Artificial Intelligence: As it Relates to Self-Driving Cars

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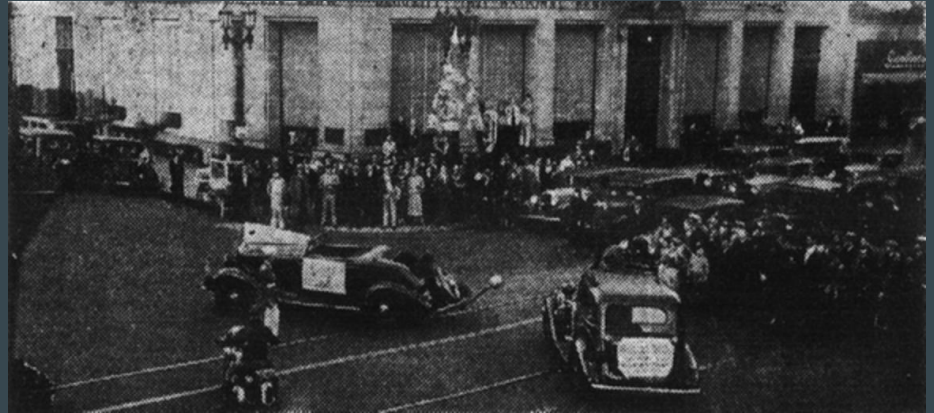
History

1907 - Lewis v. Amorous and others

- Georgia's Court of Appeals
- November 25th, 1907
- Whether or not automobiles were evil.
- "Likely no judge owned an automobile and few had ridden in one."
- Ruled that the automobile is owner's responsibility.

"It is insisted in the argument that automobiles are to be classed with ferocious animals, and that the law relating to the duty of the owners of such animals is to be applied. It is not the ferocity of automobiles that is to be feared, but the ferocity of those who drive them. Until human agency intervenes, they are usually harmless ... They are not to be classed with bad dogs, vicious bulls, evil mules, and the like."

- Georgia Court of Appeals case syllabus 1907

1926 to 1949 - Phantom Project

- First driverless car.
- Operated via radio controls.
- Toured the US giving safety demonstrations.

Average automobile deaths per year*

Years	1926-1949	2000-2015
Deaths	30,133	38,198
Vehicle miles travelled (billions)	255.23	2,954
Fatalities per 100 million VMT	12.473	1.298
Population	131,009,737	302,422,533
Fatalities per 100,000 people	23.076	12.727

* Each number in the above table above represents an average year over the corresponding time period.

- 2000-2015:
  - 231% population.
  - 27% more total deaths per year.
- 1926-1949:
  - 180% more deaths/100,000 people
  - 961% more fatalities/100 million VMT

1958 - RCA Labs

- First autonomous car.

- Not self sufficient.

- Created a 400-ft long proof of concept.

- Planned to sell the cars by mid 1970's.

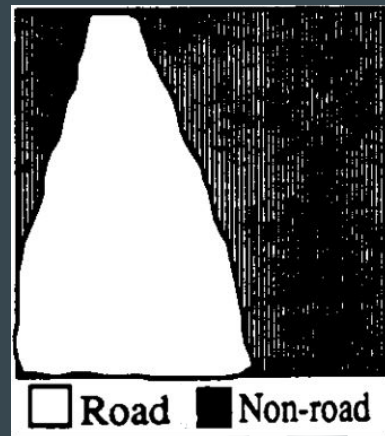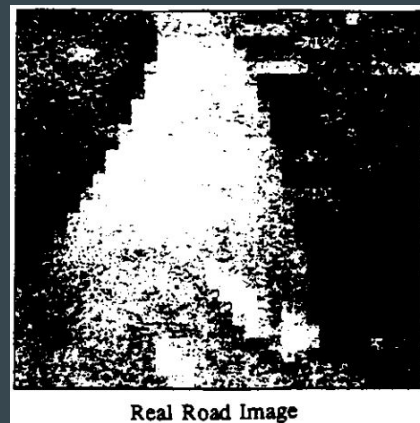# 1986 - Carnegie Mellon University's Navlab

1986 - Carnegie Mellon University's Navlab

- Collaboration between three Universities.

- First fully contained autonomous car.

