1 Autonomous driving in general

2 Tesla FSD

Autonomous driving in general

- Definition
- History
- Levels
- Challenges & impact

Definition

- Sensors
  - Radar
  - Lidar
  - Sonar
  - GPS
  - Odometry
- Control systems
  - Interpretation
  - Identify navigation paths

History

- 80's:
  - Navlab
  - DARPA
  - Prometheus project
- 1995:
  - Navlab 5 coast to coast
- 2000's:
  - CARTRE & SCOUT

History

- 2010's:
  - Waymo
  - Zoox
  - Aurora
  - Apple
  - Baidu
  - Uber/ Lyft
  - Tesla

Levels of driving automation

- Level 0:
  - Warning
  - Momentary intervention
  - No sustained vehicle control

- Level 1: "Hands on"
  - Shared control

- Level 2: "Hands off"
  - Full control
  - Driver must monitor
  - Prepared for intervention

- Level 3: "Eyes off"
  - Turn attention away from driving tasks
  - