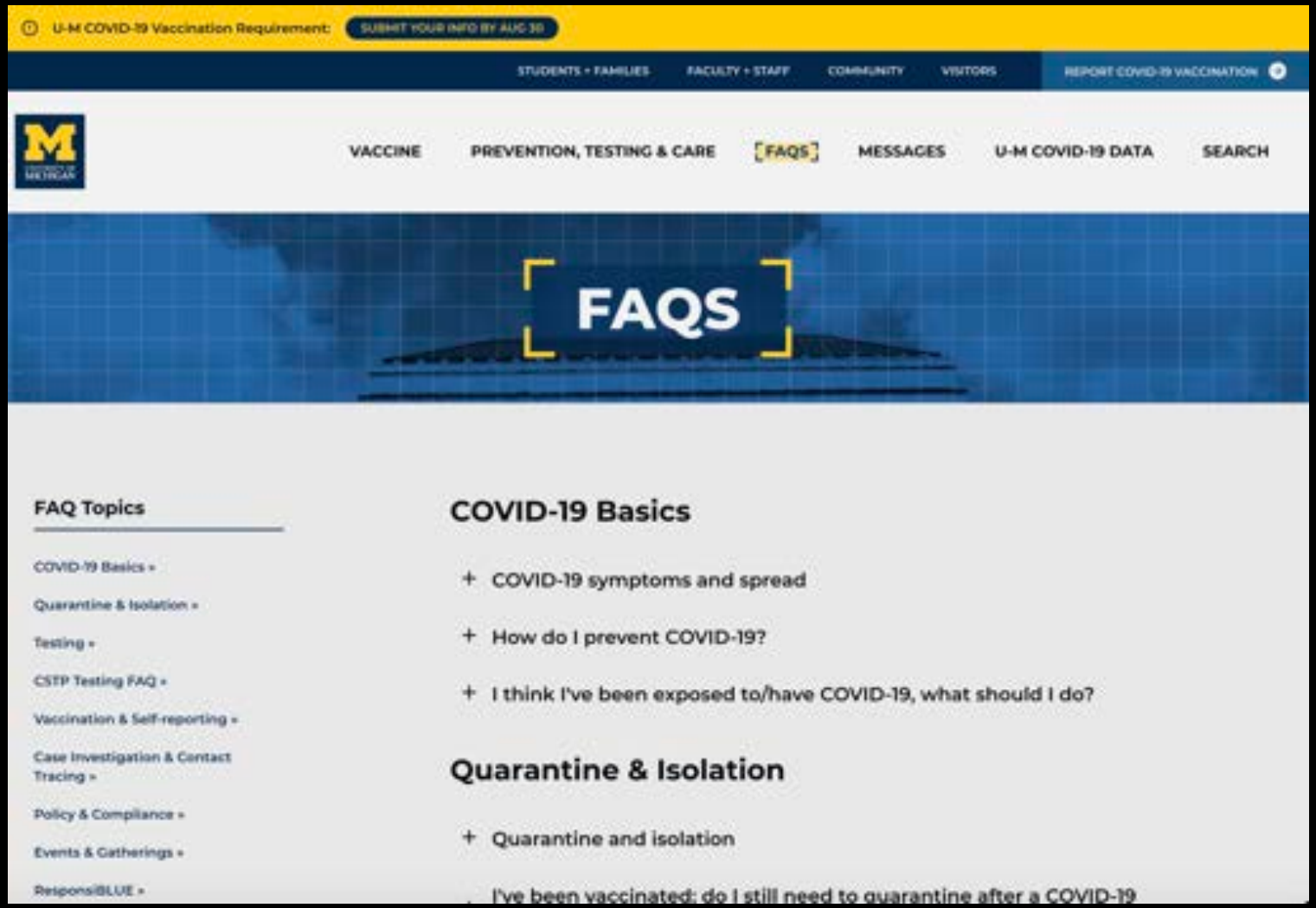
Best use of robotics: remote monitoring of our environment and planet

Your health and wellness is our top priority

Your health and wellness is our top priority

Proper safety is mandatory

https://campusblueprint.umich.edu/faqs/



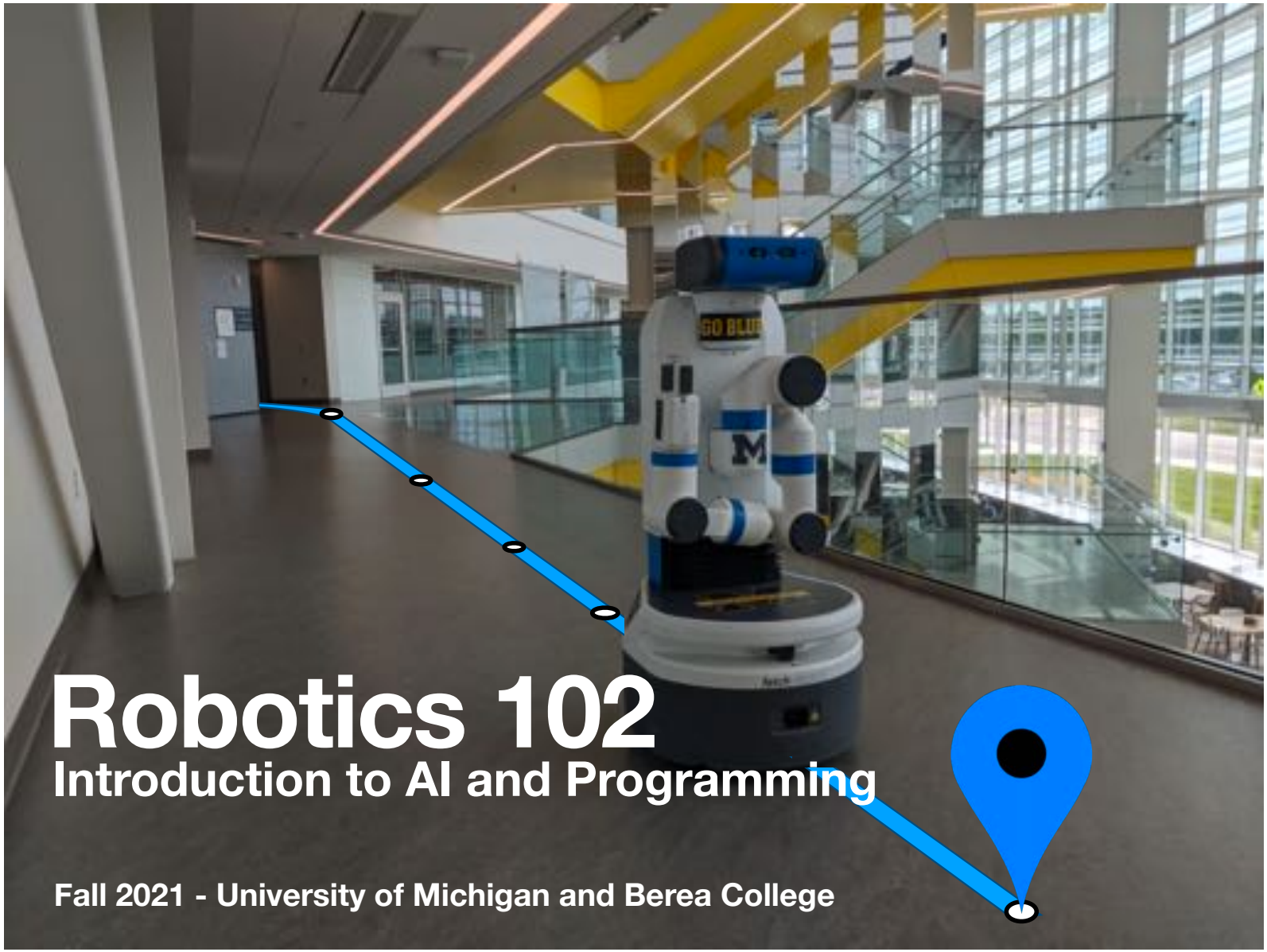
August 2020

August 2021

April 2021

July 2021

Academic Year 2021-22 ?



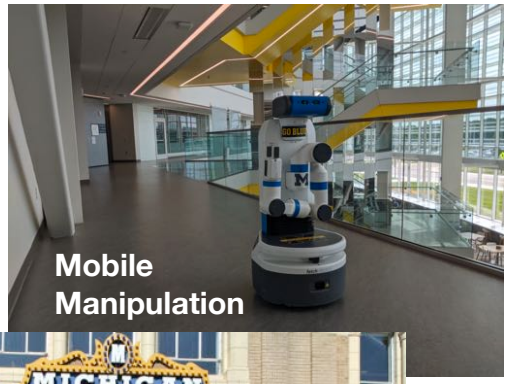
Robotics 102

Introduction to AI and Programming

Fall 2021 - University of Michigan and Berea College

Autonomous Navigation is all around you


Passenger
Cars

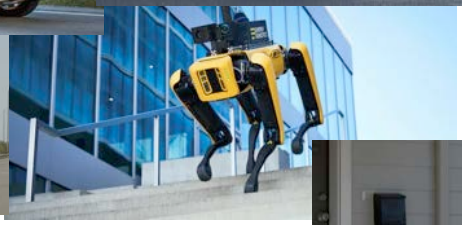

Mobile
Manipulation

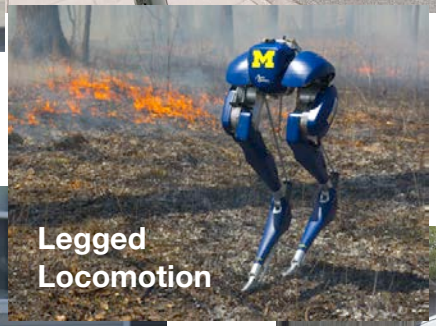

Assistive
Tech


MICHIGAN
THANK YOU
TITOS & LABATTS &
GRANGE KITCHEN
COLT
We
Live
Here
MAY
Public
Transportation

