

# ROB 430/599: Deep Learning for Robot Perception and Manipulation (DeepRob)

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Lecture 1: Welcome!

01/07/2026



# Today

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- Introductions (15min)
- Deep Learning x Robot Perception and Manipulation (25min)
- Course Resources (25min)
- P0 starter/Intro to Google Colab (15min)

# Xiaoxiao Du

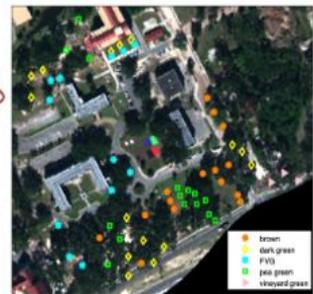
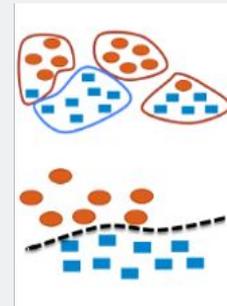


[Sounds like “she-OW she-OW doo”]

Assistant Research Scientist  
& Lecturer in Robotics

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Office: 3257 FRB or virtually

Research Interest: sensor  
data integration, pedestrian  
prediction, autonomous  
driving

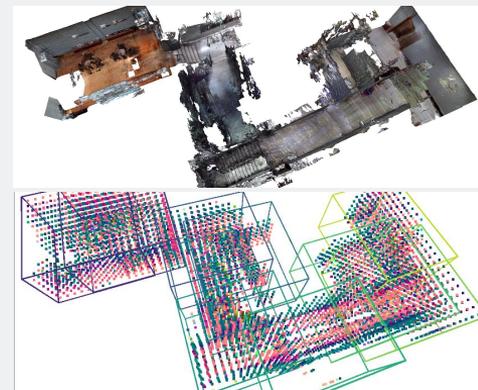
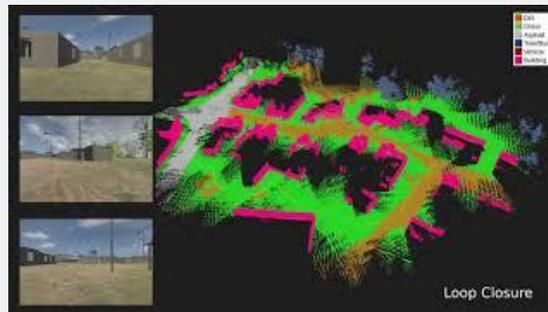


# Yulun Tian

Assistant Professor  
Scalable Spatial Intelligence Lab  
(<https://ssi.robotics.umich.edu/>)

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Research Interest: Robot  
Perception, Learning, Optimization,  
Multi-Agent Systems



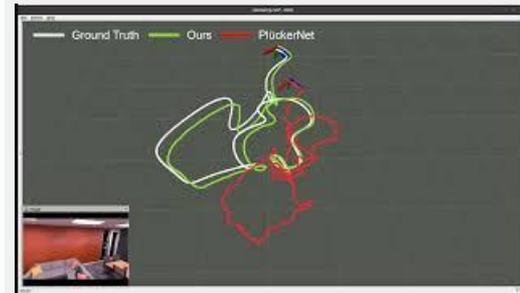
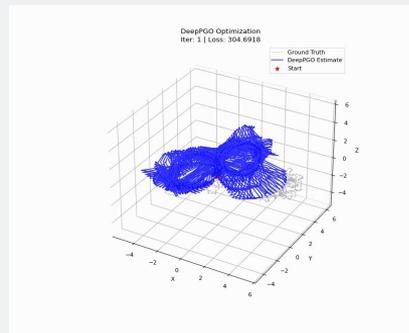
# Jaeho Shin (GSI)

Ph.D. student in Robotics (SSI Lab & CURLY)

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Research Interest: Robot Perception,  
Optimization, Geometric Learning, SLAM



