CS 4476A/6476B:
Intro to Computer Vision

Instructor: Frank Dellaert

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

Image by
kirkh.deviantart.com

And almost
265 of you!
165u+100g

Today's Class

Who are we?

Specifics of this course

What is Computer Vision?

Name
Kritika Gupta
Nikith Mahendra Hosangadi
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

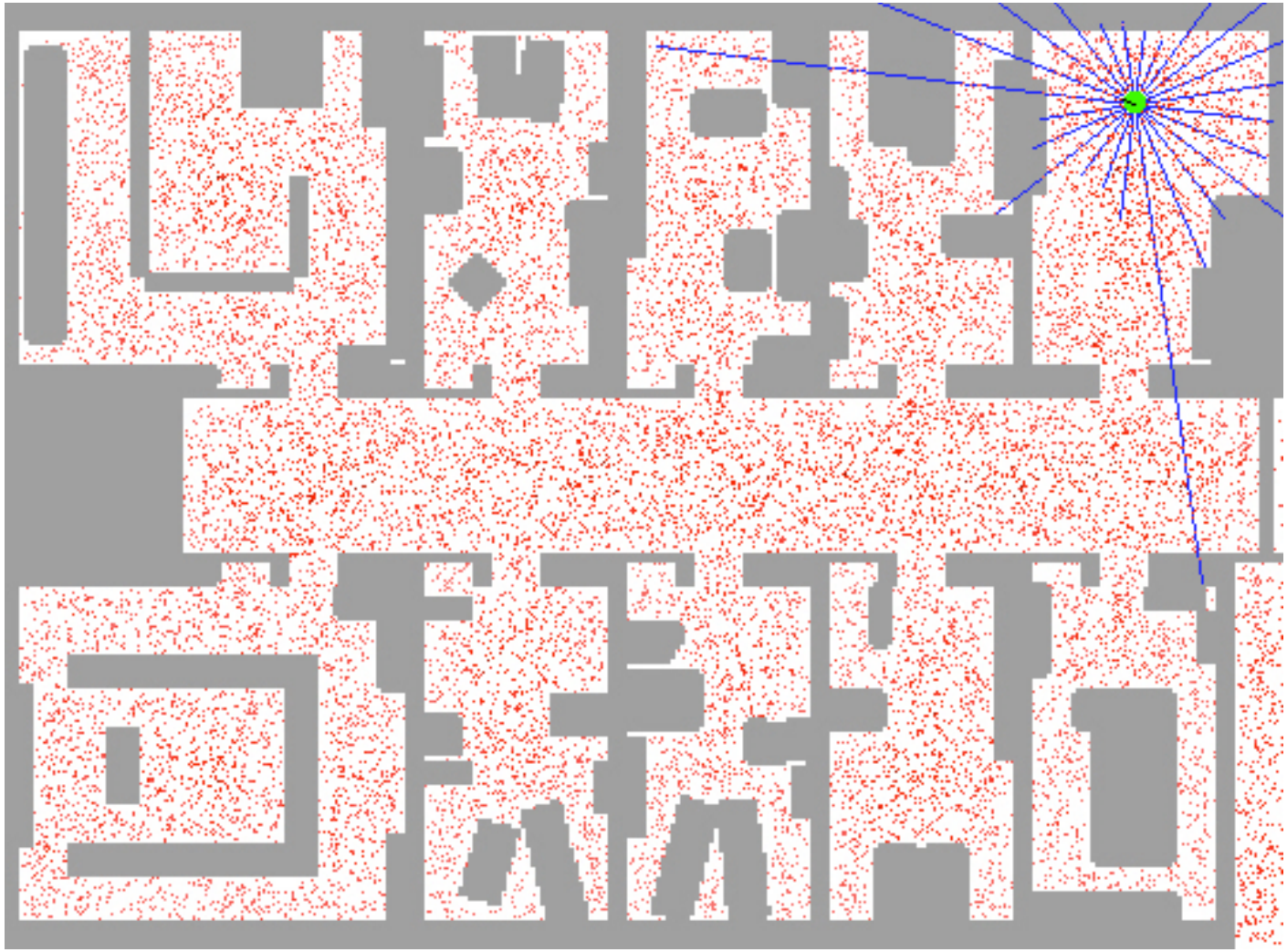
https://dellaert.github.io/

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.:

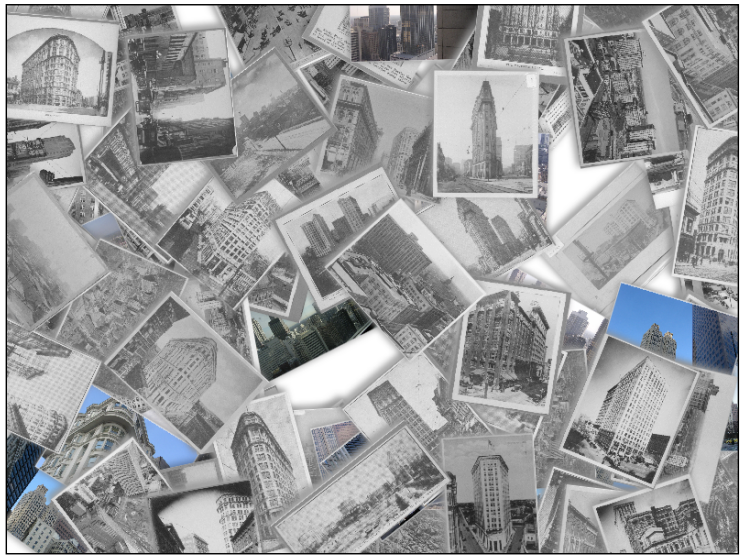
7641	Machine Learning	02, 03, 04	45
8803	3D Reconstruction and Mapping	02, 09, 10,12	70
4495	Computer Vision, undergraduate	04, 05, 06, 07, 19, 21	441
8803	Intro to Perception and Robotics	05, 06, 07,13,14, 20	485
6476	**Computer Vision**, **graduate**	06, 07, 11, 12, 13, 21	453
4475	Computational Photography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

Monte Carlo Localization, at Carnegie Mellon!



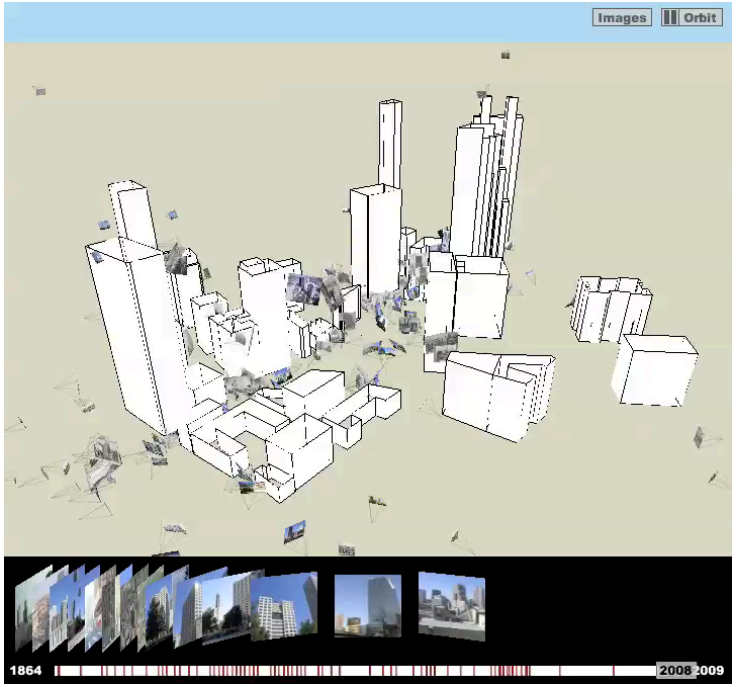
Dellaert, Fox, Burgard & Thrun, ICRA 1999
Fox, Dellaert, Burgard & Thrun, AAAI 1999

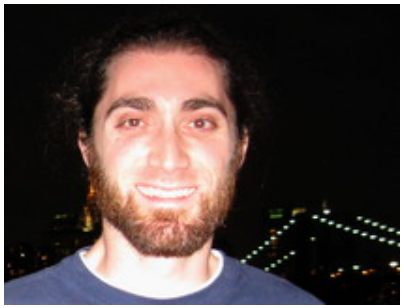
Spatiotemporal Reconstruction



Historical Image Collection

4D Cities: 3D + Time





Grant Schindler

Supported by NSF CAREER, Microsoft

Recent revival: NSF NRI award on 4D crops for precision agriculture…

Factor Graphs -> GTSAM !