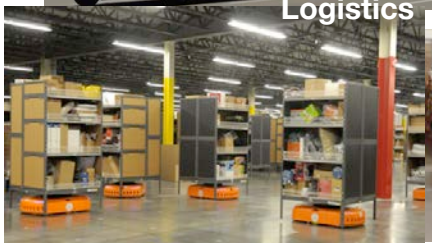

Air
Mobility

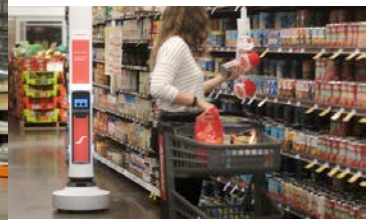

M city
SHUTTLE
STOP
M city

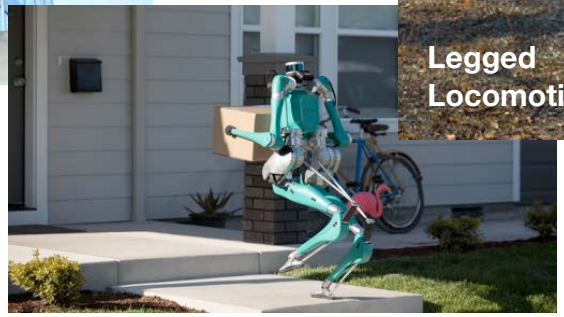



Legged
Locomotion


Delivery


Logistics

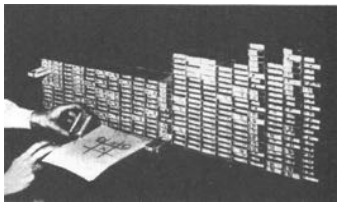


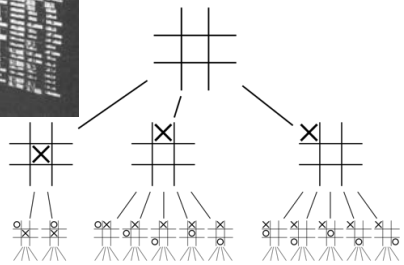


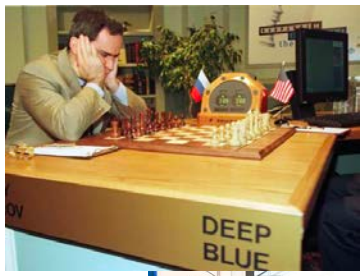

Domino's

First wave AI: Model-based

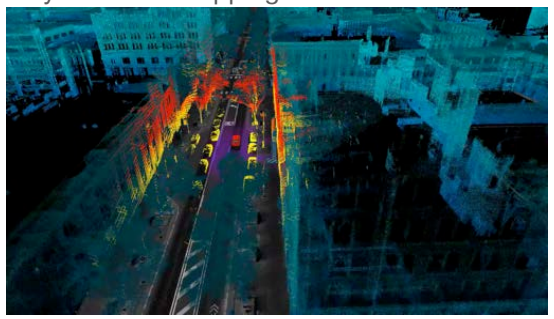
"Think through the entire problem"





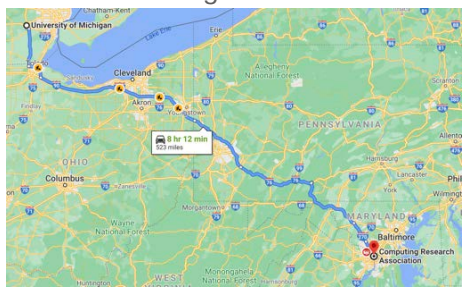


City-scale 3D mapping



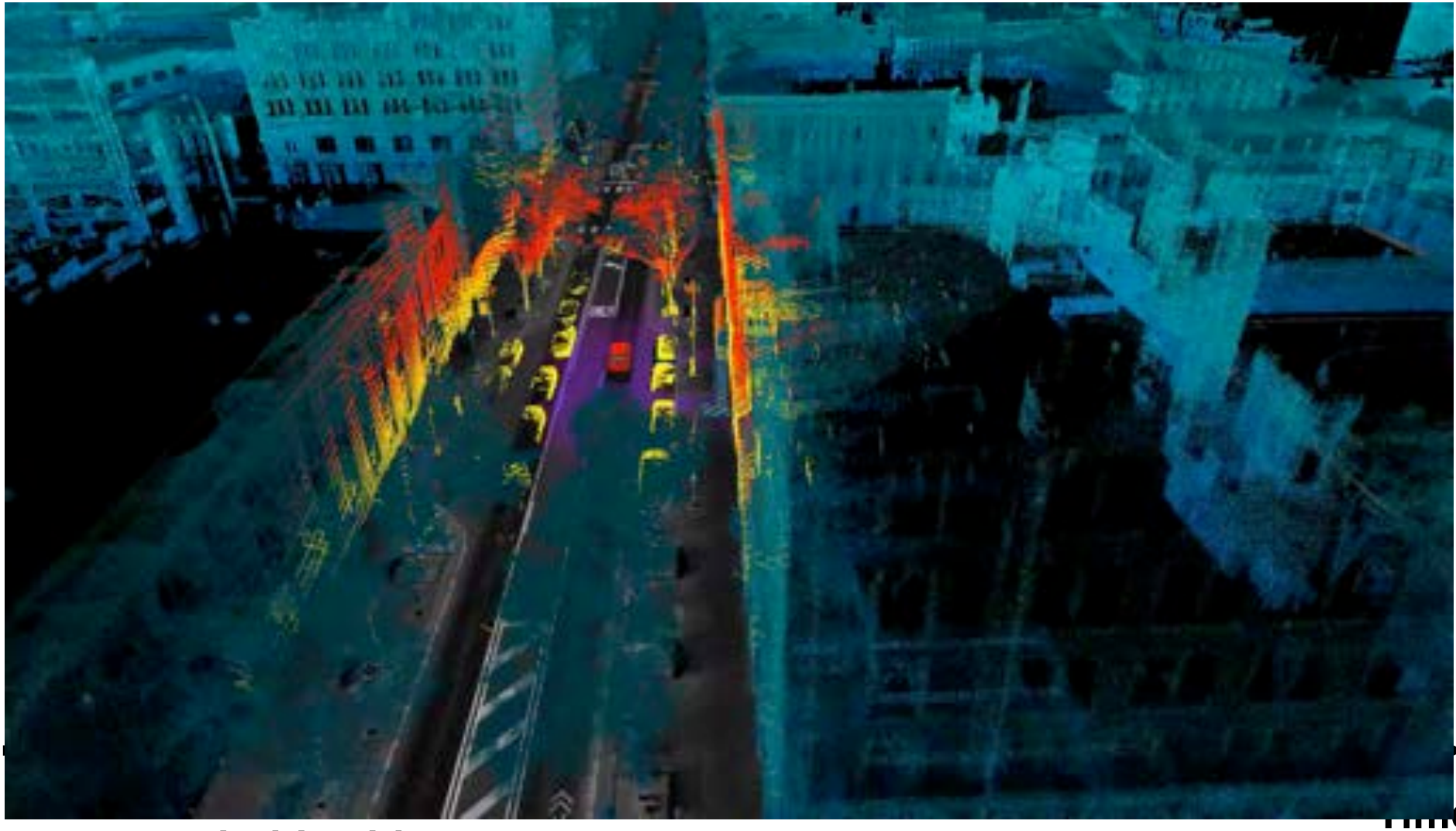
Self-driving cars

Online route navigation



1956 1960 1970 1980 1990 2000 2010 **Time**

City-scale 3D mapping



Time

Let’s watch this video closely

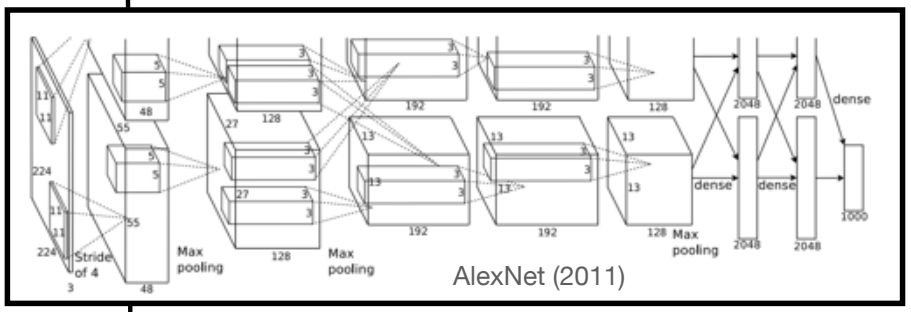
First wave AI: Model-based

"Think through the entire problem"

Second wave AI: Data-driven

"Learn from lots of data"

