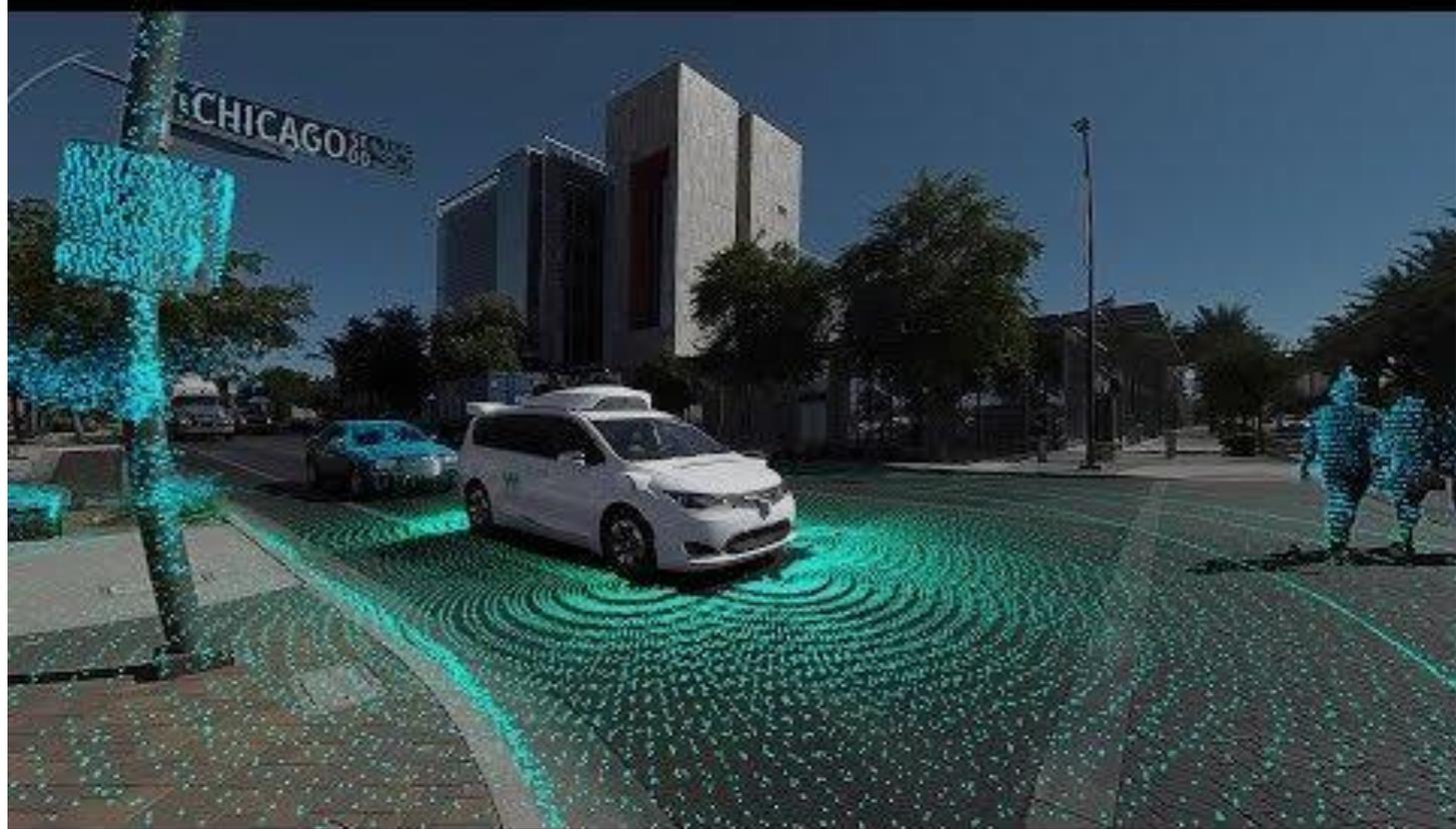


Impact of AI Decal: *The Self-Driving Cars of Today and Tomorrow*

Gokul Swamy, Brenton Chu, and
Pranav Sekhar

Quiz: <https://tinyurl.com/impactsp19q5>







Deep Learning Perception
Surround Detection

How do self-driving cars work?

→ Sensors:

- ◆ Cameras: placed around vehicle to get rid of blind spots
- ◆ LIDAR: 3D depth map (used by everyone but Tesla)

→ Processing:

- ◆ Convolutional Neural Networks are used to map from inputs to actions
- ◆ These actions are then fed into the control system of the car

→ Planning:

- ◆ The car then chooses what actions to perform over the next few seconds, where actions are the break/gas and the steering wheel

Optical Flow

→ Difference between frames

- ◆ Can be used to identify people and how fast you are going



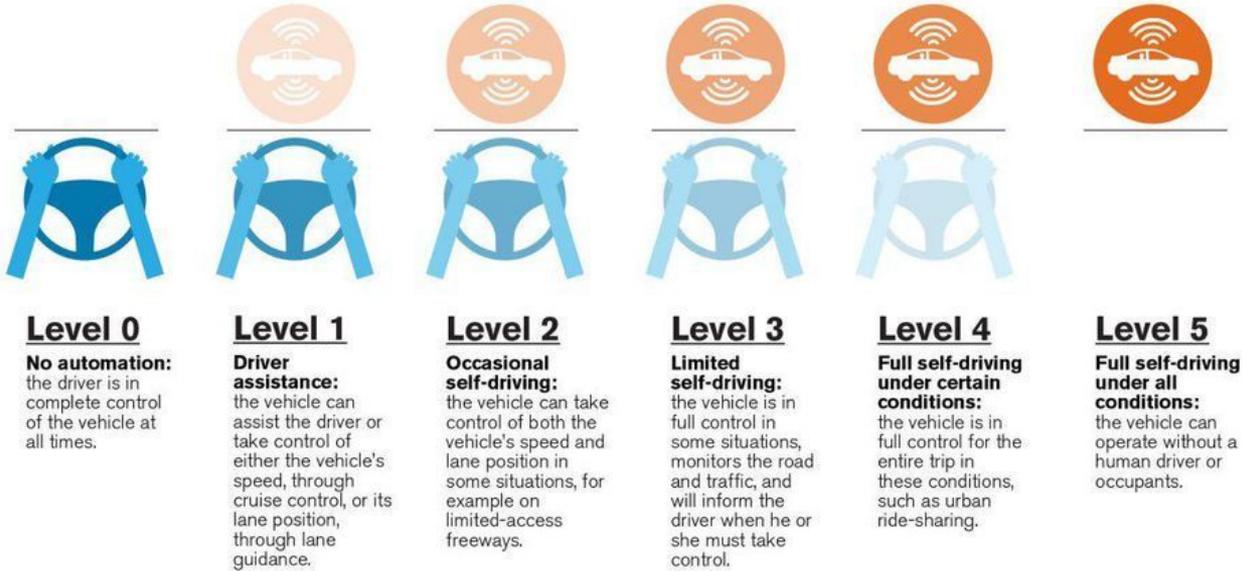
Wait ... what about the other people on the road?

- With high-school physics, you can figure out where a car will go if it has some velocity that you can sense
- It is an unsolved problem of how to model the fact that other humans on the road will respond to what you do
 - ◆ Waymo (w/ help from UC Berkeley's Anca Dragan) lead research on this
- This could lead to you never passing another car or getting stuck at an intersection waiting for the other cars to go
- If you're interested in the approaches that are currently being considered, talk to Gokul
 - ◆ If you're in the Tuesday class, you can shoot him an email: gokul.swamy@berkeley.edu

Major Players in the Race for Self-Driving Cars

- Cruise (acquired & backed by General Motors)
 - ◆ Their approach is to break driving down into subtasks and have each task handled by a separate system
- Uber
 - ◆ They have the taxi-like service part figured out (non-trivial) which puts them in the best position to profit from their advances
- Waymo (part of Google)
 - ◆ Second most data, by far the most advanced technology
- Tesla (ol' Musky)
 - ◆ Lots of data, technology is very heavily focused on computer vision and deep learning
- NVIDIA (led by former Tesla people)
 - ◆ Focusing on providing technology for fast computations, platform for others