Silicon Valley intermission at Skydio

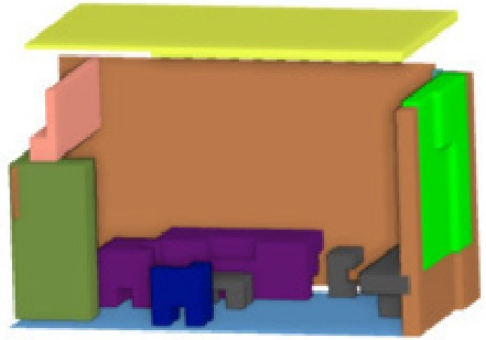
Silicon Valley intermission at Facebook

The Scene Understanding and Modeling Challenge

Color

Depth

RGB-D 360 degree image

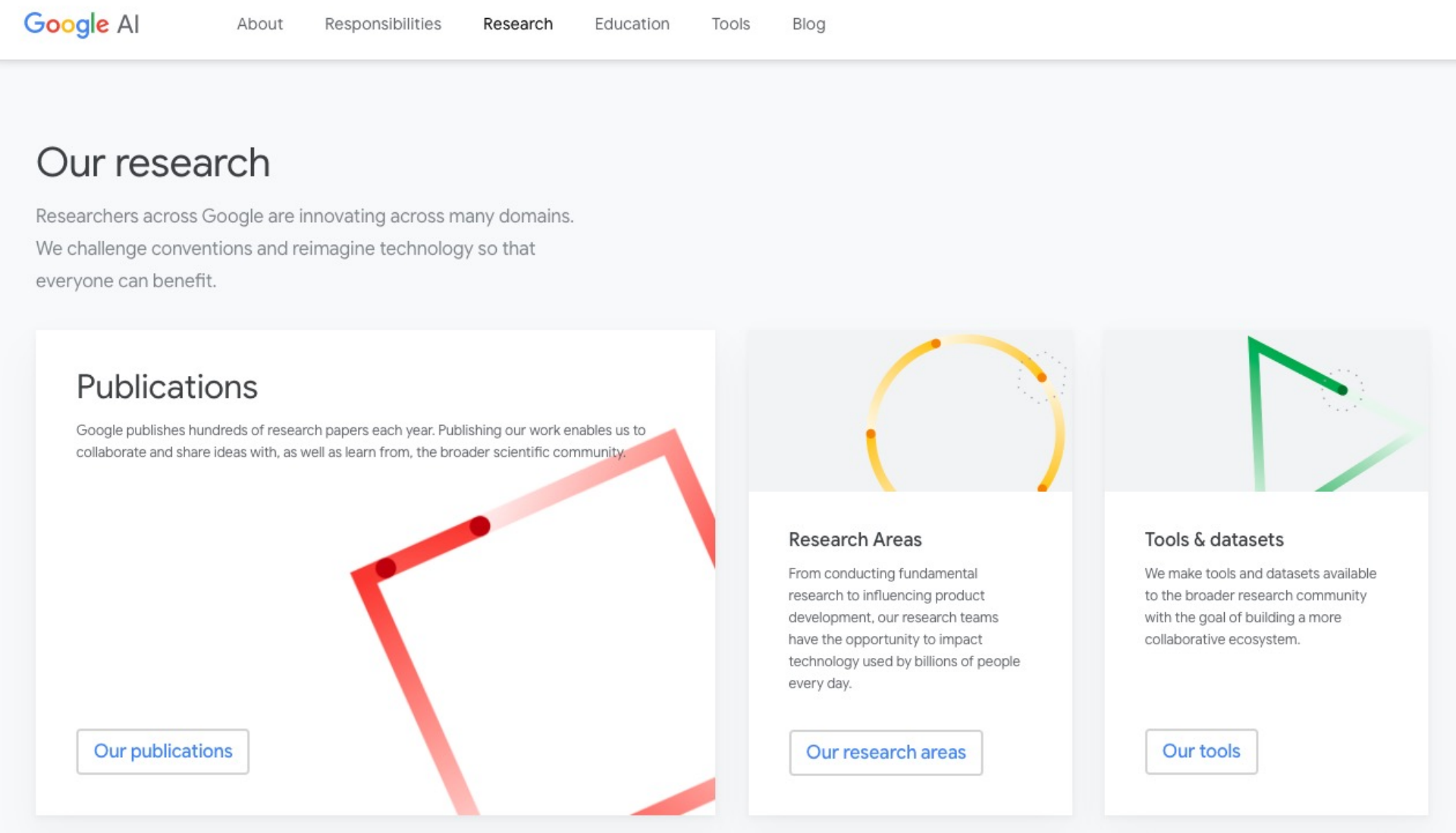


Object-based representation of a room

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



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
- Linera 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.

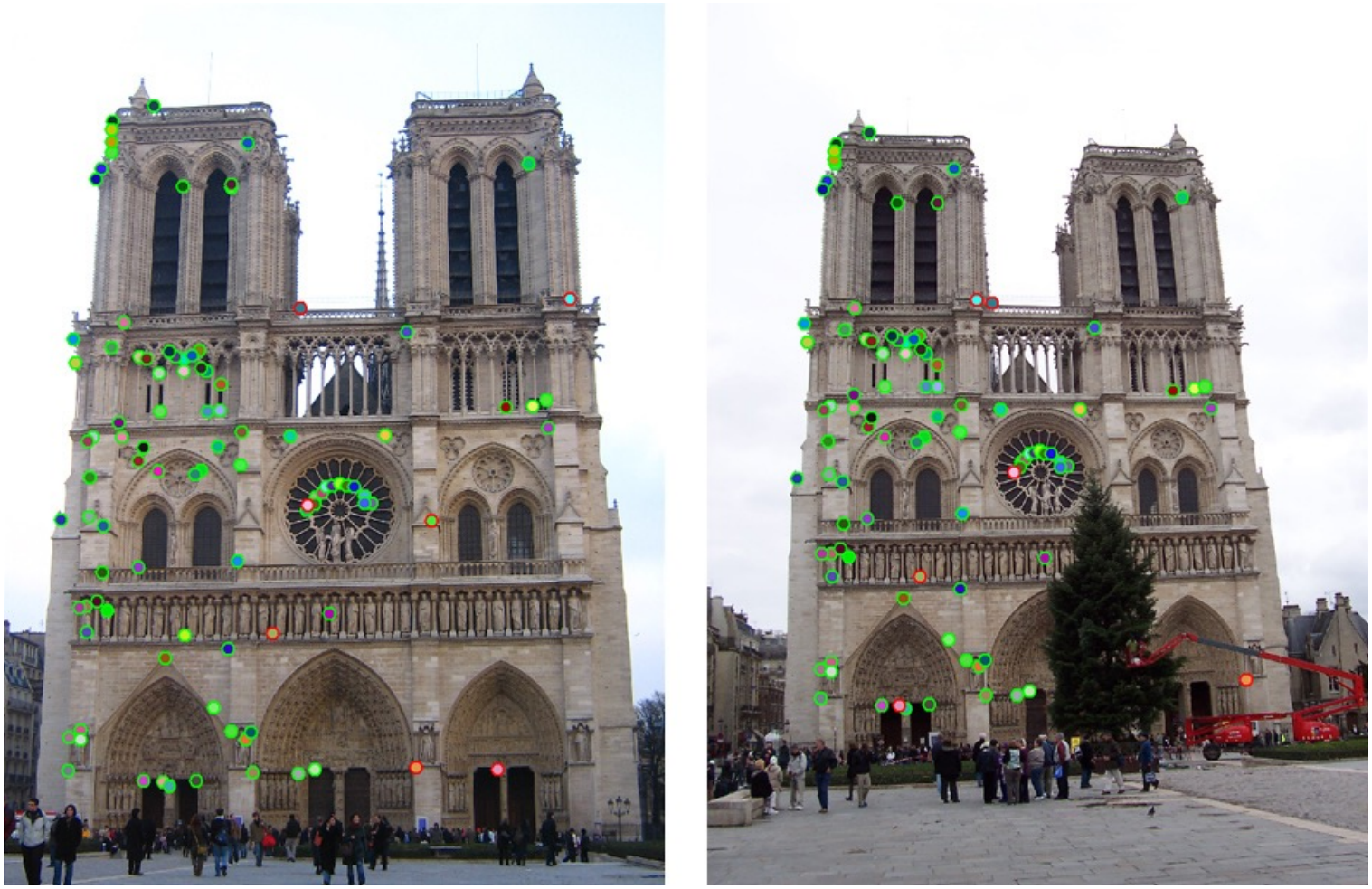
Project 3: Scene Recognition with Deep Learning

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.

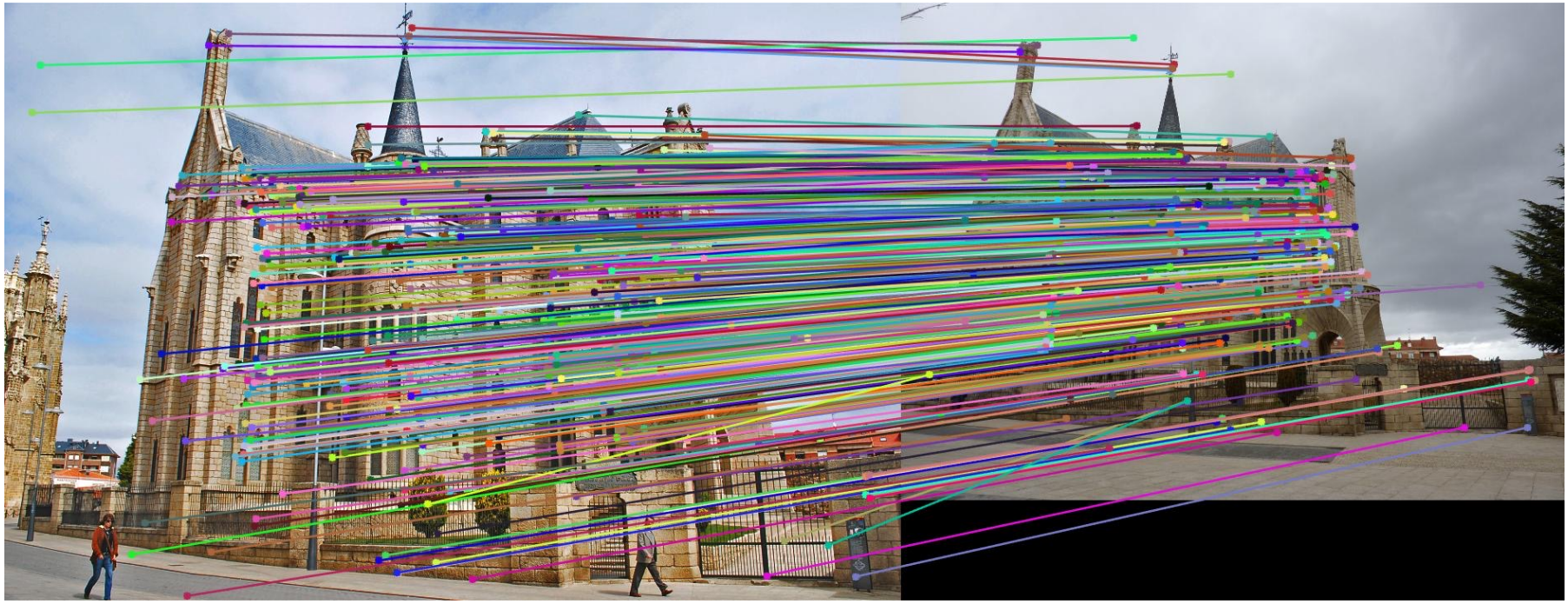
Project 4: Local Feature Matching

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



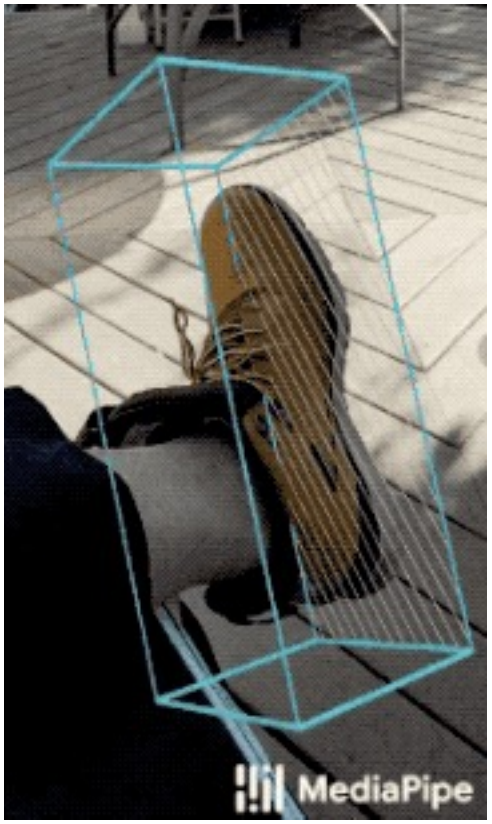
Project 5: Projection Matrix, F+Ransac

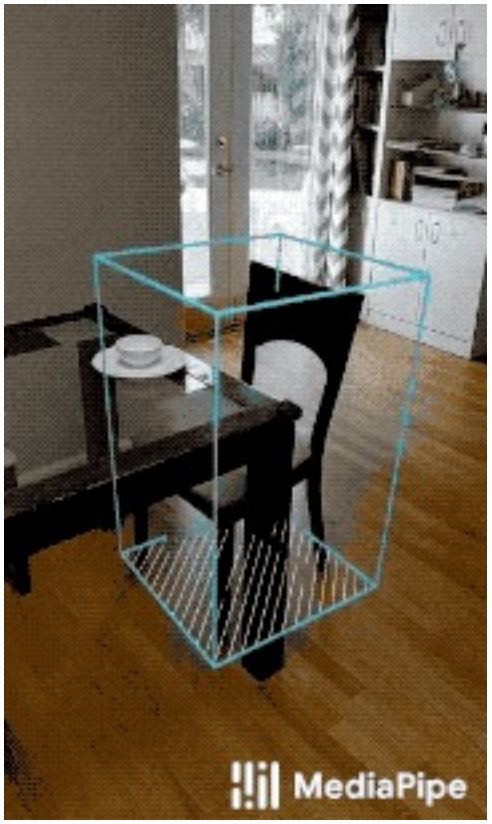
