

CS 4476A/6476B: Intro to Computer Vision

Instructor: Frank Dellaert

TAs: Heyley Gatewood(head TA), and Kritika, Nikith,
Junyan, Sarath, Shashank, Tongshu, Vince.



And almost
265 of you!
165u+100g

Today's Class

Who are we?

Specifics of this
course

What is Computer
Vision?

Name
 Kritika Gupta
 <u>Nikith Mahendra Hosangadi</u>
 Vince W Li
 Lixing Liu
 Junyan Mao
 Sarath Kumar Mutnuru
 Shashank Srikanth
 Tongshu Yang pending

Teaching Assistants



Heyley Gatewood (head TA)

A bit about me

<https://dellaert.github.io/>

Originally from Belgium

1989 EE in Leuven

1993 M.Sc. ECE at CWRU

2001 Ph.D. CS, Carnegie Mellon

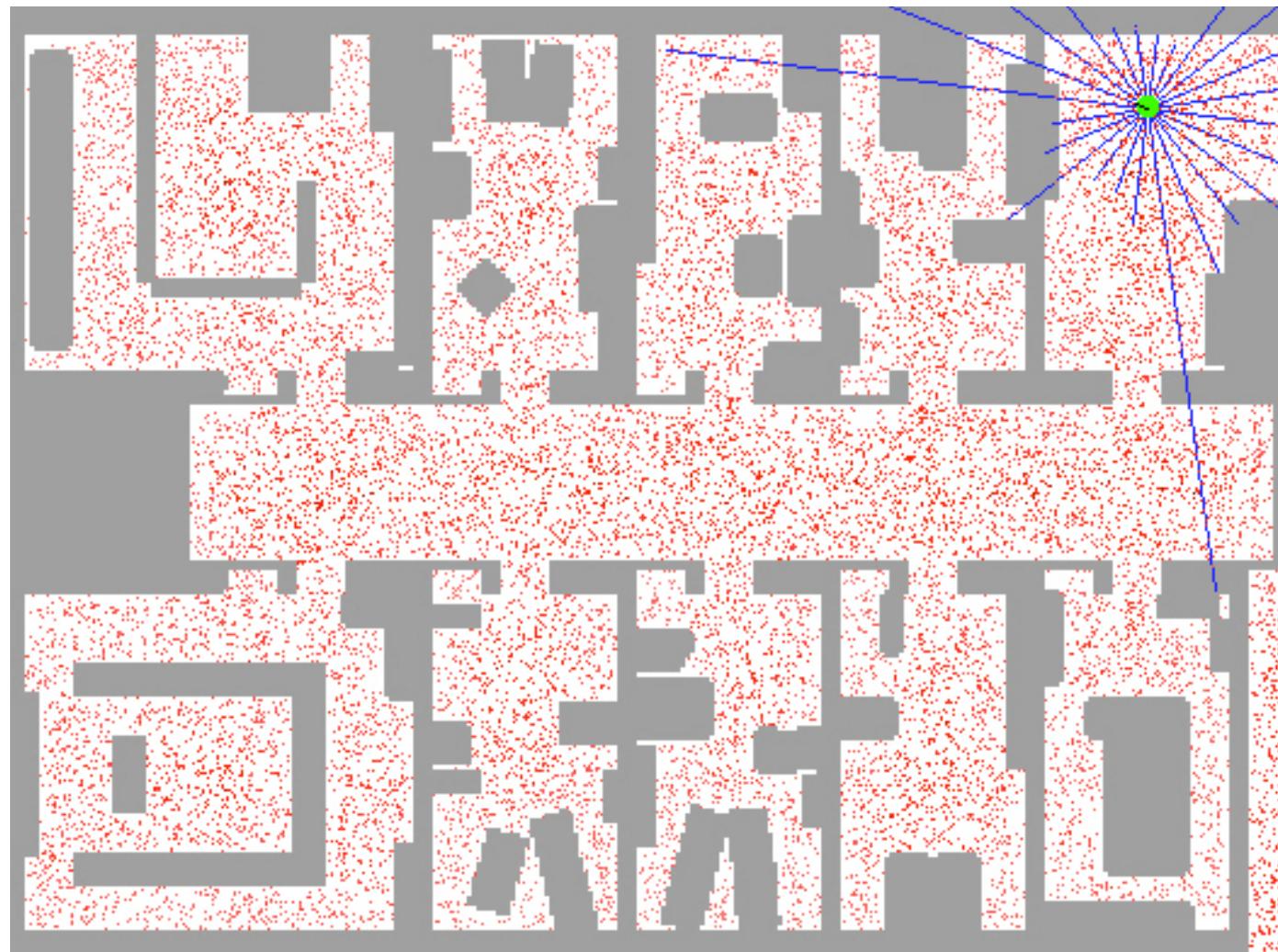
Georgia Tech since August 2001

Teaching Computer Vision etc.:

7641	Machine Learning	02, 03, 04	45
8803	3D Reconstruction and Mapping	02, 09, 10,12 04, 05, 06, 07,	70
4495	Computer Vision, undergraduate	19, 21 05, 06, 07,13,14	441
8803	Intro to Perception and Robotics	, 20 06, 07, 11, 12,	485
6476	Computer Vision, graduate	13, 21 07, 09,	453
4475	Computational Photography	18	155
4480	Digital Video Special effects	08, 09, 10, 11	146
			1697



Monte Carlo Localization, at Carnegie Mellon!



On-line August 24
to September 5

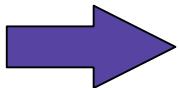


Dellaert, Fox, Burgard & Thrun, ICRA 1999
Fox, Dellaert, Burgard & Thrun, AAAI 1999

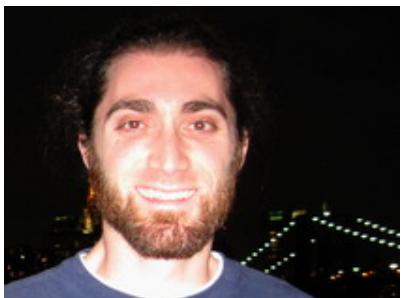
In the Smithsonian Institution's National Museum
of American History and ON THIS WEB SITE

Spatiotemporal Reconstruction

4D Cities: 3D + Time



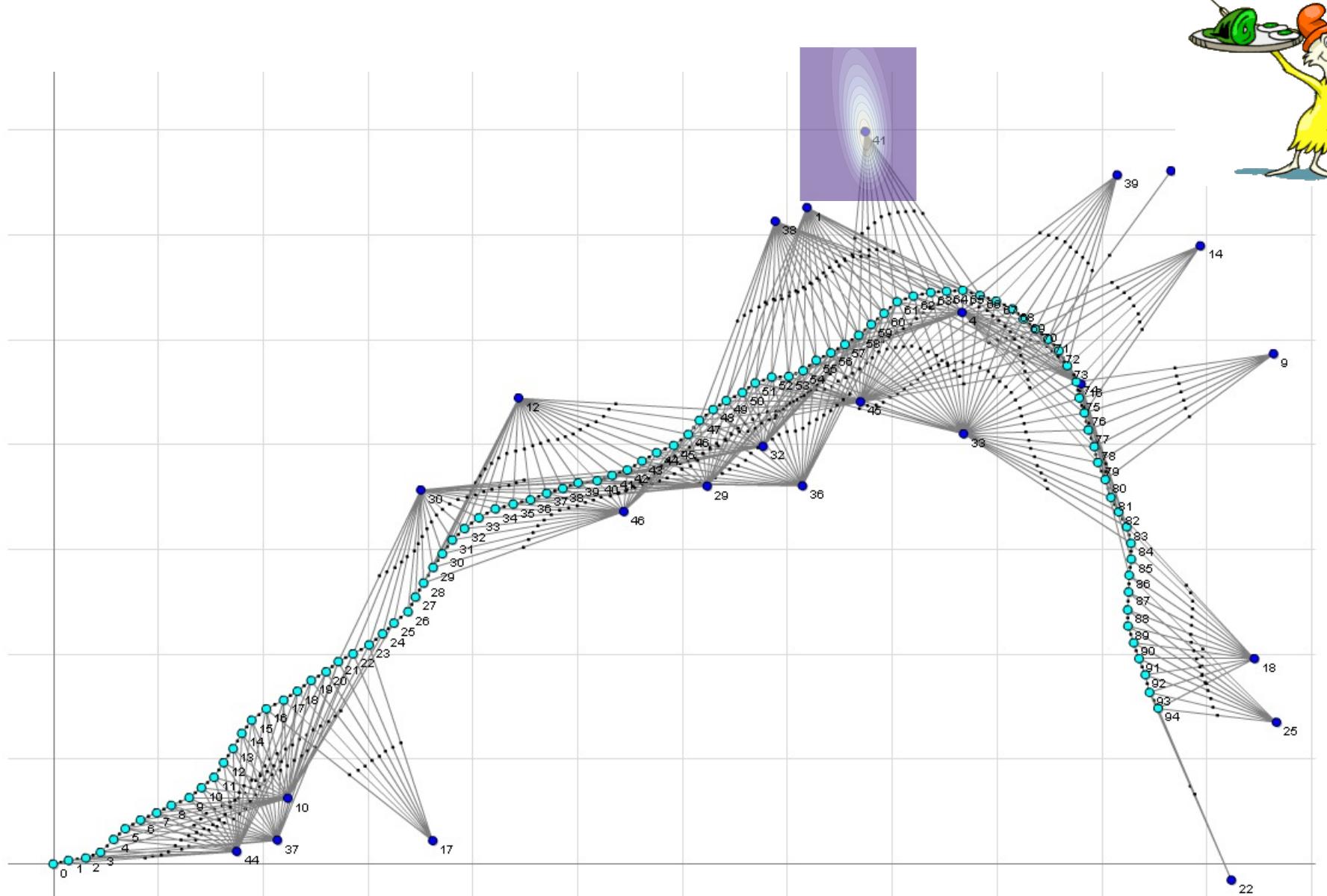
Historical Image Collection



Supported by NSF CAREER, Microsoft
Recent revival: NSF NRI award on 4D
crops for precision agriculture...

Grant Schindler

Factor Graphs -> GTSAM !



Silicon Valley intermission at Skydio



Silicon Valley intermission at Facebook



The Scene Understanding and Modeling Challenge

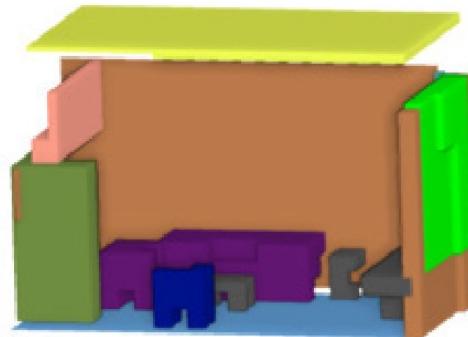
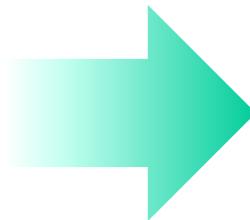
Color



Depth