- First car to use AI.

- Autonomous Land Vehicle In a Neural Network (ALVINN) as the "brains".

- Monumental achievement for the technology.

What exactly is ALVINN?

- Used lasers and cameras as input.
- Learned from simulations.
- Learned in different environments.
- Driven in new environments.

Real Road Image

☐ Road ■ Non-road

Current Self Driving Car

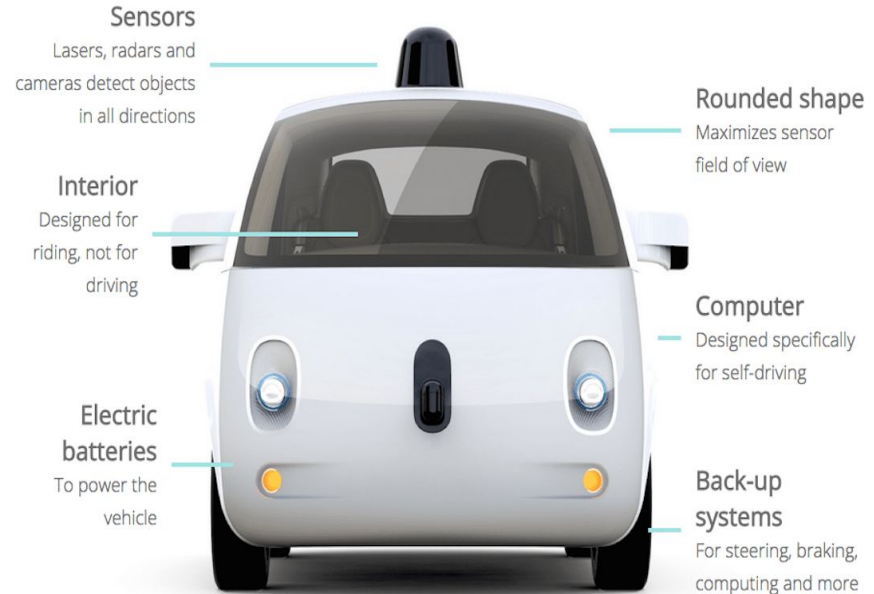# Self-Driving Car Today

Notable Companies:

- Google

- Tesla

- NVIDIA

- Mercedes Benz

- Audi

What's Inside...