Five Levels of Vehicle Autonomy



Source: SAE & NHTSA

Current State of Vehicle Autonomy

- Level 0
 - ◆ Older cars
- Level 1 (minimal assistance)
 - ◆ Most modern cars
- Level 2 (partial automation)
 - ◆ Tesla Autopilot
 - ◆ Nissan ProPilot
 - ◆ Cadillac Super Cruise
- Level 4 (fully automated under most conditions)
 - ◆ Waymo
 - ◆ Experimental Cars

Self-Driving Cars Research & Development

- Two primary approaches to introducing self-driving cars publically
- Method 1: Perfect level 5 self-driving before releasing
 - ◆ Waymo (Google), Uber, etc
 - ◆ Mostly tech-oriented companies
- Method 2: Add more self-driving features over time
 - ◆ Tesla, etc
 - ◆ Mostly automaker companies
- Pros and cons to both approaches
 - ◆ Method 1 reduces accidents from incomplete programs and overreliance
 - ◆ Method 2 allows people to better adjust and for more data collection
 - Waymo: 7 **million** miles since 2009 (as of late 2018)
 - Tesla: 1.2 **billion** miles since 2014 (as of late 2018)

Q:

What are the benefits of self-driving cars, and what are the potential dangers?

Self-Driving Benefits and Dangers:

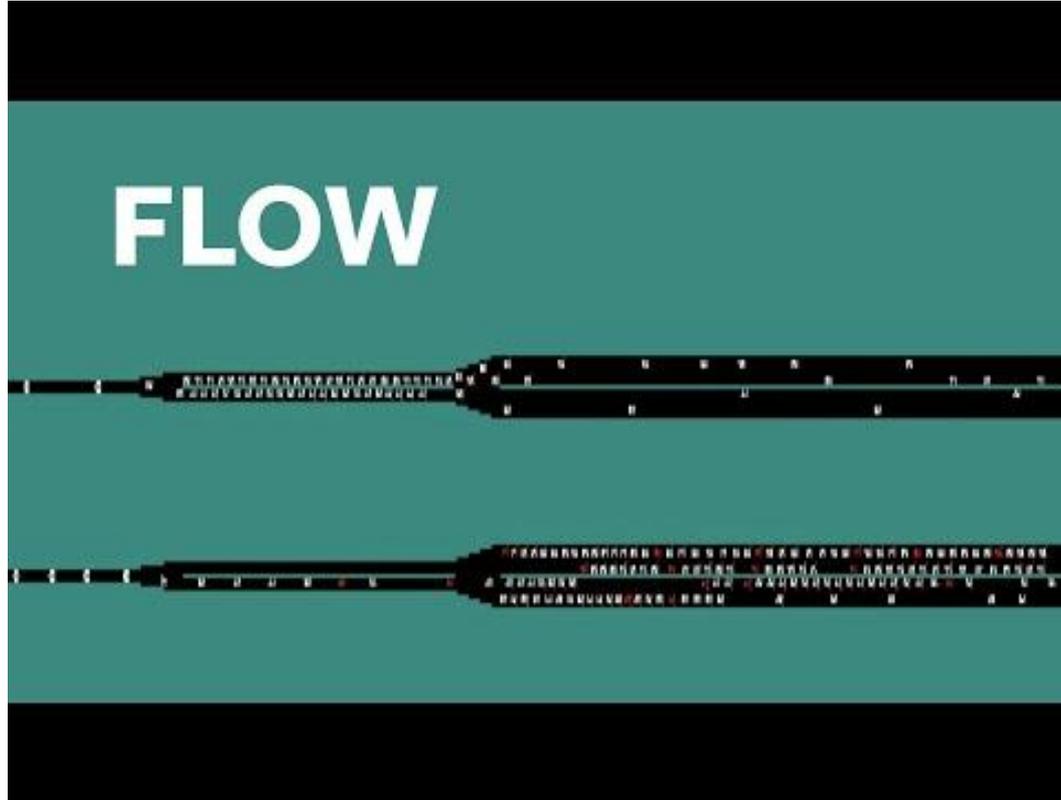
- Benefit: Fewer Accidents
- Benefit: Less Traffic
- Benefit: Reduced need for parking
- Danger: Automation of jobs
- Danger: Hacking
- Danger: Vague accountability