RGB-D 360 degree image



Object-based representation of a room

Organizers

Daniel Huber (Facebook)

Lyne Tchapmi (Stanford University)

Frank Dellaert (FB / Georgia Tech)

Vision Problems Addressed

Object segmentation

6-DOF pose estimation

Object completion

Appearance modeling

Instance labeling

Layout estimation

Silicon Valley engagement at Google AI



About Responsibilities Research Education Tools Blog

Our research

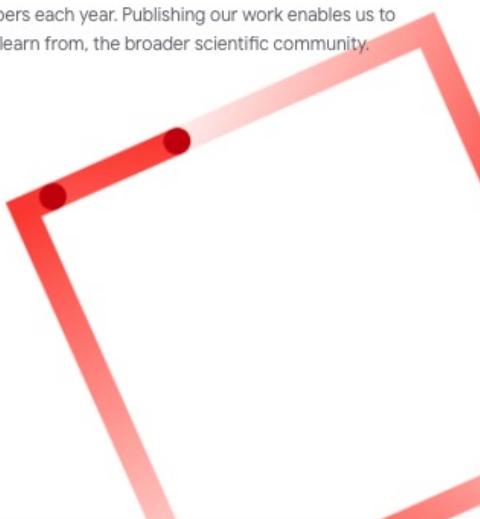
Researchers across Google are innovating across many domains.