# Vaibhav Gurunathan (IA)

Undergraduate Senior double majoring in  
Computer Science and Robotics

- Previously IA for SLAM
- Also IA for EECS 467

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Super interested in all things ML + Robotics

- Currently doing research in Field  
Robotics Group



# Cindy Yang (IA)

Undergraduate in Computer Engineering & Robotics

- Previous IA for ROB320
- Systems Director on MFly

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Interests in embedded systems and controls



# Sunny Xu (IA)

Undergraduate in Computer Science & Robotics

- Previous IA for PHYSICS 240

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Interests in robotics control and autonomy



# Advaith Balaji (IA)



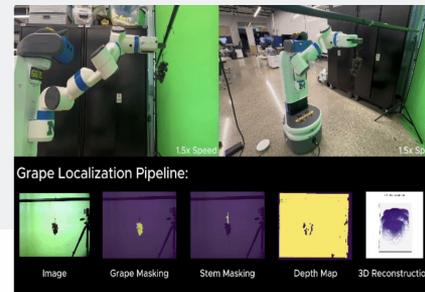
Undergraduate student in  
Robotics

Researcher at PROGRESS Lab

Email: [advaithb@umich.edu](mailto:advaithb@umich.edu)

Research Interests:

- Robot Reasoning
- Perception and Planning for Manipulation



3D Object Localization with  
Signed Distance Fields (SDFs)

Banana



# Raphael Allusson (IA)

Undergraduate Senior in Robotics

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Research Interests:

- Powered prosthetic control methods, sim-to-real control



# Aha Slides (In-class participation tool)

Try it out!