- LIDAR
  - Laser Illuminating Detection and Ranging
- Antenna
  - GPS signal
- Camera System
  - Detects car surroundings
- Central Computer
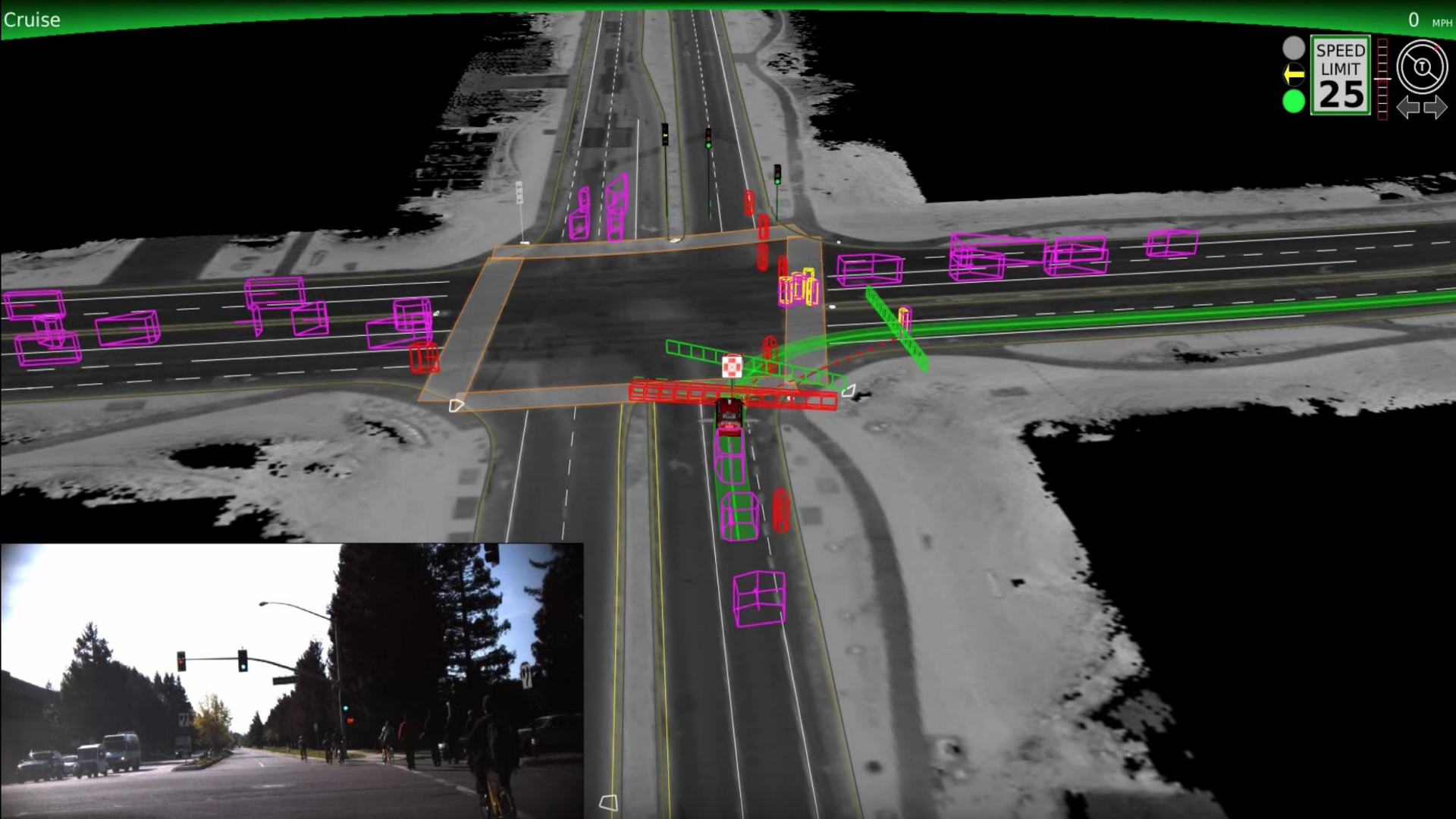 - Collects information
- Radar
  - Scans objects