Understand geometry of pose estimation, and use a random sampling algorithm to do a detailed matching based on the fundamental matrix constraint.

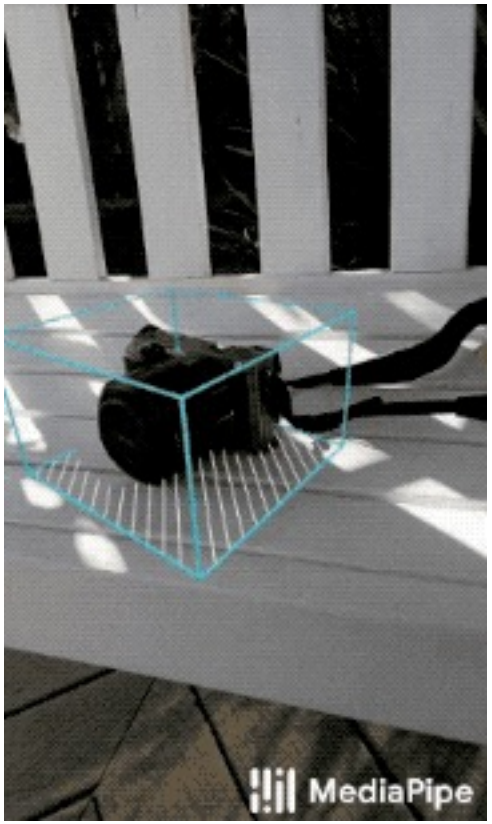


Project 6: Object and Pose Detection

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







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