<https://ahaslides.com/L2OBP>



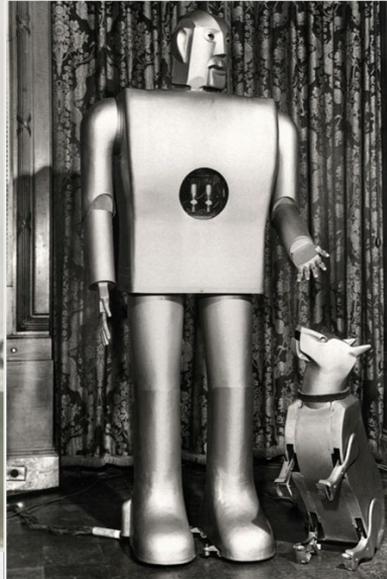


# FIGURE 03

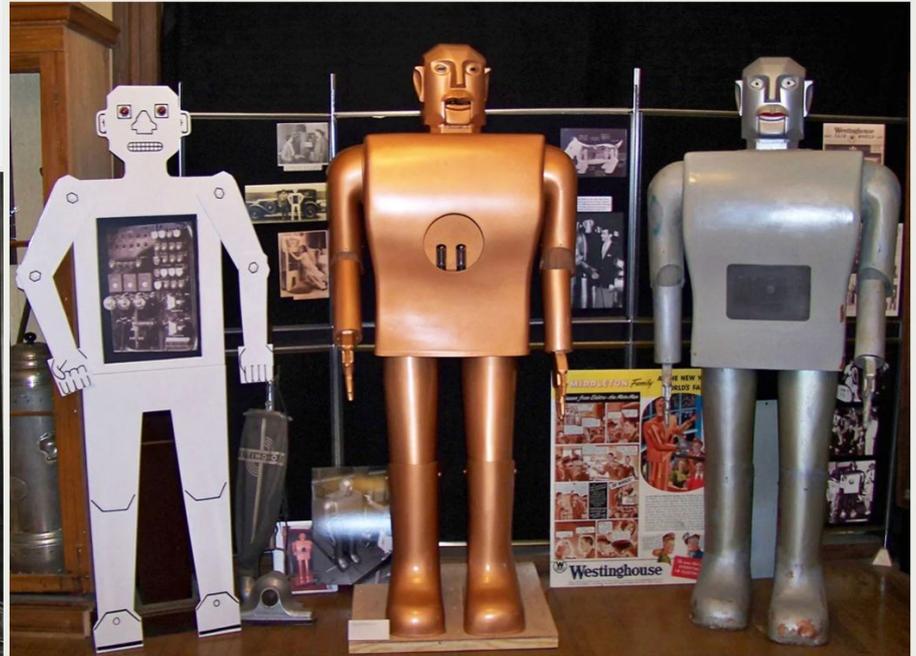
LAUNCH

# How did we get started?

## Elektro, 1939



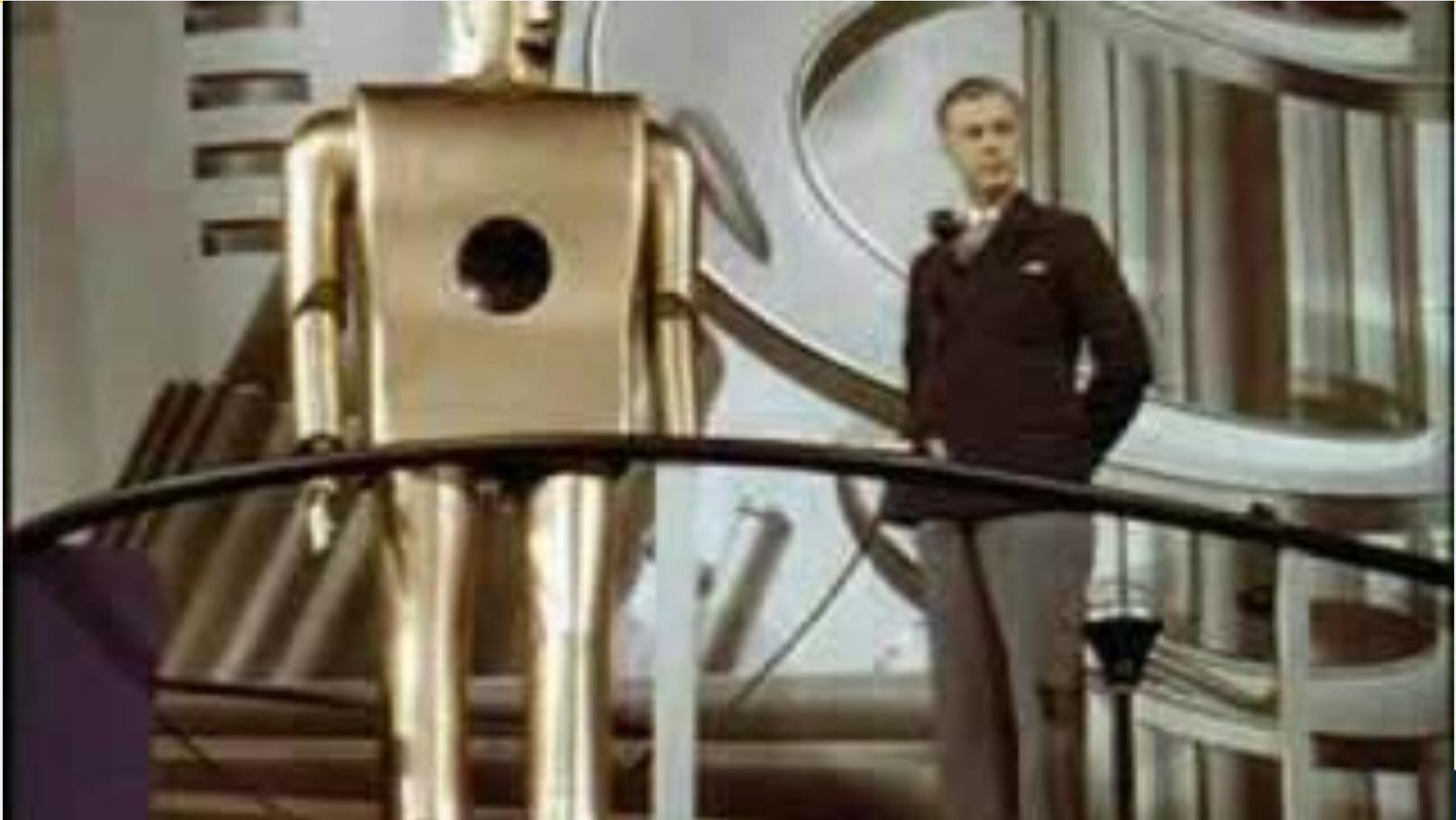
Robot's Best Friend: Westinghouse introduced Sparko the dog as a companion for Elektro. PHOTO: BETTMANN/GETTY IMAGES