Sensors
Lasers, radars and cameras detect objects in all directions

Rounded shape
Maximizes sensor field of view

Interior
Designed for riding, not for driving

Computer
Designed specifically for self-driving

Electric batteries
To power the vehicle

Back-up systems
For steering, braking, computing and more

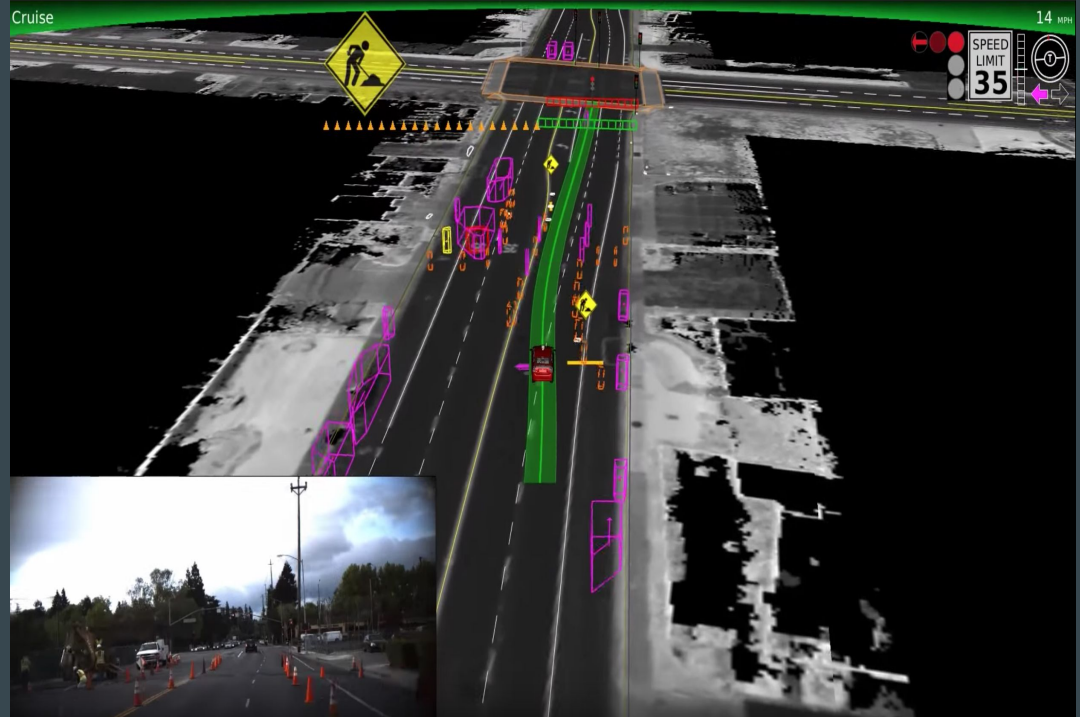# Google's Self-Driving Car

Building a 3D World

- LIDAR builds a 3D map and scans for potential hazards

- Uses a Velodyne 64-beam laser

- LIDAR device can build a virtual world but can not accurately monitor objects in motion.
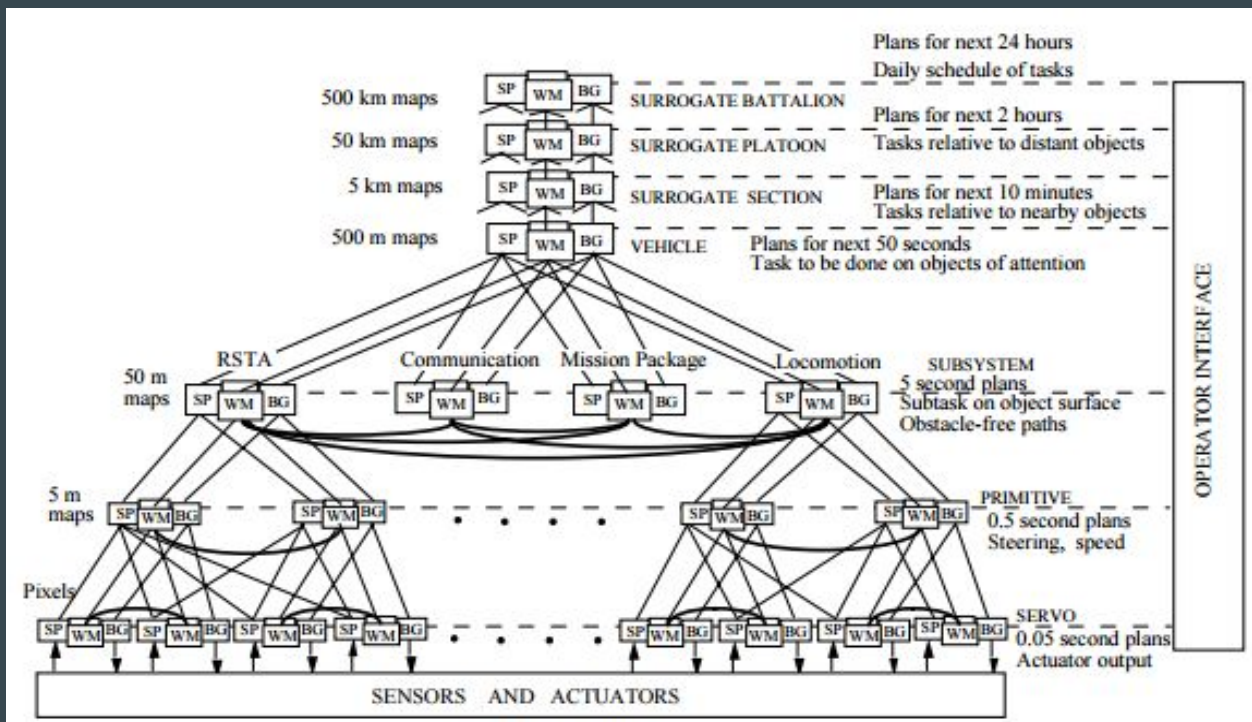
SPEED
LIMIT
25

Making Decisions

- Real-time Control System
  - Cognitive architecture

Making Decisions

- 4D/RCS Reference Model Architecture

Questions?