

# CS 6476: Computer Vision

Instructor: Frank Dellaert

Tas: Sergio Aguilera (head TA), and Arvind, Ayush, Sen, and possibly a few more hires soon...



And almost  
200 of you!

# Today's Class

Who are we?

Specifics of this  
course

What is Computer  
Vision?



# Teaching Assistants

- **Sergio** Aguilera
- **Sen** Wang
- **Ayush** Rakesh Baid
- **Arvind** Krishnakumar

# 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

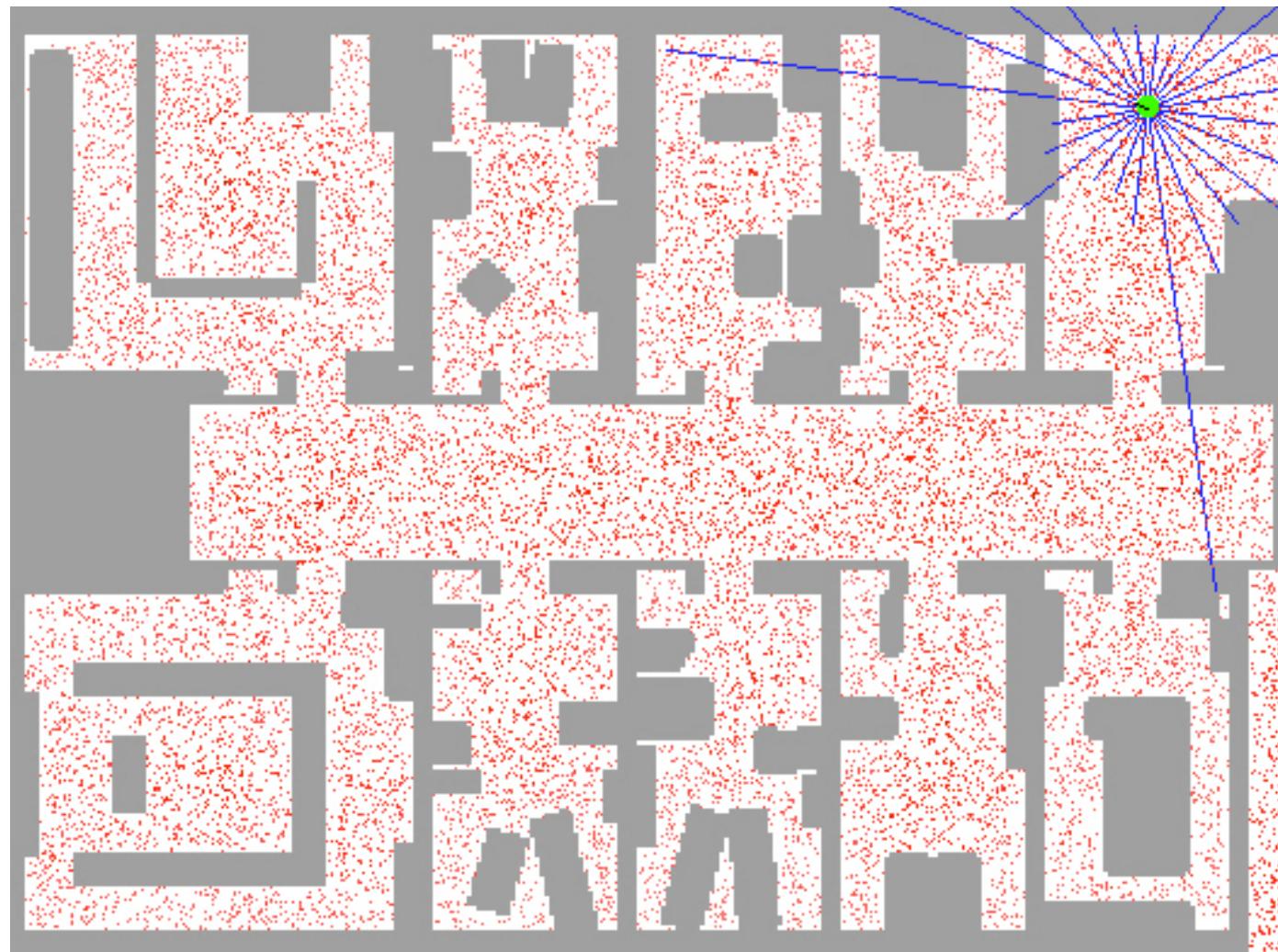
Georgia Tech since August 2001

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 05, 06, 07,13,14	278
8803	Intro to Perception and Robotics	, 20 06, 07, 11, 12,	485
7495	<b>Computer Vision, graduate</b>	13, 20 07, 09,	353
4475	Computational Photography	<b>18</b> 08, 09,	155
4480	Digital Video Special effects	10, 11	146
			<b>1432</b>



# Monte Carlo Localization, at Carnegie Mellon!



On-line August 24  
to September 5

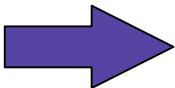


Dellaert, Fox, Burgard & Thrun, ICRA 1999  
Fox, Dellaert, Burgard & Thrun, AAAI 1999

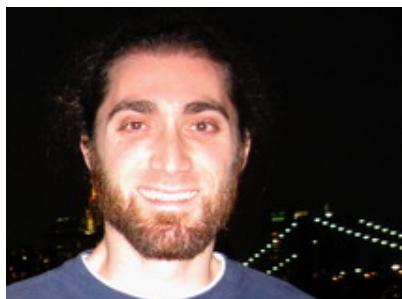
In the Smithsonian Institution's National Museum  
of American History and ON THIS WEB SITE