Robot Family: Herbert Televox (left) was Westinghouse's first human-form robot. The more famous member of the Westinghouse robot family was Elektro; a copy is shown in the middle, while the original is on the right. PHOTO: MANSFIELD MEMORIAL MUSEUM

# 1939 World Fair – First Humanoid Robot

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# Elektro the Robot and his Dog Sparko (1940s)

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# In-hand manipulation (Dec. 2024)

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# World Simulation (Aug. 2025)

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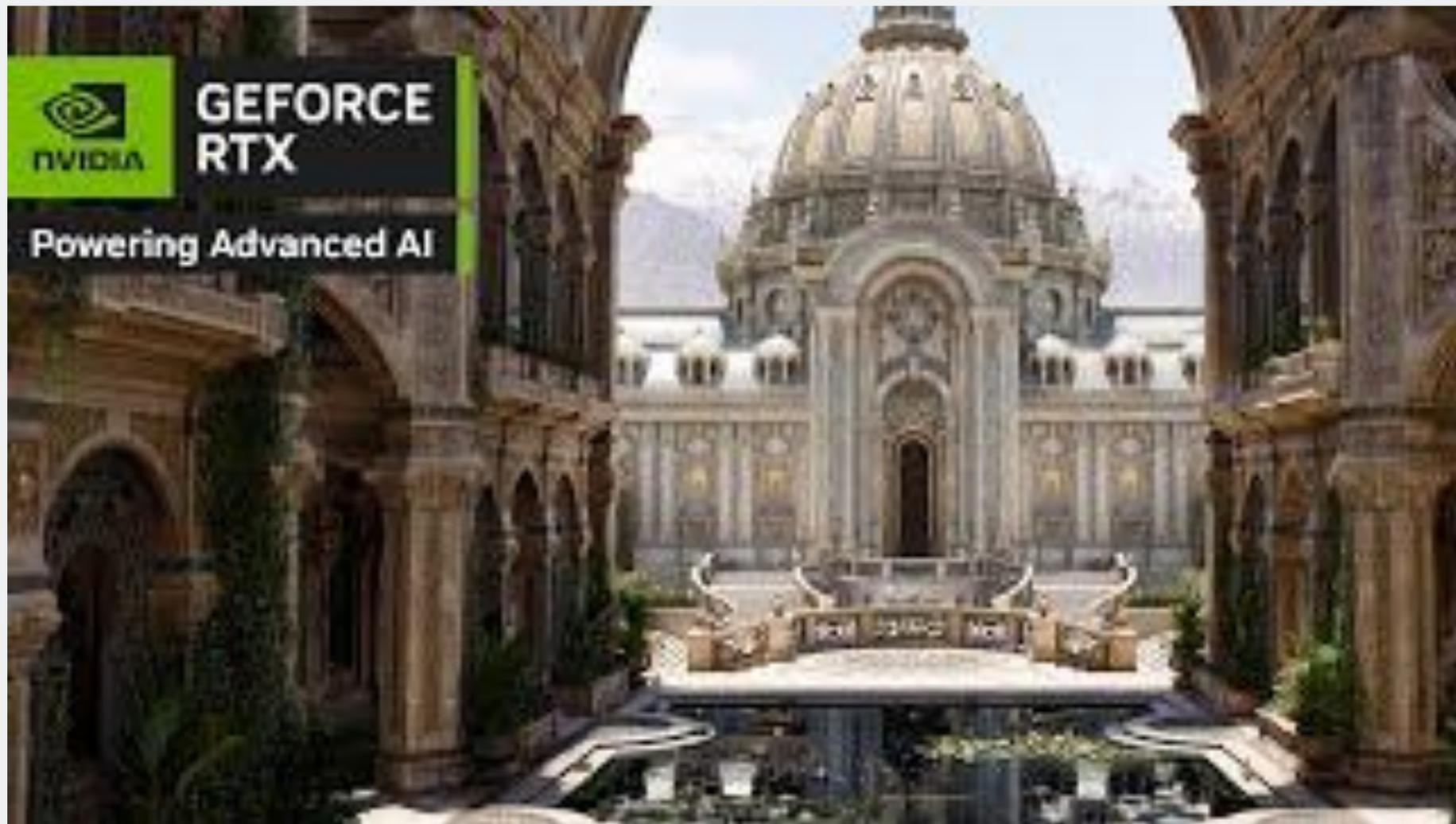




NVIDIA

**GEFORCE  
RTX**

Powering Advanced AI

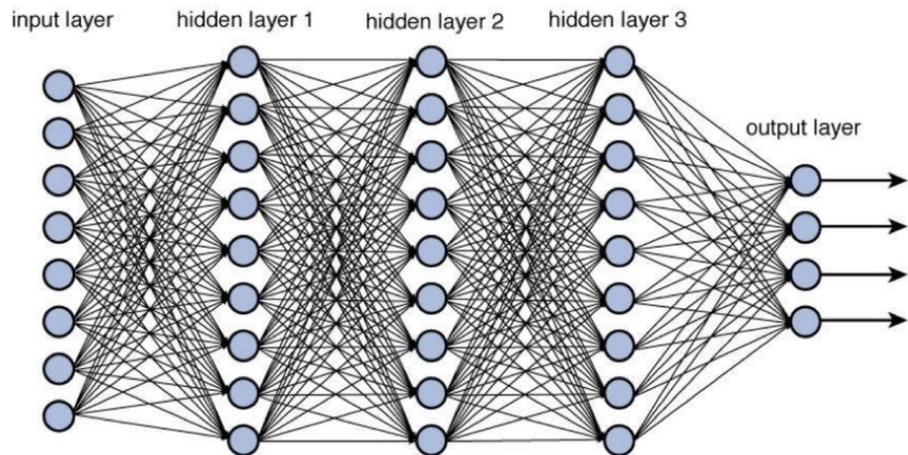


# Sora2 (Sept. 2025)

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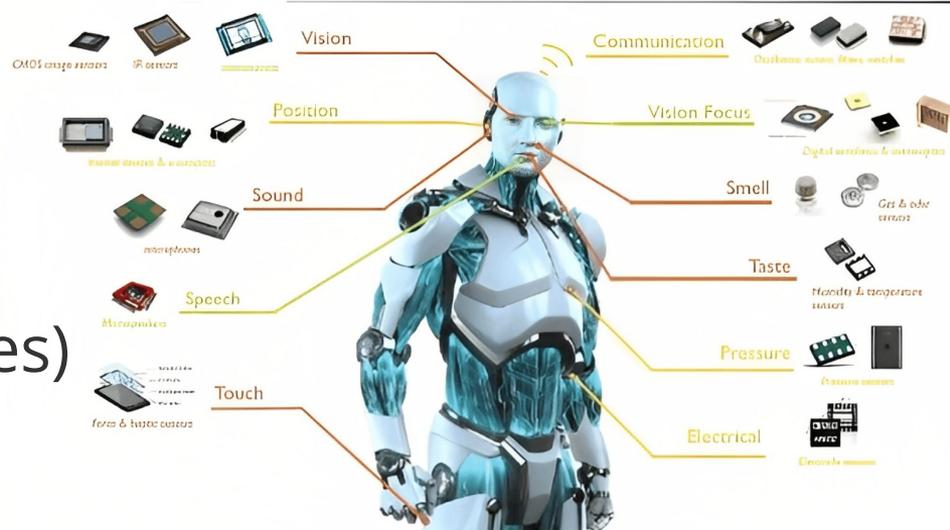