Benefit: Fewer Accidents

- Self-driving cars don't DUI, fall asleep, text and drive, rubberneck, etc
- Tesla reports their autopilot gets into an accident once every 3.34 million miles
 - ◆ National average is one per 500,000
 - ◆ However, autopilot may only be activated in ideal situations, inflating values

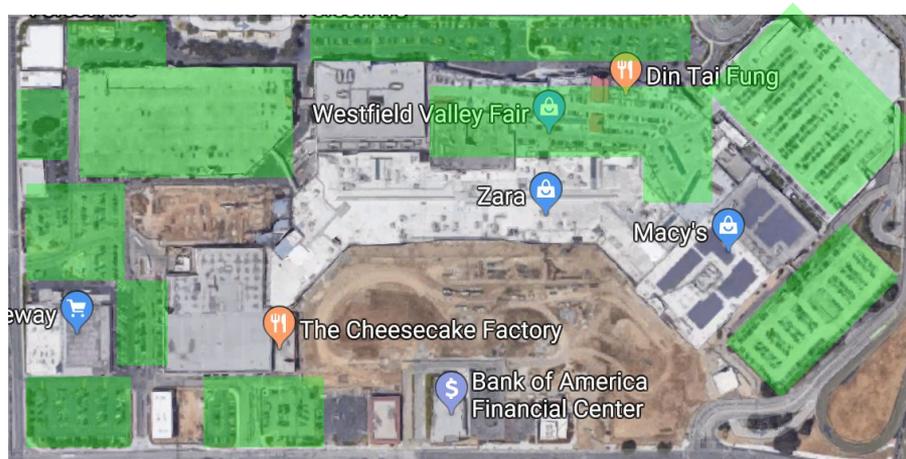


Benefit: Less Traffic



Benefit: Reduced Need for Parking

- The average American spends 17 hours a year looking for parking
 - ◆ In San Francisco its 83 hours, and in New York City its 107 hours
- All that time spent is that much more time an extra car is on the road
 - ◆ Double benefit! Rid the parking hassle, and further reduce traffic (and car emissions)
- Parking lots take a lot of space