We challenge conventions and reimagine technology so that everyone can benefit.

Publications

Google publishes hundreds of research papers each year. Publishing our work enables us to collaborate and share ideas with, as well as learn from, the broader scientific community.

[Our publications](#)



Research Areas

From conducting fundamental research to influencing product development, our research teams have the opportunity to impact technology used by billions of people every day.

[Our research areas](#)



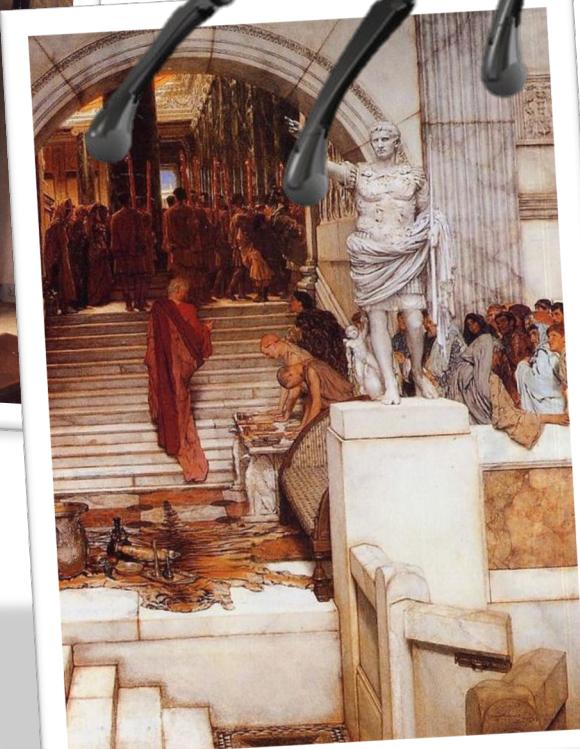
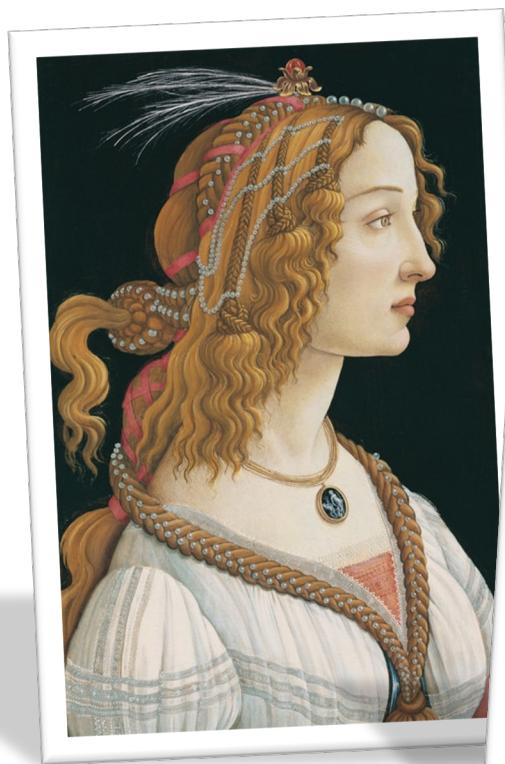
Tools & datasets

We make tools and datasets available to the broader research community with the goal of building a more collaborative ecosystem.

[Our tools](#)



What's next? Robot Art! Dynamics!