# Deep Learning x Robot Perception



## Deep Neural Networks

Robot Sensory Data  
Commonly, visual data (images)  
(but not limited to)



# PROGRESS Lab Fetch Robot (2017)



# Final Project (DeepRob 2024 GrapeBot)

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More at:

<https://deeprob.org/w24/reports/>

<https://deeprob.org/w25/reports/>

# Other Robotics and AI courses

First wave AI: Model-based

“Think through the entire problem”

# DeepRob is a step into modern robot learning

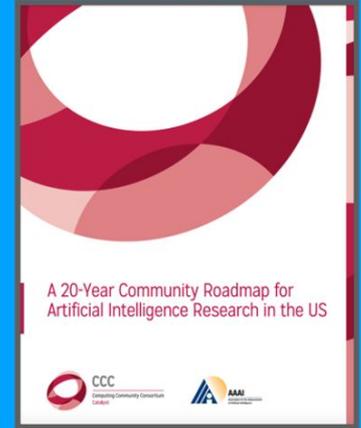
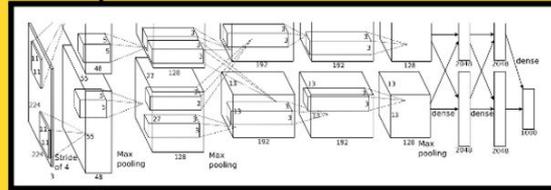
Second wave AI: Data-driven

“Learn from lots of data”

# Research for future AI

Third wave AI: Explainable

“Combine first and second wave AI to generate explanations”



1956

2011

20??

Time

# Course Resources

**Canvas** <https://canvas.it.umich.edu/>: links to all resources, quiz / in-class activities, grades, etc.

**Google Drive** (lectures slides, jupyter notebooks, etc.)  
[https://drive.google.com/drive/folders/1mCrdjDJccFLXWWKVC9QcCjUuzEA9QKZr?usp=drive\\_link](https://drive.google.com/drive/folders/1mCrdjDJccFLXWWKVC9QcCjUuzEA9QKZr?usp=drive_link)

**Piazza** (Q&A, project help, etc.): <https://piazza.com/umich/winter2026/rob430>

**Autograder** (project submissions): <https://autograder.io/>

**Office Hour Queue** <https://oh.eecs.umich.edu/courses/rob430-599>

# Course Schedule

## ROB 430/599 DeepRob, Winter 2026: Course Plan

*\*Note: This is a live document. There may be small changes/updates throughout the semester. Be sure to check back often!*