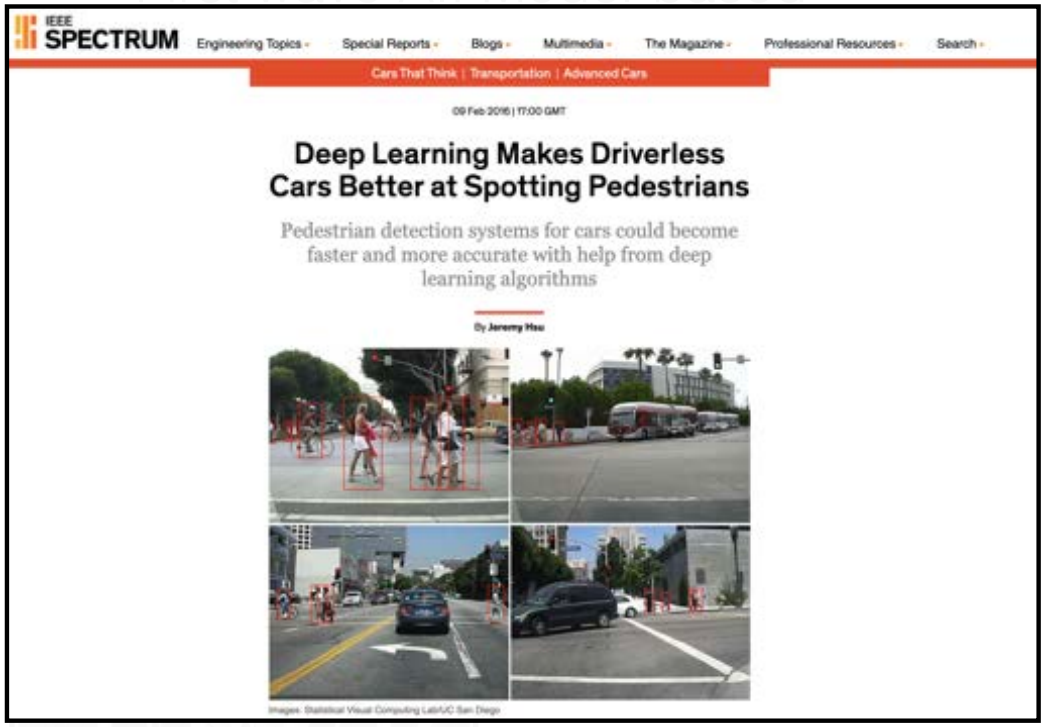
Rise of "deep learning"



1956

2011

Time



Second wave AI: Data-driven

"Learn from lots of data"

"deep learning"

2011

Time

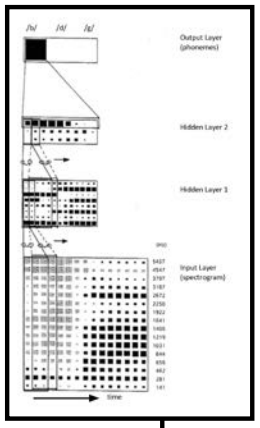
The AI of today needed
decades of investment and research

Second wave AI: Data-driven

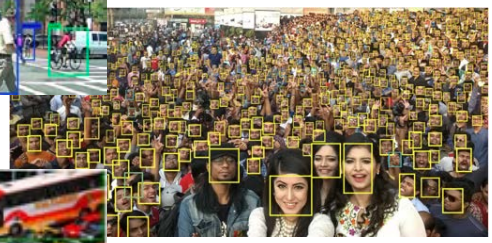
"Learn from lots of data"

Rosenblatt's Perceptron

Speech recognition by neural networks



Waibel et al.



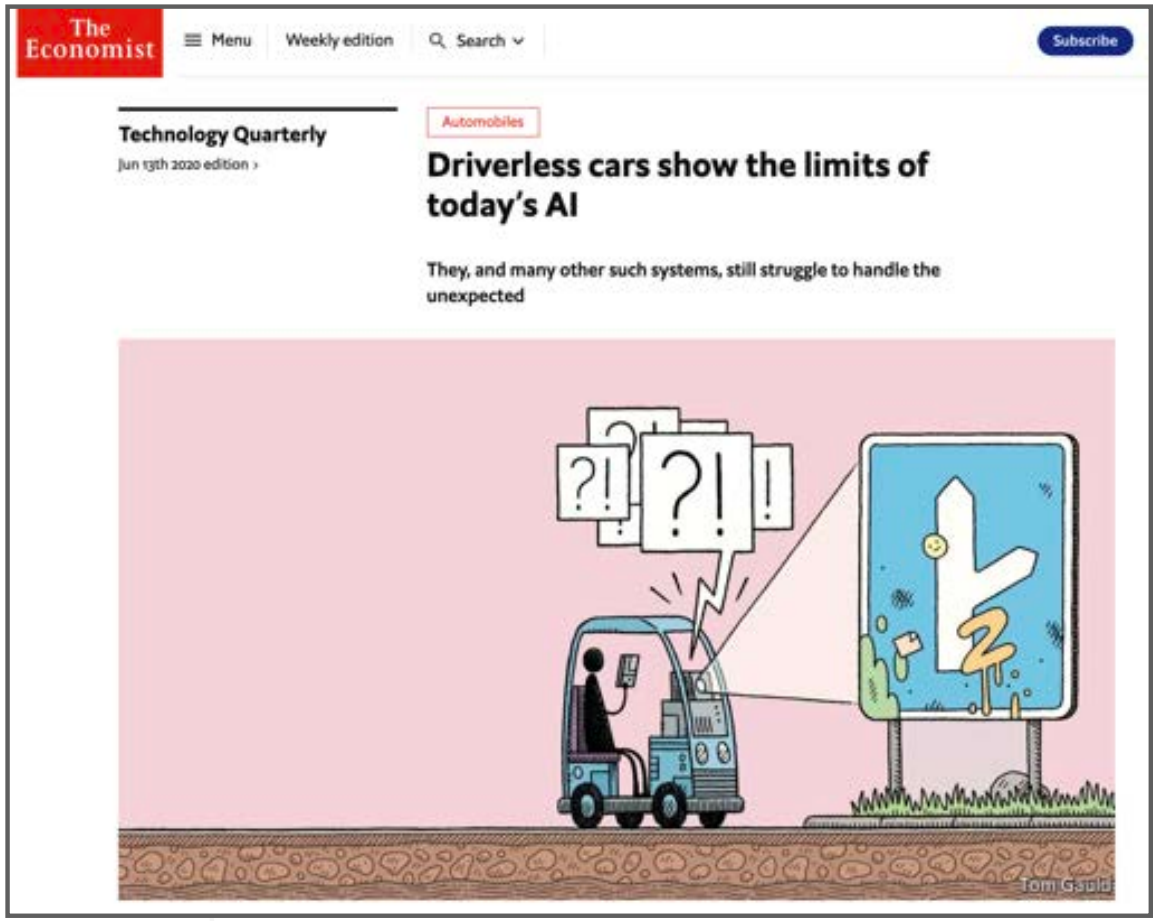
"deep learning"

1958

1989

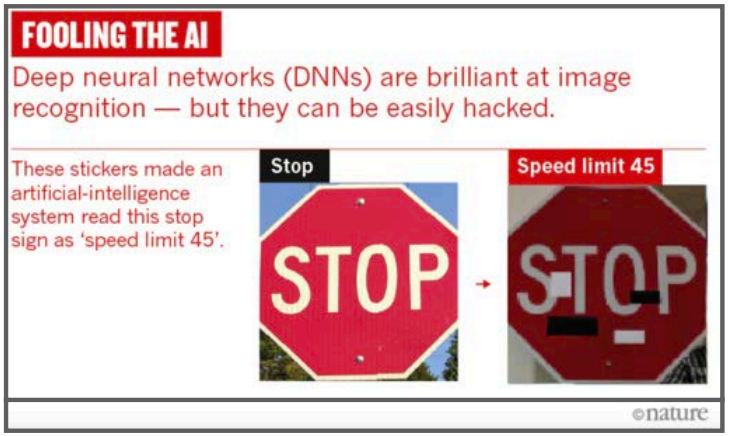
2011

Time



Second wave AI: Data-driven

"Learn from lots of data"



1956

2011

Time

First wave AI: Model-based

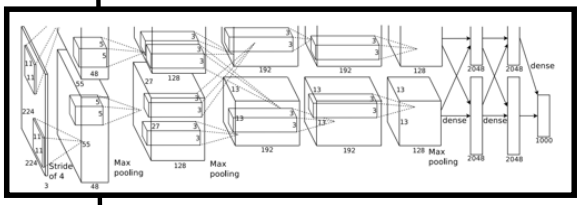
"Think through the entire problem"

Second wave AI: Data-driven

"Learn from lots of data"

Third wave AI: Explainable

"Combine first and second wave AI to generate explanations"



??

1956

2011

20??

Time

Is this handwritten character a ‘9’ or a ‘4’?

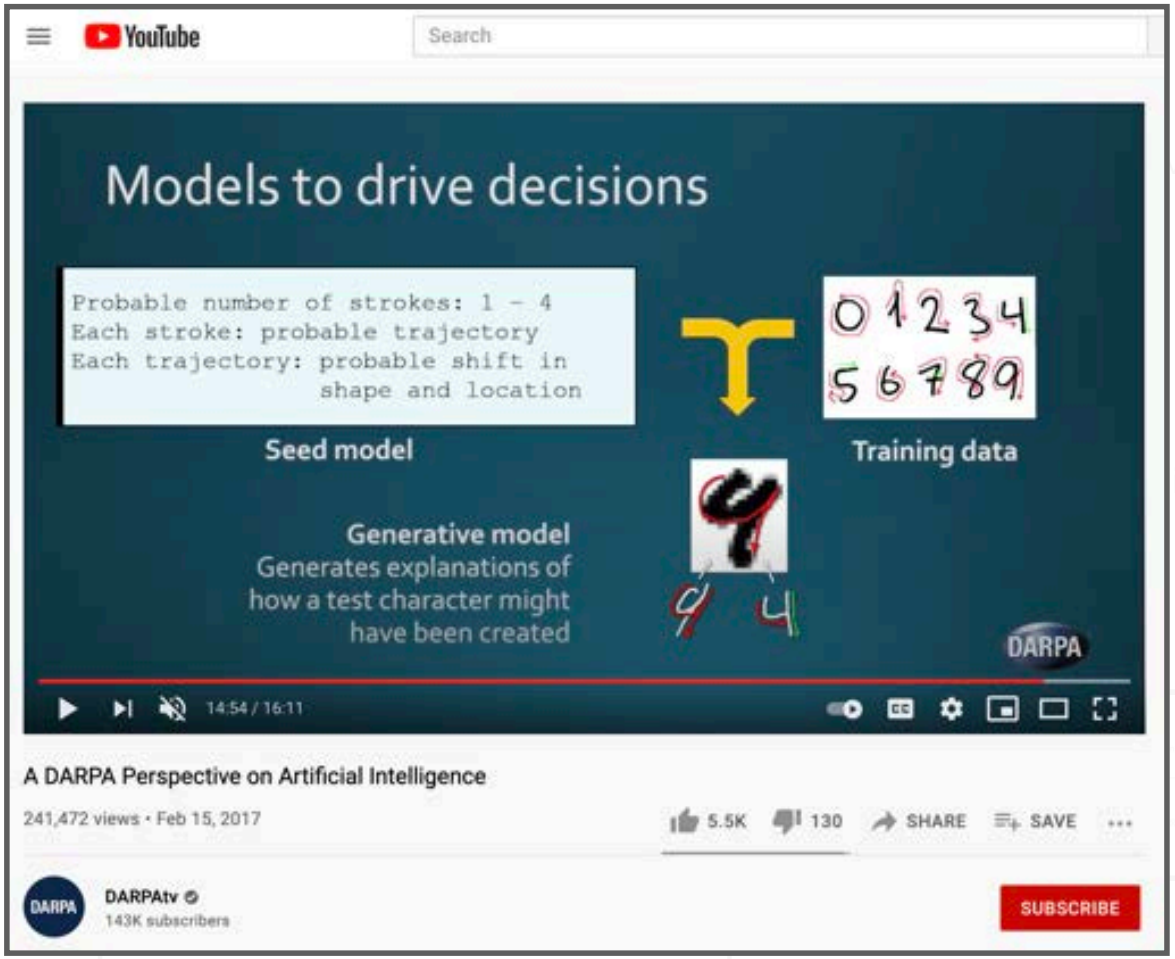
Third wave AI: Explainable

“Combine first and second wave AI to generate explanations”

??

20??

Time



Third wave AI: Explainable

"Combine first and second wave AI to generate explanations"

??

20??

Time

First wave AI: Model-based

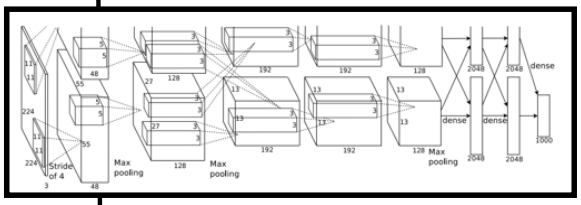
"Think through the entire problem"

Second wave AI: Data-driven

"Learn from lots of data"

Third wave AI: Explainable

"Combine first and second wave AI to generate explanations"



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1956

2011

20??

Time

Robotics 102 is a first step into modern AI

First wave AI: Model-based

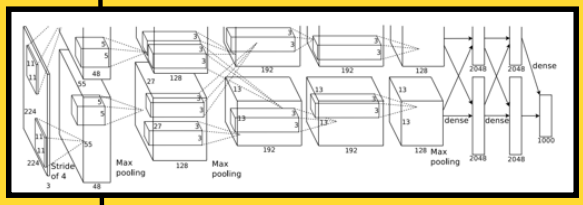
"Think through the entire problem"

Second wave AI: Data-driven

"Learn from lots of data"

Third wave AI: Explainable

"Combine first and second wave AI to generate explanations"



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1956

2011

20??

Time

Robotics 102 is a first step into modern AI

Research for future AI

First wave AI: Model-based

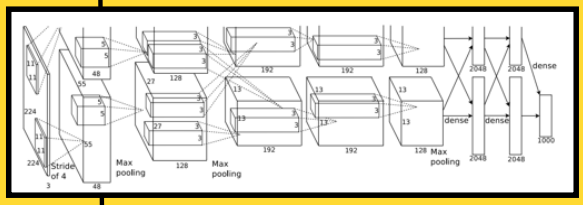
"Think through the entire problem"

Second wave AI: Data-driven

"Learn from lots of data"

Third wave AI: Explainable

"Combine first and second wave AI to generate explanations"



??

1956

2011

20??

Time

Our goal

Our goal

Give you the power of autonomous navigation

Our goal

Give you the power of autonomous navigation

Our goal

Give you the power of autonomous navigation

Our goal

Give you the power of autonomous navigation

Your task

Understand foundational AI algorithms
and implement them in code

Our goal

Give you the power of autonomous navigation

“KiMBot”
Kiwi Drive MBot

Our goal

Give you the power of autonomous navigation

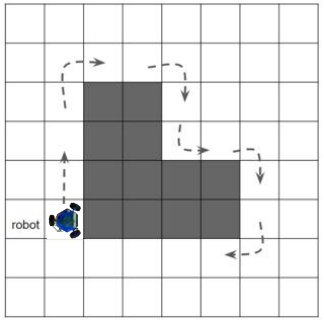
“MBot Omni”
Kiwi Drive MBot

Robotics 102 Trailer (by Brody!)
In the Michigan Robotics Building
https://youtu.be/XN5VHmK1mTM

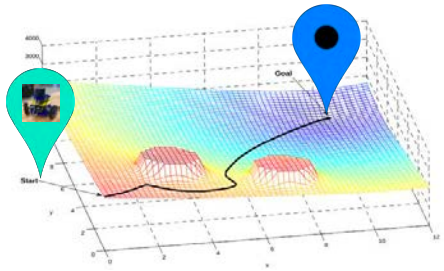
Your task

Understand foundational AI algorithms and implement them in code

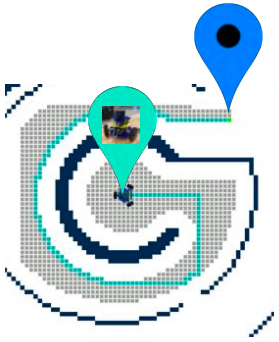
Project 0: Pocket Calculator



Project 1: Wall following



Project 2: Potential Fields



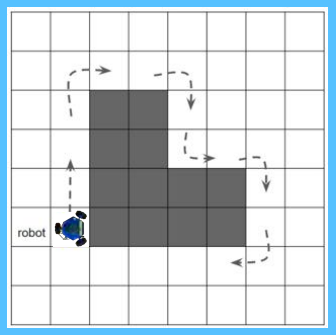
Project 3: A* Pathfinding

Project 4: Neural Networks

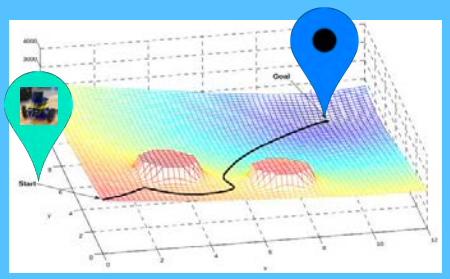
Understand foundational AI algorithms and implement them in code

C++ Programming

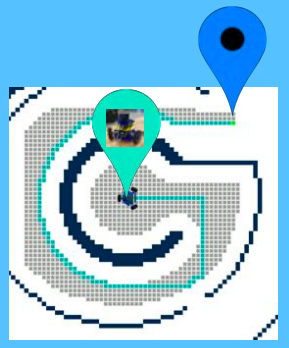
Project 0: Pocket Calculator



Project 1: Wall following



Project 2: Potential Fields



Project 3: A* Pathfinding

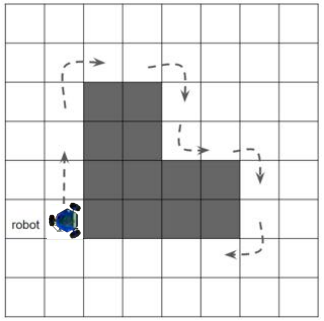
the julia programming language

Project 4: Neural Networks

Understand foundational AI algorithms and implement them in code

as Graphs and Graph algorithms

Project 0: Pocket Calculator



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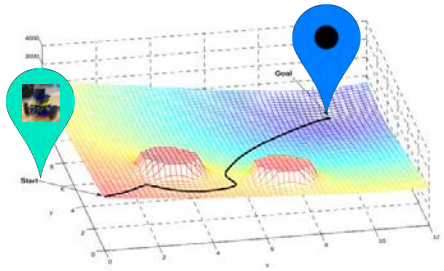
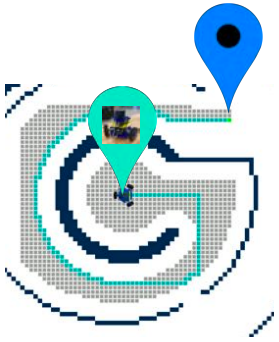


Project 2: Potential Fields



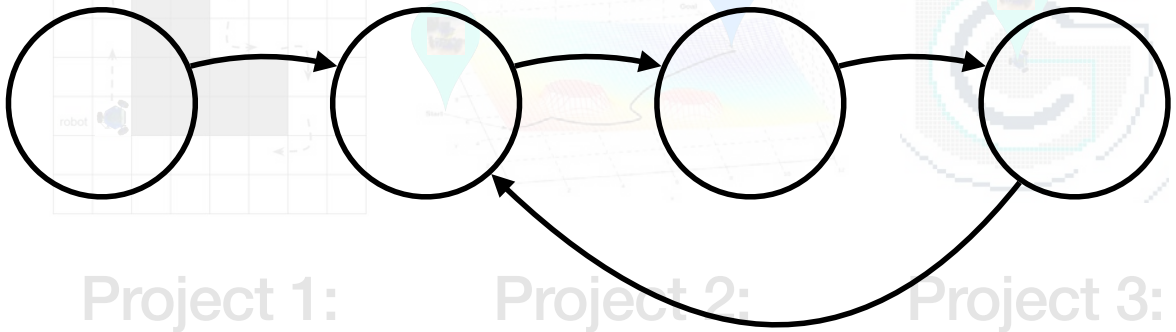
Project 3: A* Pathfinding

Project 4: Neural Networks

Understand foundational AI algorithms and implement them in code

as Graphs and Graph algorithms

A graph is a collection of nodes (noted by circles) that are connected by edges (noted by arrows)



Project 0: Pocket Calculator

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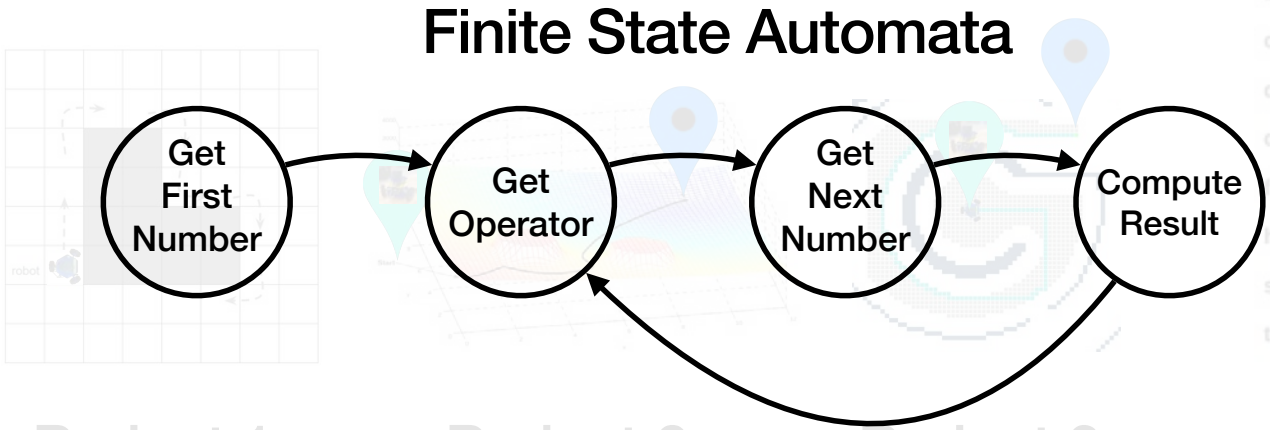
Understand foundational AI algorithms and implement them in code

as Graphs and Graph algorithms

Project 0: Pocket Calculator



Project 1: Wall following

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Understand foundational AI algorithms and implement them in code

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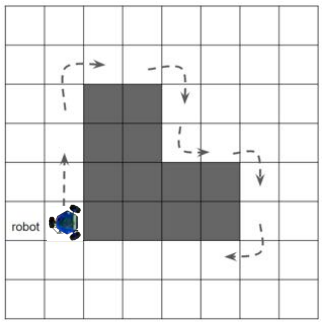
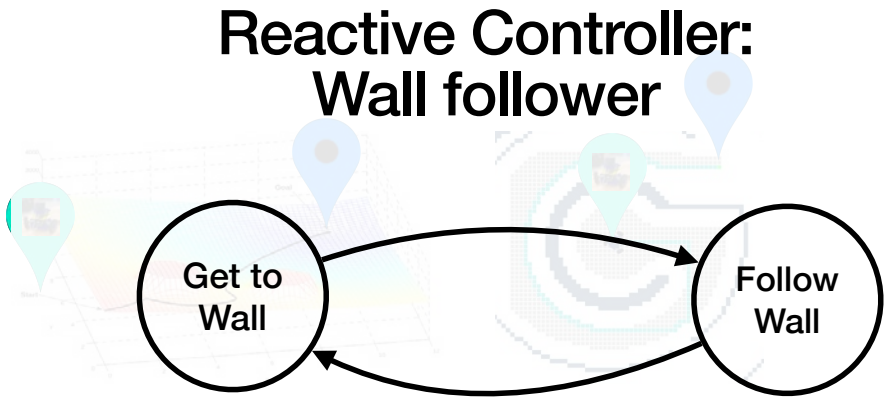




Project 0: Pocket Calculator

Project 1: Wall following

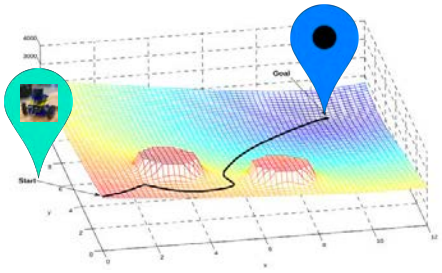
Project 2: Potential Fields

Project 3: A* Pathfinding

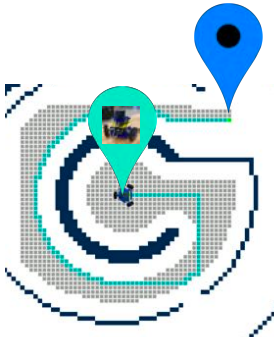
Project 4: Neural Networks

foundational AI algorithms
plement them in code

s and Graph algorithms

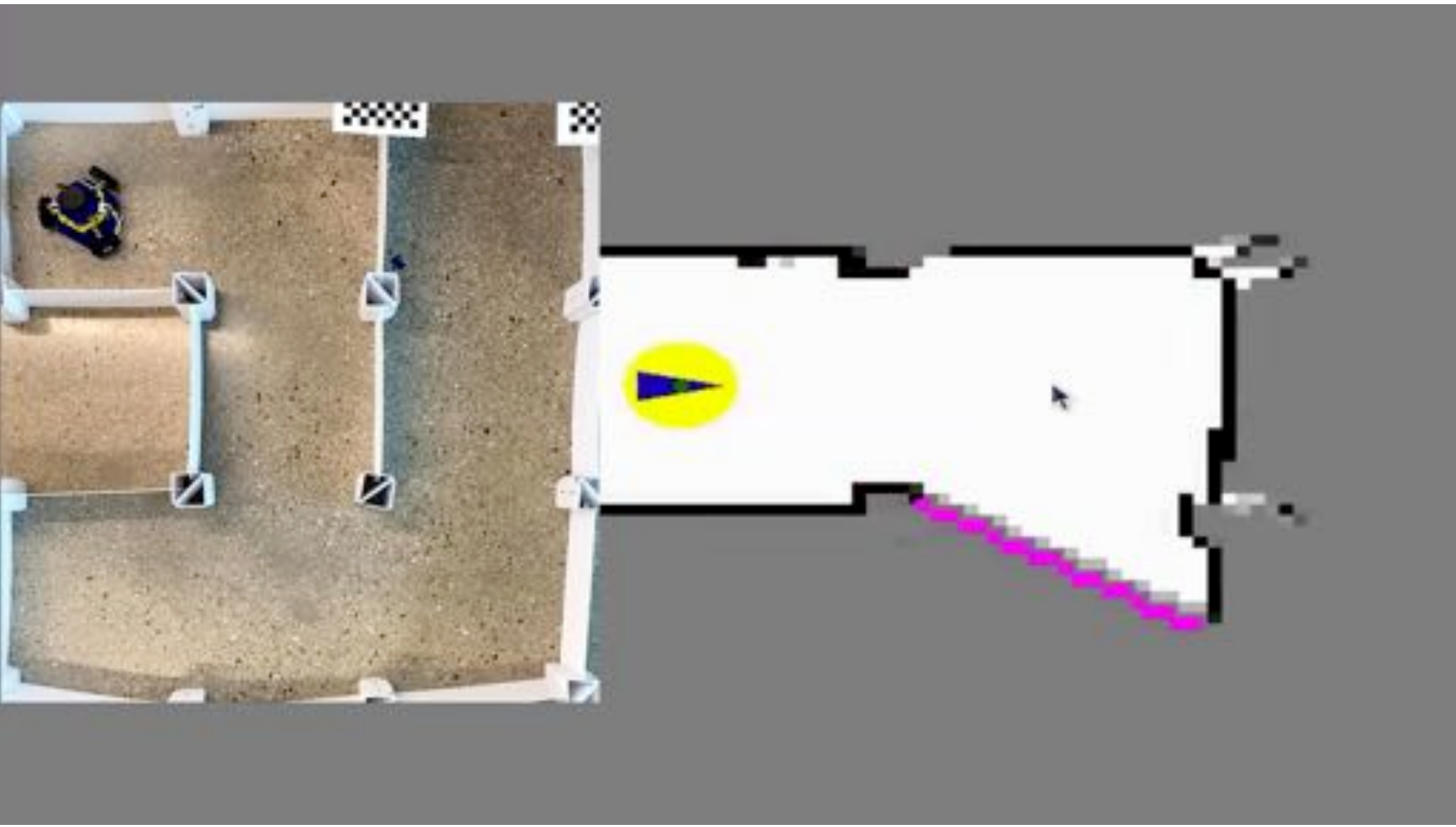


Project 2:
Potential
Fields



Project 3:
A*
Pathfinding

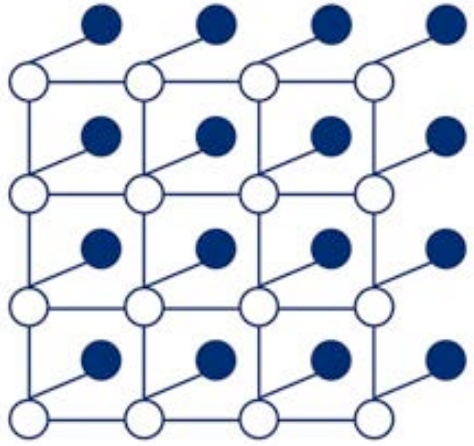
Project 4:
Neural
Networks

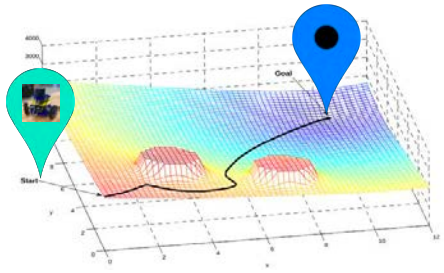


Understand foundational AI algorithms and implement them in code

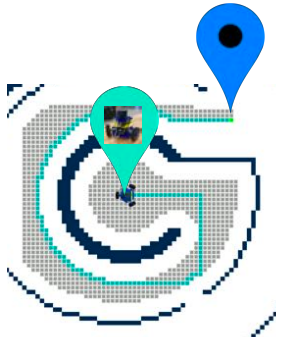
as Graphs and Graph algorithms

Robot models its environment as graph of “hidden” nodes with observations





Project 2: Potential Fields



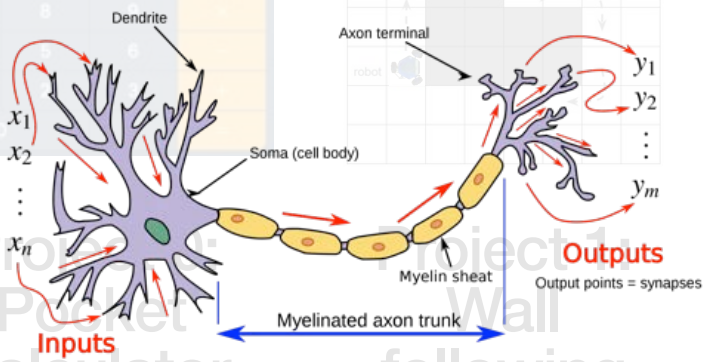
Project 3: A* Pathfinding

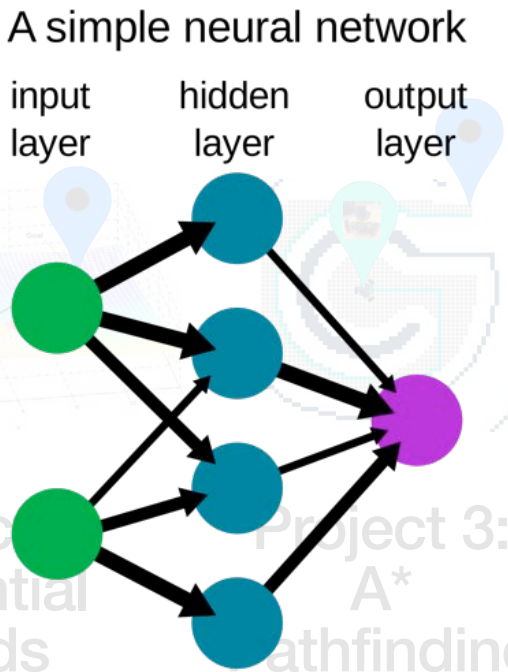
Project 4: Neural Networks

Understand foundational AI algorithms and implement them in code

as Graphs and Graph algorithms

Neural network is a graph of artificial neuron nodes that send activations





Project 4: Neural Networks

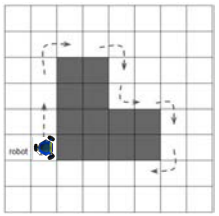
ROB 102 Grading

- Final grade determined by total of points earned
  - An A grade of some form is earned with 93 points or above
  - A B grade of some form is earned with 83 points or above
  - A C grade of some form is earned with 73 points or above