<https://dellaert.github.io/NeRF/>

Course Website/Syllabus

Fall '19 Computer Vision



<https://dellaert.github.io/21F-x476/>

Project 0: Linear Algebra with Pytorch



Out: 6.30 today

Due: Friday September 3, midnight

Late policy: 10% per day

Learning Objectives:

- Set up a conda environment
- Understand how to start a jupyter notebook
- Linear algebra in python using pytorch
- Test your code using unit tests
- Use gradescope to submit your work

Project 1: Image Filtering and Hybrid Images

Implement image filtering to separate high and low frequencies

Combine high frequencies and low frequencies from different images to create an image with scale-dependent interpretation



Project 2: CNN Image Segmentation



Learning Objectives:

- 1.Understanding convolutional neural networks for **inference**
- 2.Construct a basic CNN for image segmentation
- 3.Understand the use of some basic layers used in CNNs
- 4.Set up the inference workflow in Pytorch.

Project 3: Scene Recognition with Deep Learning

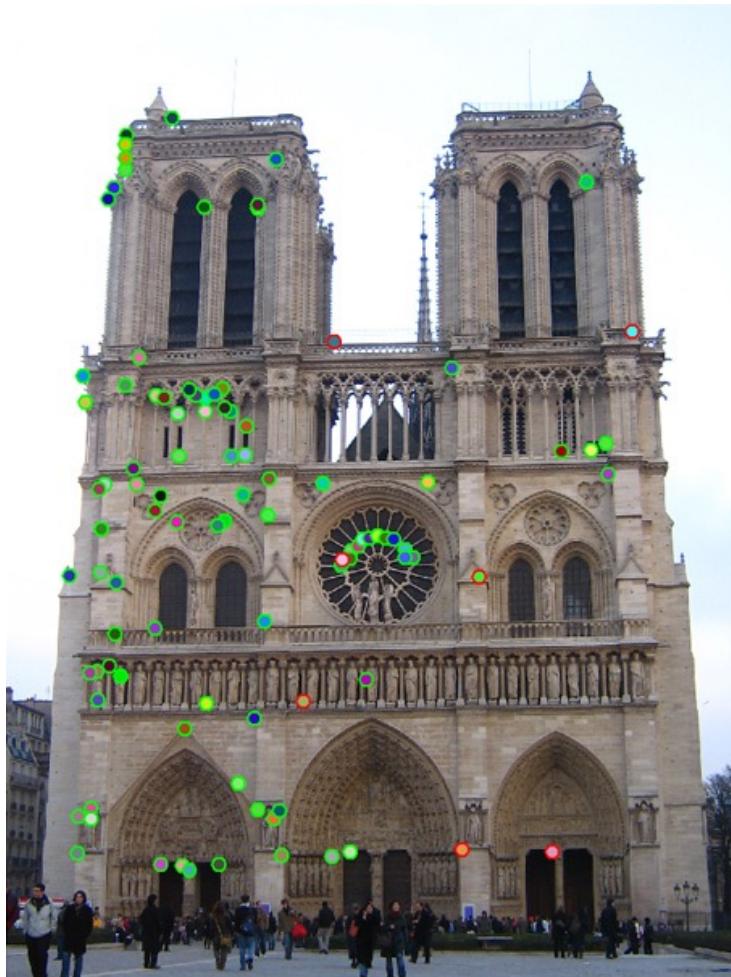


Learning Objectives:

1. Understanding the rationale behind data pre-processing
2. Construct a basic CNN for multi-class classification
3. Understand some more basic layers used in CNNs
4. Set up the **training** workflow in Pytorch.

Project 4: Local Feature Matching

Implement interest point detector, SIFT-like local feature descriptor, and simple matching algorithm.