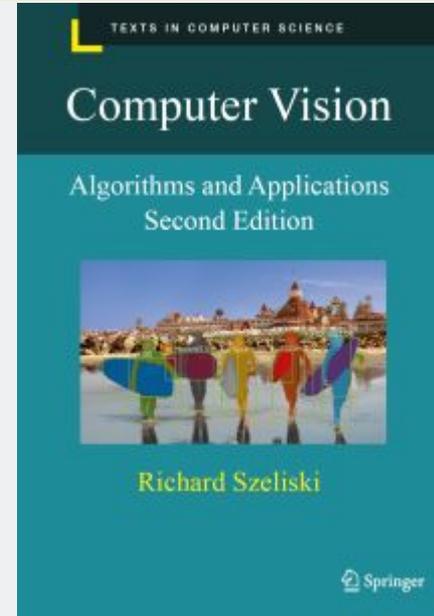
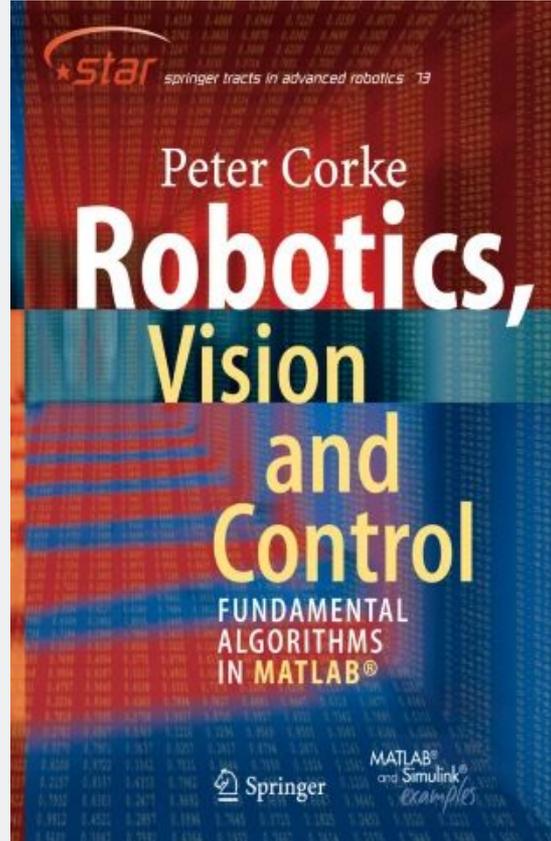
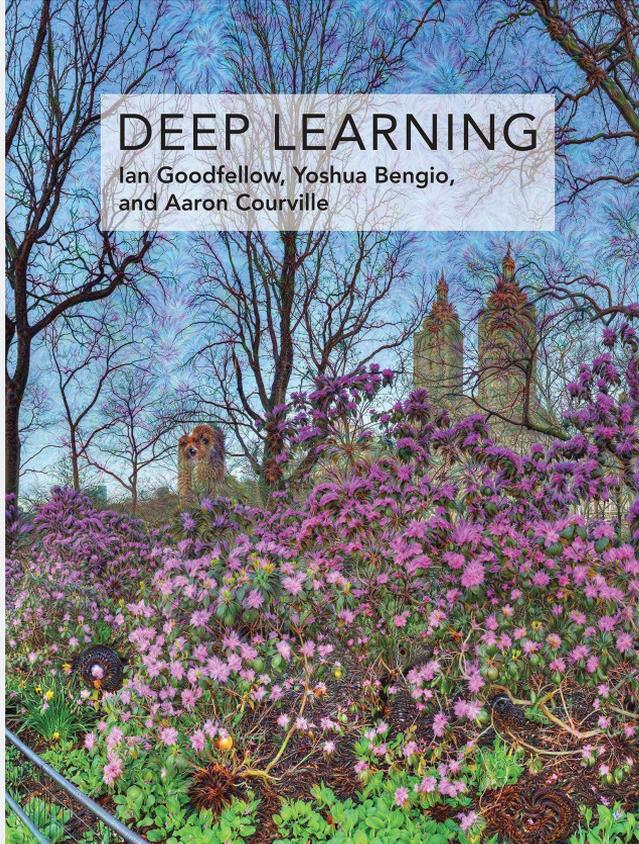
Mondays and Wednesdays 12:00PM-1:30PM (Lecture)

Tuesdays 3:30PM-5:30PM (Flex Day - lecture/lab/discussion/project help)

Date	Class + Primary Instructor	Supplementary Materials	Assignments Due
Week 1: Course Intro			
W Jan. 7	(X+Y) Lecture 1: Course Overview		Out: P0
Week 2: Classification			
M Jan.12	(Y) Lecture 2: Image Classification		Out: P1  <b>Due: P0 (Jan.18)</b>
Tu Jan.13	(J) Discussion 0: Intro to Python and PyTorch		
W Jan.14	(Y) Lecture 3: Linear Classifier		

# References

(not limited to)