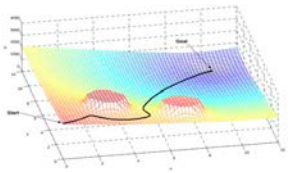
In Class Activities: 20 points

Participation: 5 points

Project 0: 15 points



Project 1: 15 points



Project 2: 15 points

Project 3: 15 points

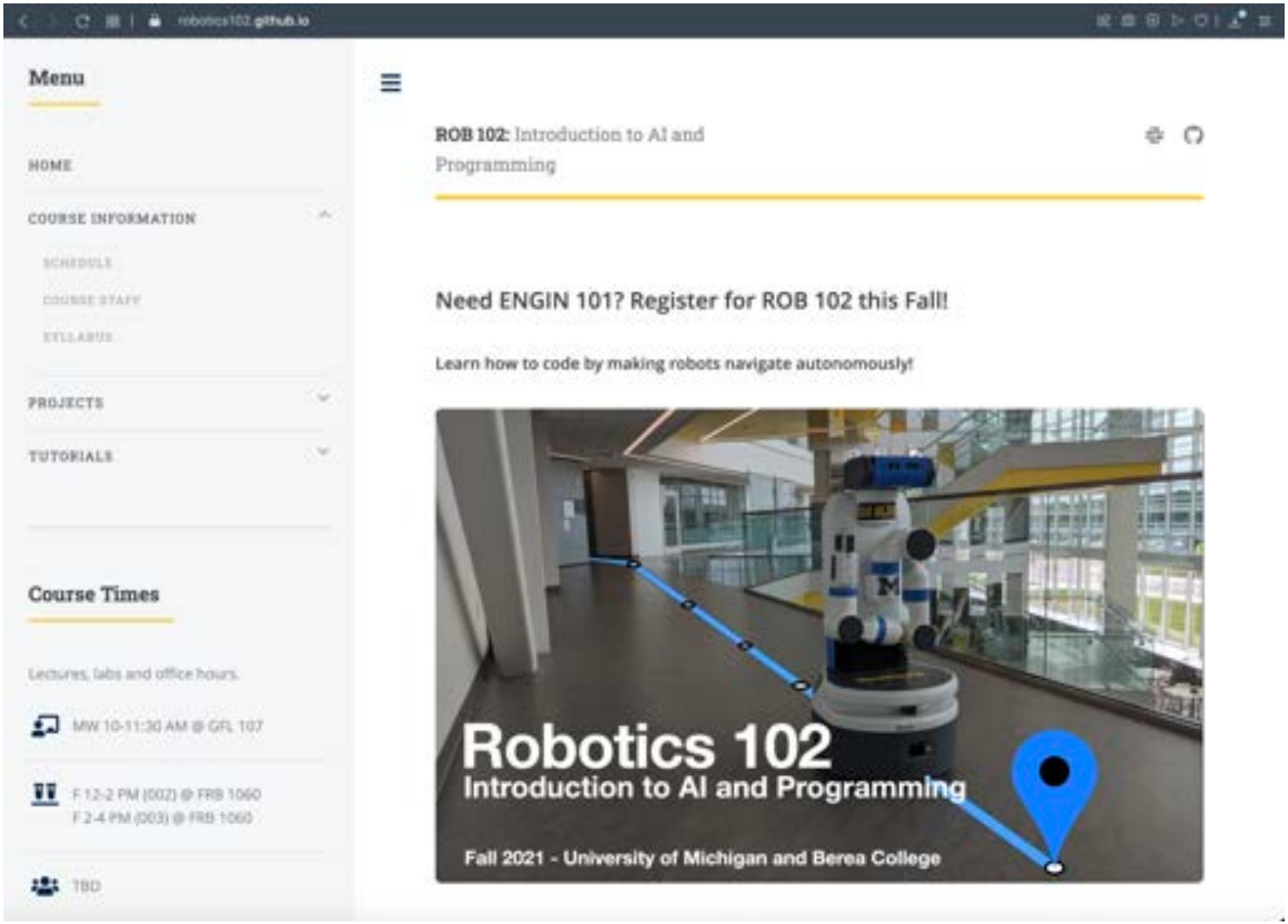
Project 4: 15 points

Advanced Extensions: 4 points

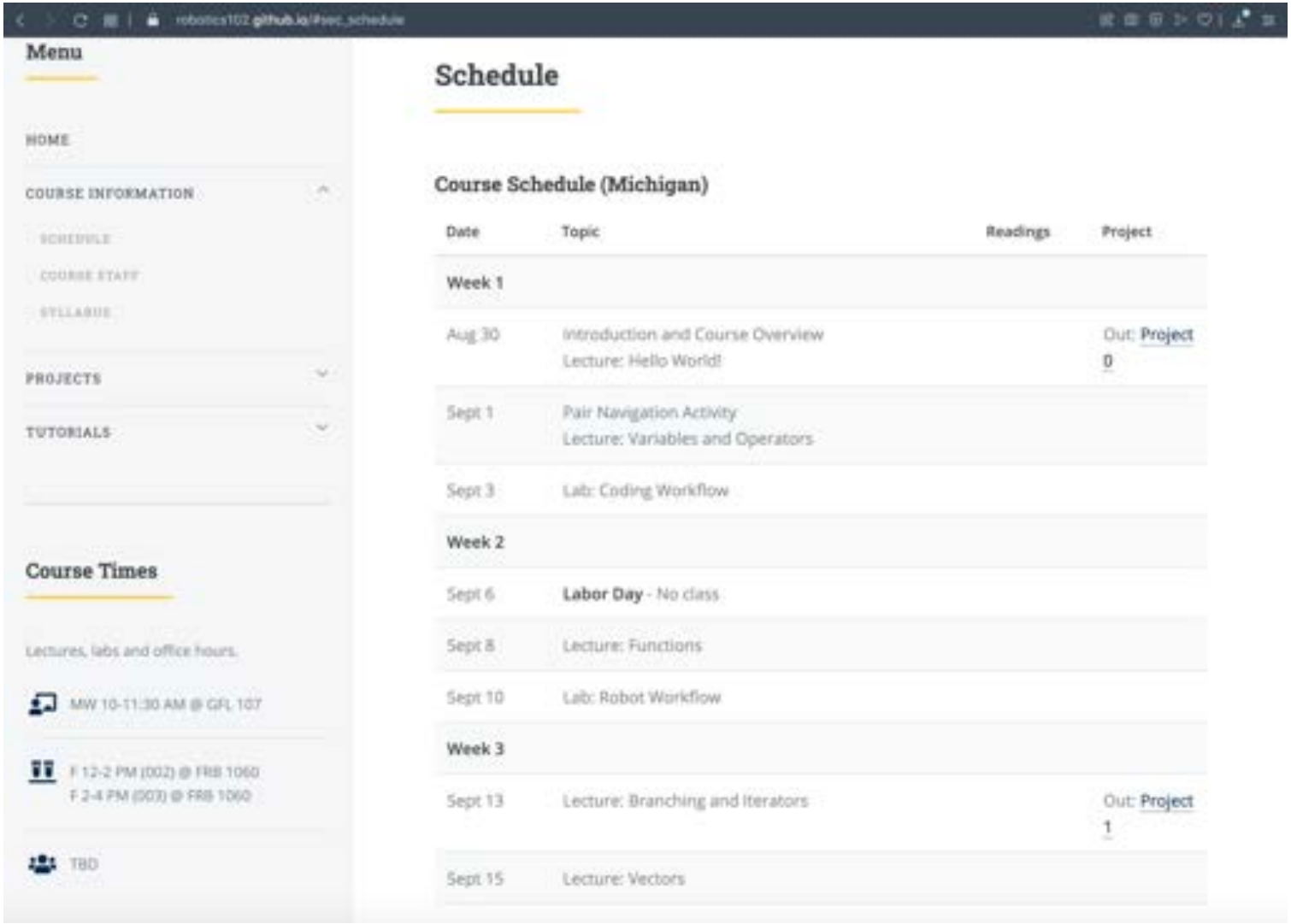
ROB 102 Flipped Classroom

- Course website: robotics102.github.io (or robotics102.org)
- All course material posted on course website, slack workspace, or your git repository
  - Robotics 102 does not use Canvas
- Lectures will be posted on course website
- Class lecture meetings (MW 10-11:20am) are dedicated to in-class activities and interactive help on projects
- Class lab sessions (F 12-2pm or F 2-4pm) are dedicated to tutorials for coding and working with robots, as well as interactive help

Robotics 102 Course Website



Robotics 102 Course Schedule



Menu

HOME

COURSE INFORMATION

SCHEDULE

COURSE STAFF

SYLLABUS

PROJECTS

TUTORIALS

Course Times

Lectures, labs and office hours.

MW 10-11:30 AM @ GFL 107

F 12-2 PM (002) @ FRB 1060
F 2-4 PM (003) @ FRB 1060

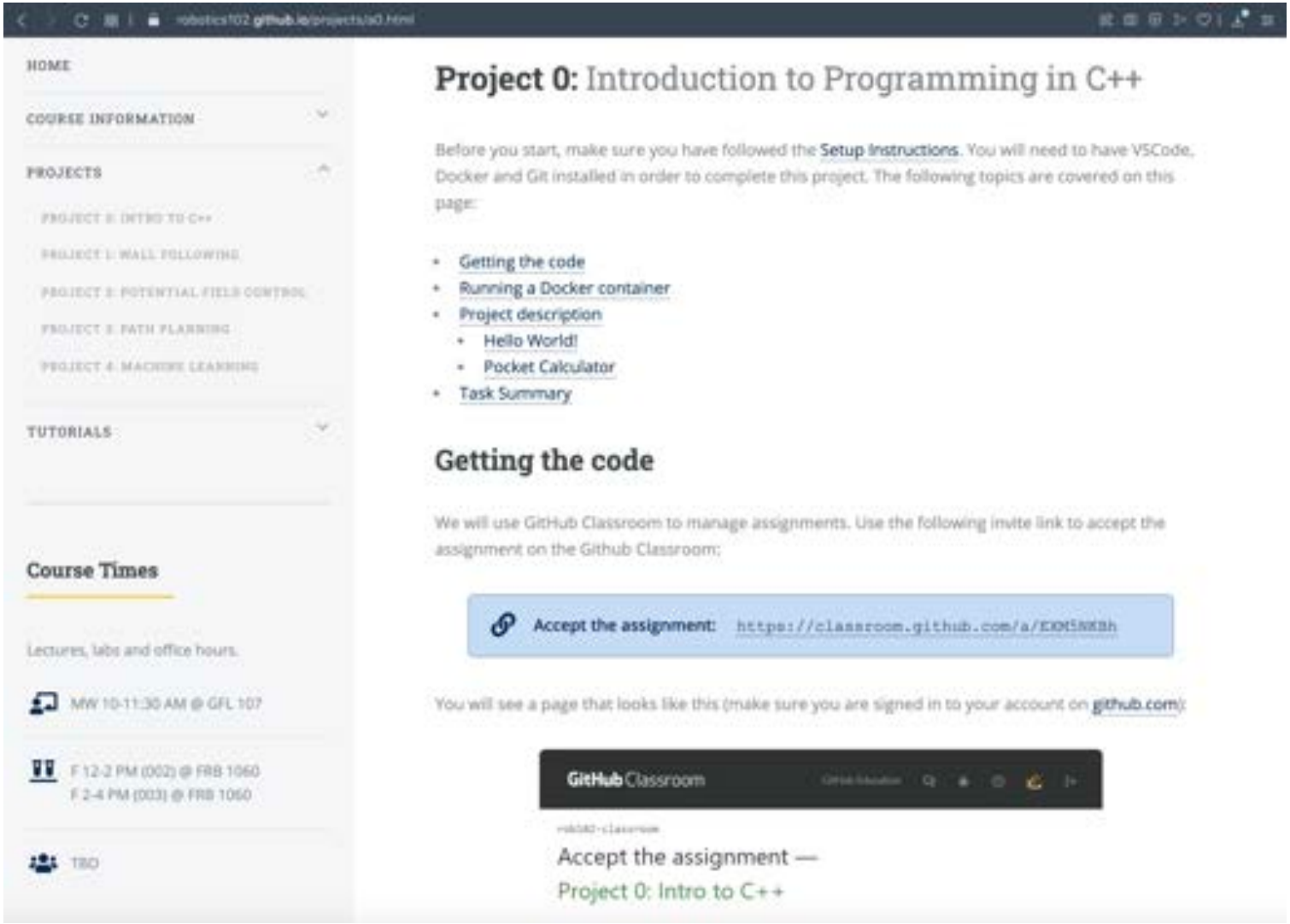
TBD

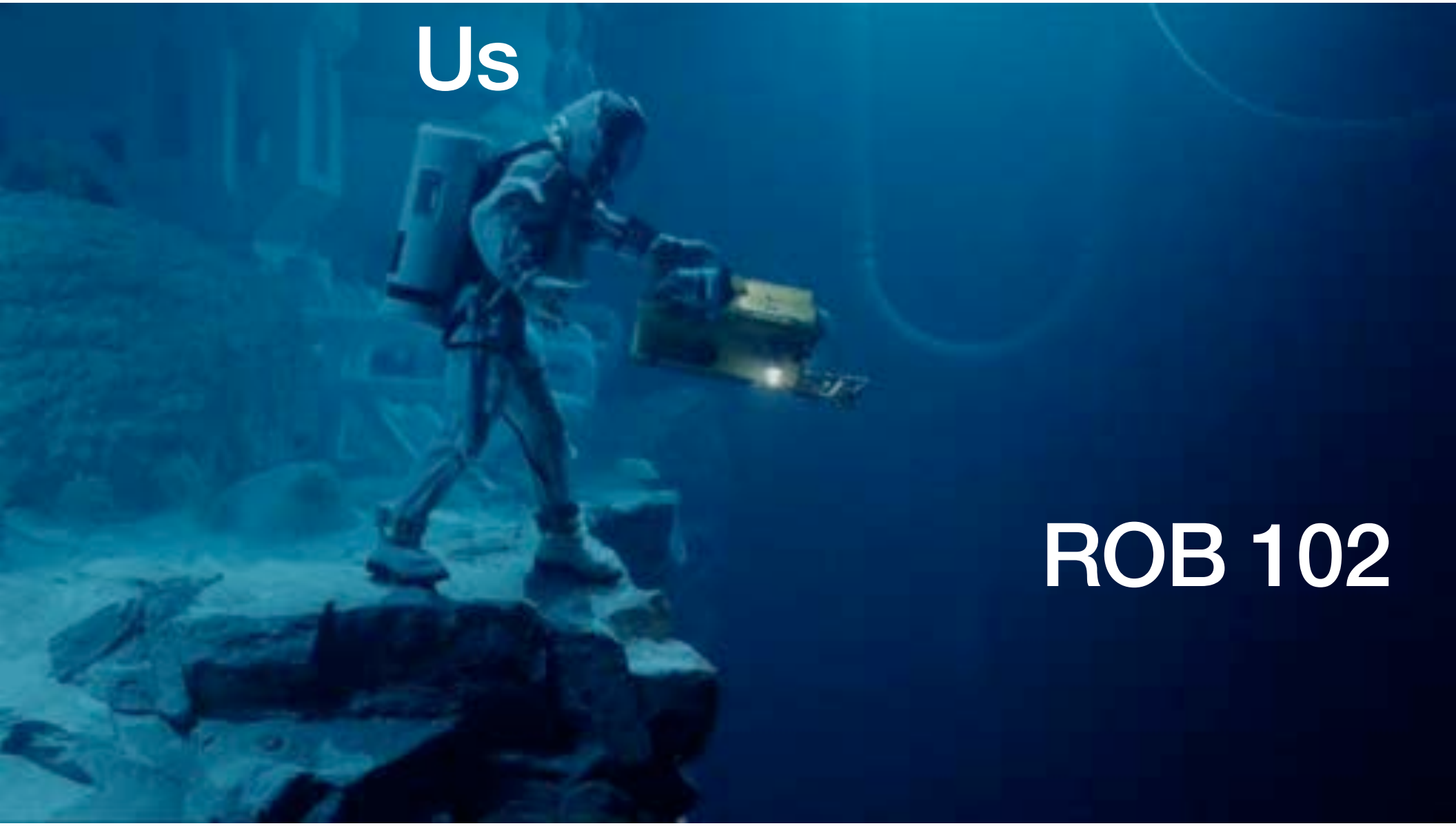
Schedule

Course Schedule (Michigan)