# Spatiotemporal Reconstruction

4D Cities: 3D + Time



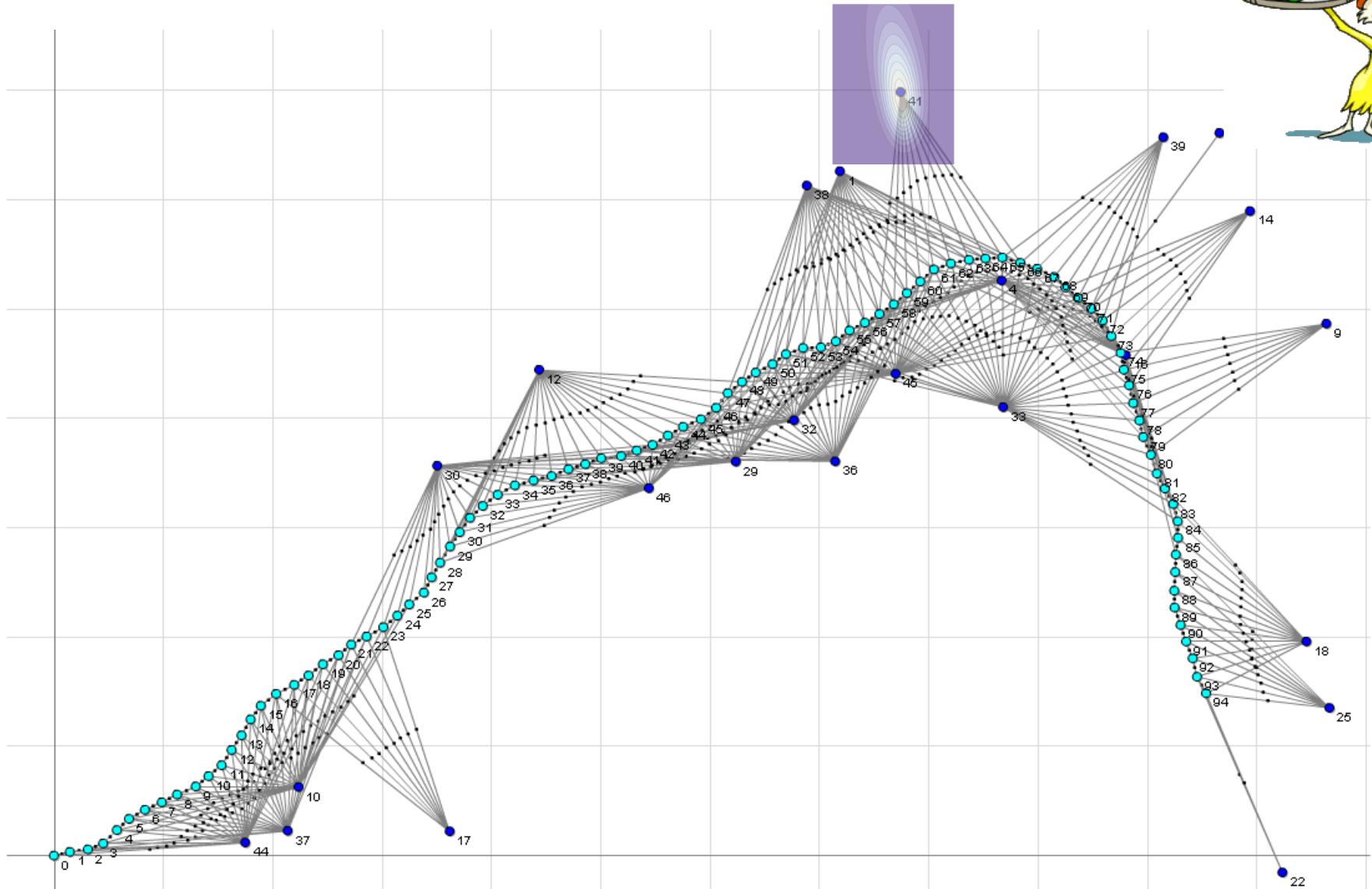
Historical Image Collection



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

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# Silicon Valley intermission at Facebook



## The Scene Understanding and Modeling Challenge

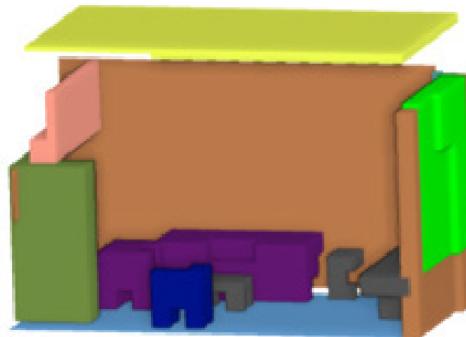
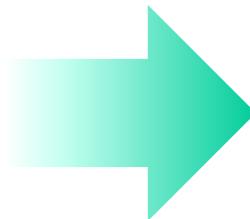
Color



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

Google AI

About

Responsibilities

Research

Education

Tools

Blog

## Our research

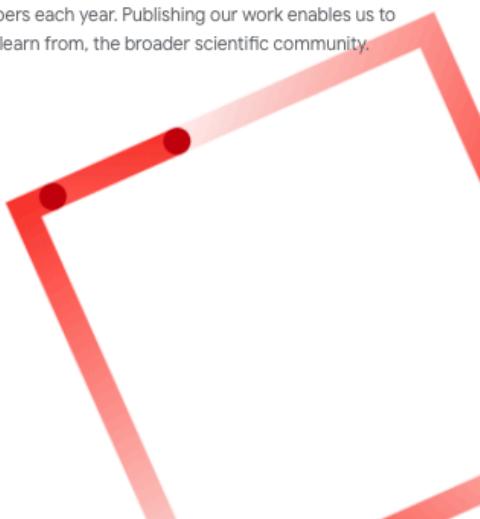
Researchers across Google are innovating across many domains.