Robotics {book}

# Grading

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- Programming Projects (individual) **(52%)**
  - Project 0 5%
  - Project 1 11%
  - Project 2 12%
  - Project 3 12%
  - Project 4 12%
- Midterm (individual) **(10%)**
- Final Project (Group) **(23%)**
  - Proposal Presentation 5%
  - Final Report and code (paper reproduction, algorithmic extension) 15%
  - Showcase (Video, Website, etc.) 3%
- In-class activities (individual) [quiz, notebooks, etc.] **(10%)**
- Participation (individual) [in class participation, office hours, Piazza, etc.] **(5%)**

**Total: 100%**

# Assignments

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- P0: Intro to Python and PyTorch
- P1: KNN and Linear models
- P2: Classification and Detection using CNNs
- P3: Pose Estimation
- P4: Transformers
- in-class activities (Aha Slides, Codes/Notebooks, Canvas Quizzes, etc.)
- Mid-term (in-class)
- Final Project

# Lecture content (Tentative)

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- Image Classification (linear/non-linear)
- Training and Optimizing Neural networks
- Backpropagation
- Convolutional Neural Networks
- Pose Estimation
- Transformers
- Generative Methods
- Frontiers in DL
  - Neural Rendering (Nerf, Gaussian Splatting)
  - Diffusion
  - Language models
  - Reinforcement learning
  - Applications
  - ...

If you have ideas, please feel free to reach out!

# Computing Resources

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- **Google Colab**
  - Students get one-year Colab Pro subscription for free (Faster GPU, More GPU memory)
  - Activate with your University of Michigan google account
  - Introduction during first discussion section next Tuesday
- **Great Lake cluster/ARC** [\[link\]](#)
  - Requested, will announce when confirmed
- **Vis Studio** [\[link\]](#)
  - Room 1401, Duderstadt Center
  - Priority given to VR/XR applications and classes. Walk-in hours available (local GPU machines).

# GenAI Activity

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U-M GenAI website: <https://genai.umich.edu/>

Activity: Use **DALL-E** to generate images based on prompts such as “deep learning for robot perception” “deep learning for robot perception and manipulation” and submit the generated images under Piazza thread.

Piazza: <https://piazza.com/umich/winter2026/rob430>

# GenAI Course Policy

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For individual projects (P0-P4) and mid-term, **NOT ALLOWED** - must complete code yourself

For final project, permitted to brainstorm **with disclosure**

See [Course Information Document](#) for more details

# Collaboration Policy

✔ Encouraged Collaboration	✘ Unacceptable Collaboration
✔ Discussing high-level design strategies, e.g., helper function organization or data structure choices	✘ Walking through an important piece of code step-by-step, sharing pseudocode, sharing comments
✔ Helping others understand the spec or project nuances	✘ Give someone your code as a reference
✔ Explaining a compiler or runtime error to someone	✘ Fixing/Debugging a compiler or runtime error for someone
✔ Brainstorming edge cases for testing	✘ Discussing specifics about what test cases are on the autograder, especially if one person has submitted already and the other is still working on the code
✔ Sharing template code/code updates (if any) provided by the course staff	✘ Copying code in whole or in part, or writing original code for someone else, or having someone else write your project
✔ Looking at small snippets of someone else's code to understand concepts	✘ Copy code, or sharing your code in a way that could be copied, e.g., sending code over email or taking a picture of code

# Collaboration Policy

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- **Group assignment (final project) will contain a signed statement of contribution with your submission**

"I participated and contributed to team discussions on each problem, and I attest to the integrity of each solution. Our team met as a group on [DATE(S)]. "

“Contribution of Authors: [Team member A] did [Task XXX]; [Team members B and C] did [Task YYY]; [Team members A, B and C] did [ZZZ]. [All authors] [gave feedback on the software development, contributed to writing the report/making the demo presentation, and approved the final version for submission.]”

- **All members are expected to contribute to the project implementation (codes) as well as write-up and final presentation**

# Office Hours: Stay Tuned

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- Will be updated on Canvas as google calendar

URL: <https://tinyurl.com/deeprobw26OH>

(Add this to your UM Google calendar to view)

# Intro to Google Colab

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Example Notebook: <https://tinyurl.com/rob430lec1>