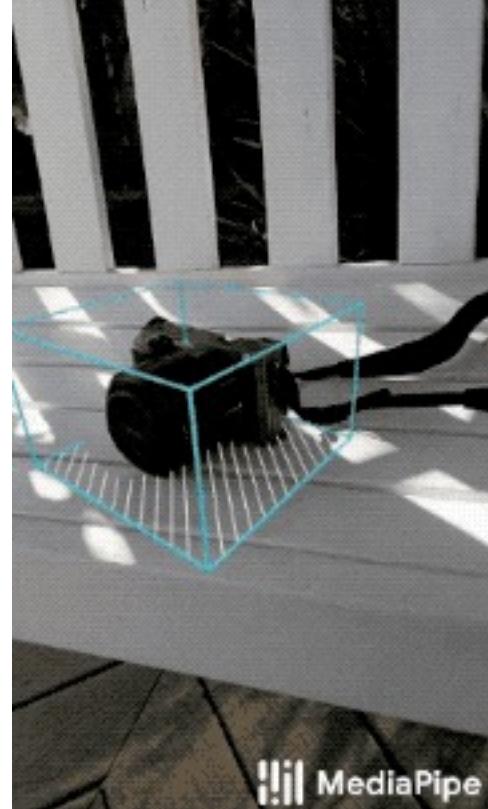
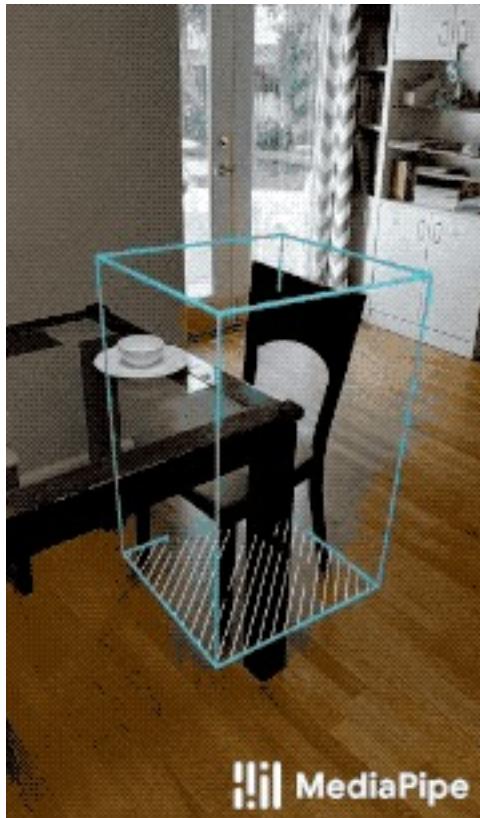
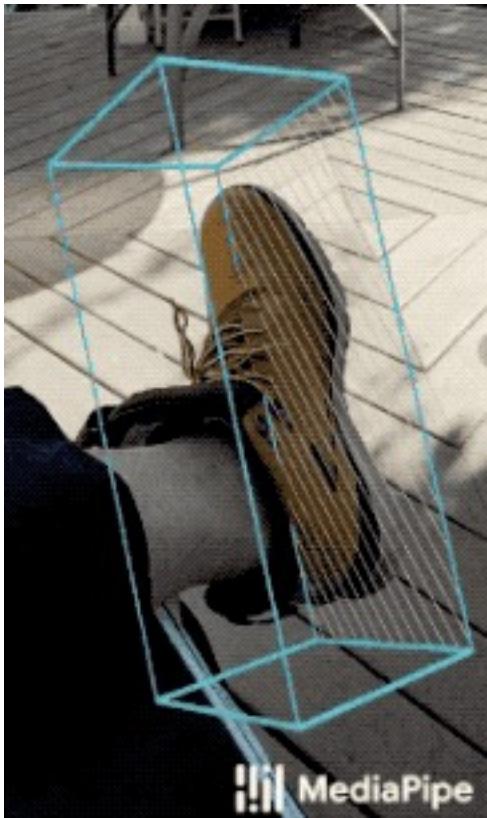
Project 5: Projection Matrix, F+Ransac

Understand geometry of pose estimation, and use a random sampling algorithm to do a detailed matching based on the fundamental matrix constraint.



Project 6: Object and Pose Detection

Application of open source libraries (Google Mediapipe) to a practical problem, using your own imagery.



<https://google.github.io/mediapipe/solutions/objectron.html>