Date	Topic	Readings	Project
Week 1			
Aug 30	Introduction and Course Overview Lecture: Hello World!		Out: Project 0
Sept 1	Pair Navigation Activity Lecture: Variables and Operators		
Sept 3	Lab: Coding Workflow		
Week 2			
Sept 6	**Labor Day** - No class		
Sept 8	Lecture: Functions		
Sept 10	Lab: Robot Workflow		
Week 3			
Sept 13	Lecture: Branching and Iterators		Out: Project 1
Sept 15	Lecture: Vectors		

Robotics 102 Project 0: Pocket Calculator

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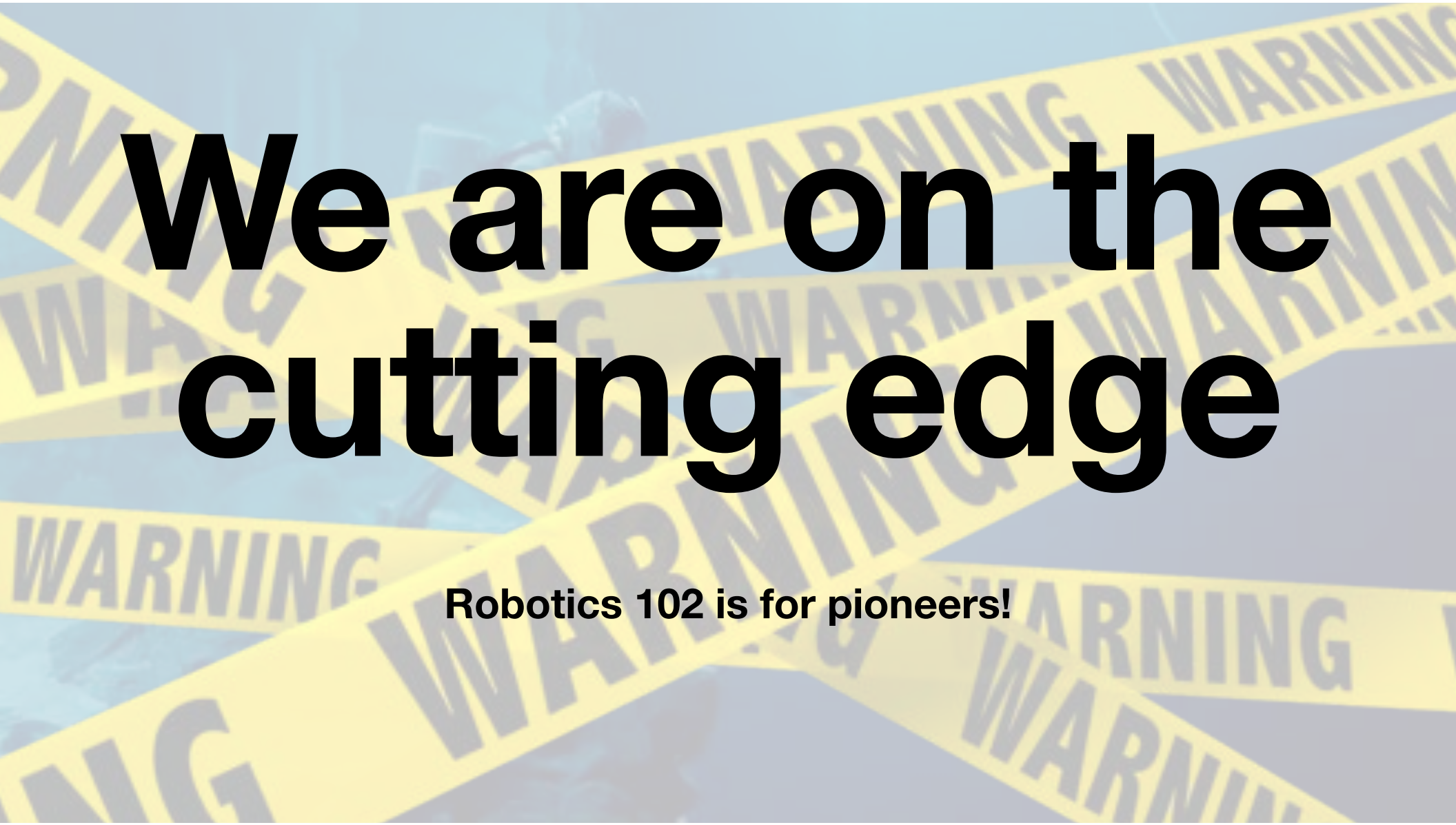

We are on the cutting edge
Robotics 102 is for pioneers!

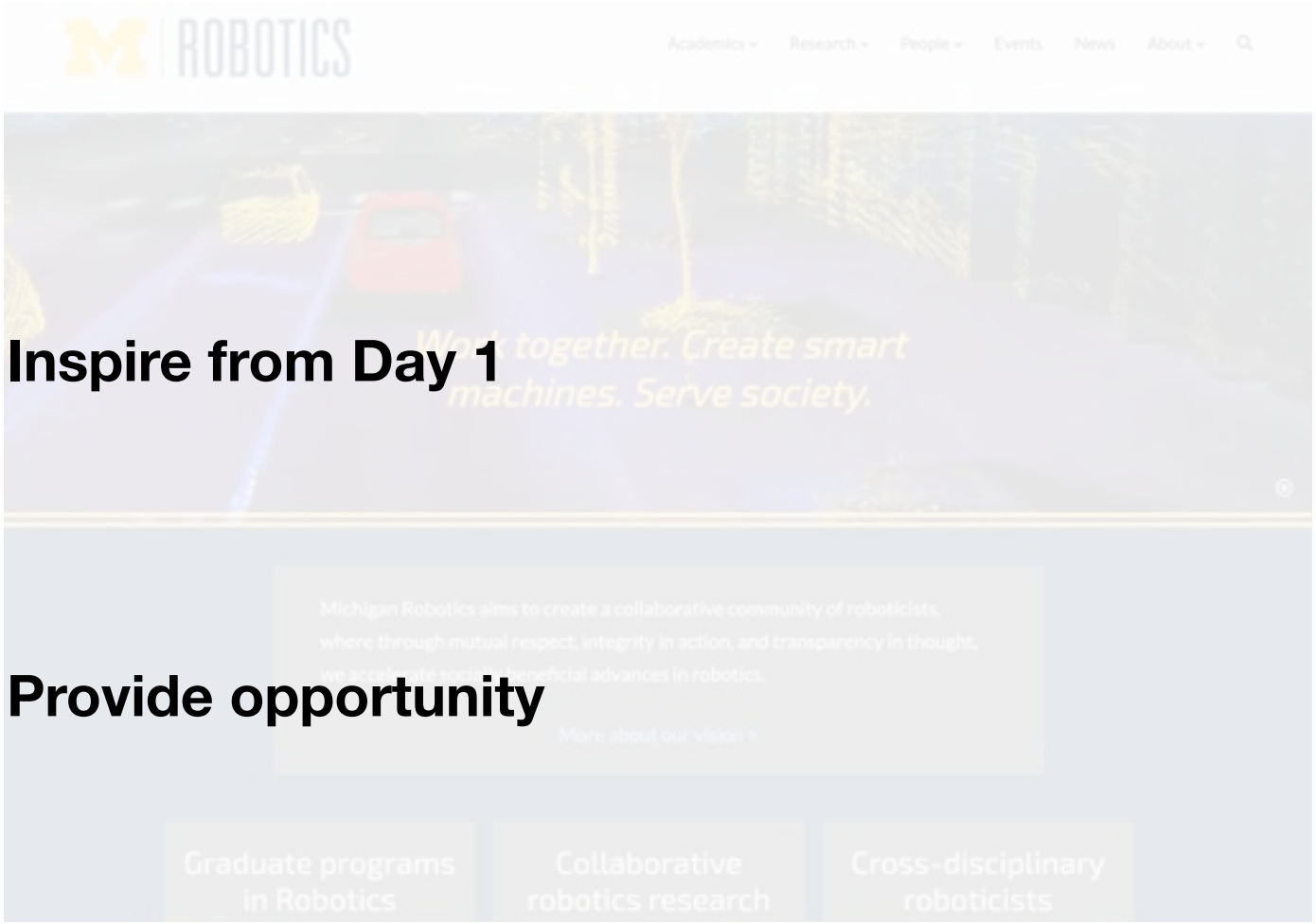
We are on the cutting edge

Robotics 102 is for pioneers!

This is first offering of an innovative approach to education

Robotics with Respect

Robotics with Respect



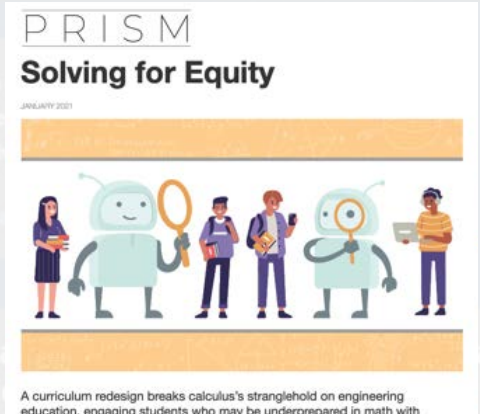
Inspire from Day 1

Provide opportunity

Robotics with Respect

Inspire from Day 1

Provide opportunity



Roboticists show and prove!

Time for a demo…

In the new Robotics Building

Robotics with Respect

Inspire from Day 1

Provide opportunity