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

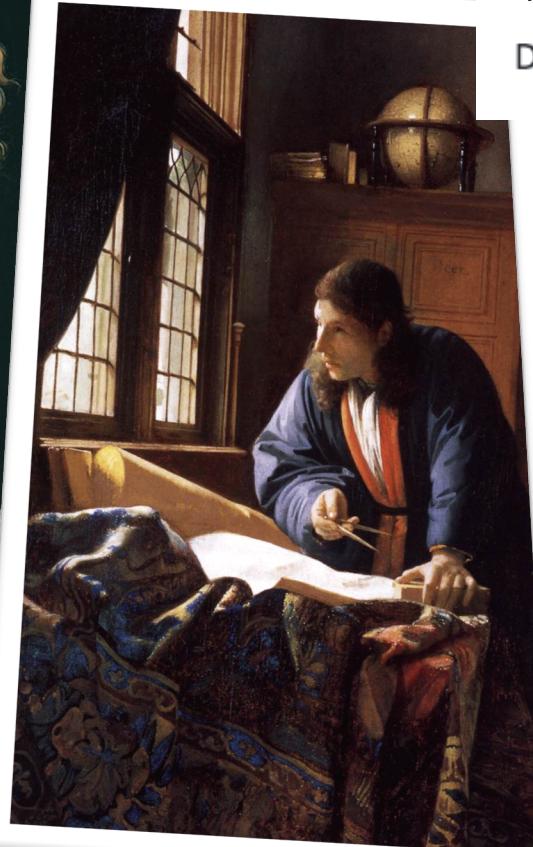
We make tools and datasets available to the broader research community with the goal of building a more collaborative ecosystem.

[Our tools](#)



# What's next? Robot Art! Dynamics! SwiftFusion!

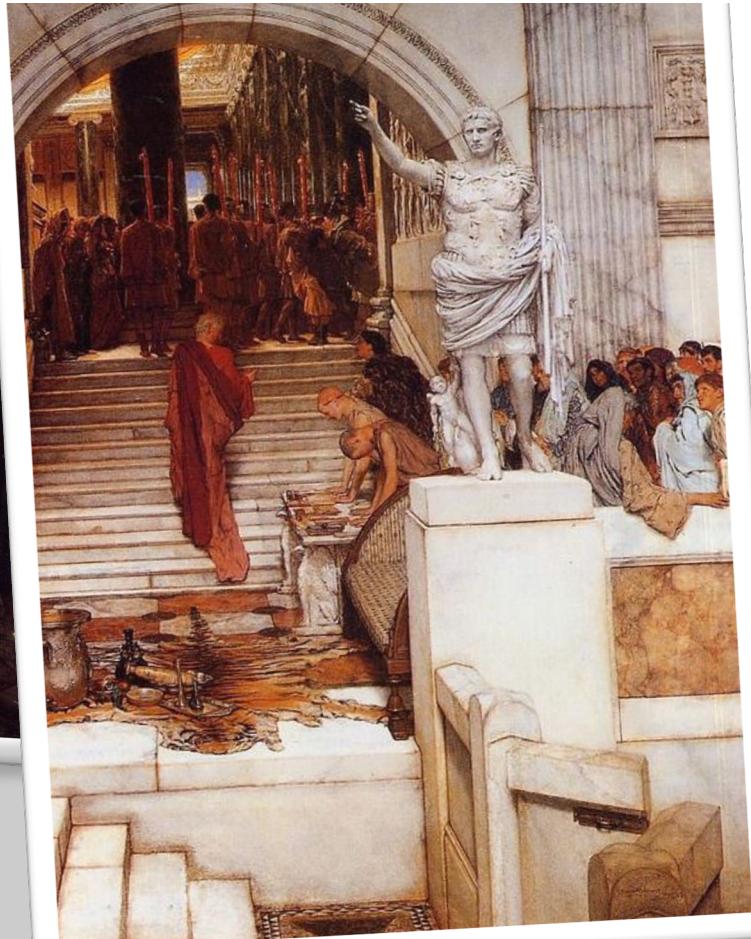
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## SwiftFusion

Powered by TensorFlow

Differentiable Swift based sensor fusion library.



For-credit projects available for SwiftFusion

# Course Website/Syllabus

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## Fall '19 Computer Vision



<https://dellaert.github.io/20F-6476/>

# Project 0: Linear Algebra with Pytorch

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Out: 6.30 today

Due: September 1<sup>st</sup>, 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

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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: Scene Recognition with Deep Learning

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## Learning Objectives:

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

# Project 3: Local Feature Matching

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