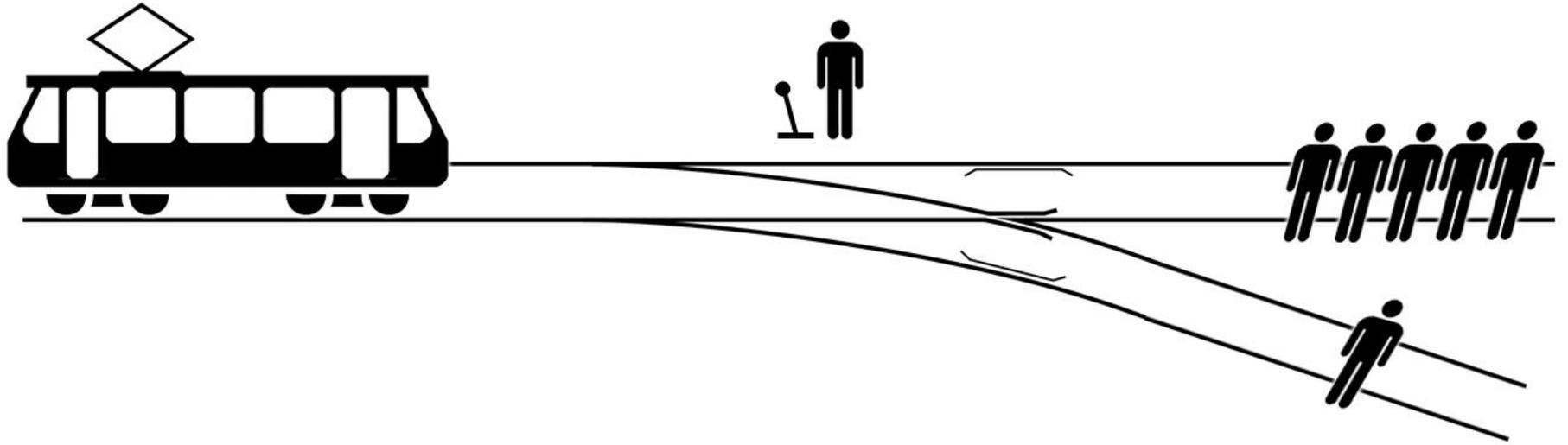


Danger: Hacking

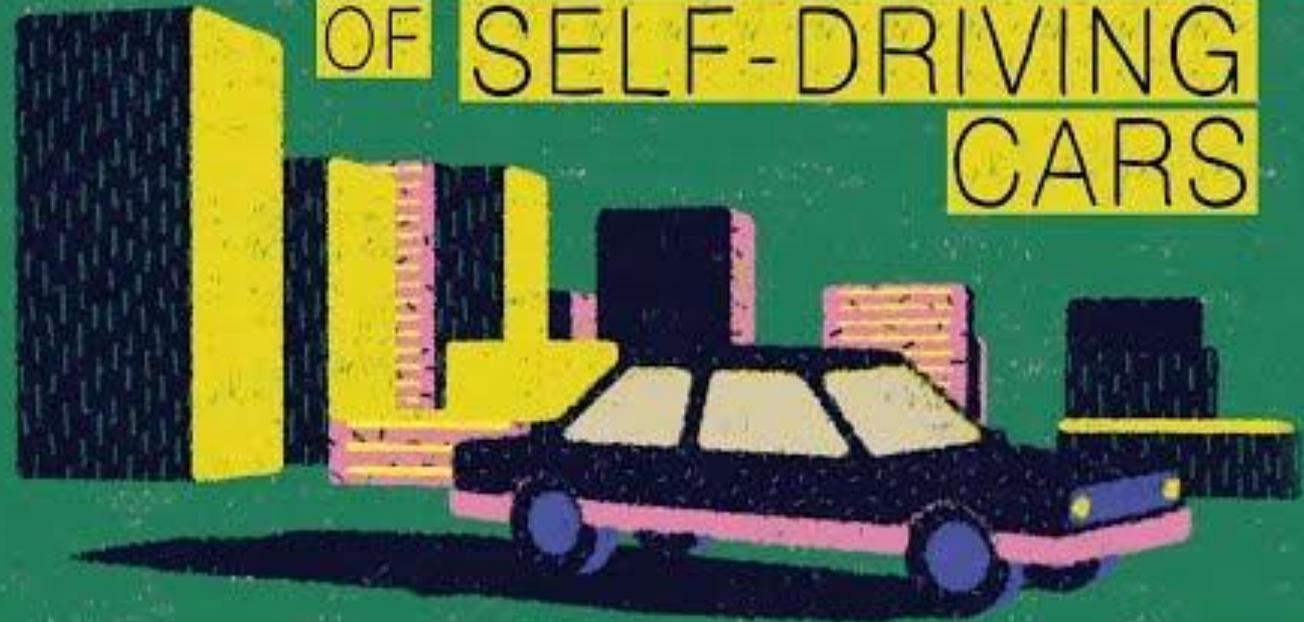
- Already, software in cars (e.g. infotainment systems) can be hacked
 - ◆ Overall, this is largely not too dangerous as this is separate from the driving functions of the car
- Hacking of autonomous vehicles can result in taking over entire functions of the car
 - ◆ Remote Car theft
 - ◆ Causing accidents/terrorism
 - ◆ Hijacking/kidnapping



Danger: Vague Accountability



THE ETHICAL DILEMMA OF SELF-DRIVING CARS



Impact of AI Decal: *Activity*



Activity 1

- Now we're going to go to <http://moralmachine.mit.edu/>
- As we walk through each example, we'll discuss which action to take
- We'll discuss findings afterwards

Activity 2

- Let's discuss the social implications of AVs (autonomous vehicles)
- We'll get into groups for brainstorming
- In your group, discuss what a world with L5 AVs would look like for *you*
- For instance...
 - ◆ Going out with friends
 - ◆ Commuting
 - ◆ Road trips
- As you brainstorm, keep in mind the impact on:
 - ◆ Ridesharing, car ownership, insurance costs/structures, parking, etc.

Impact of AI Decal: *Next: Optical Illusions for Neural Networks*

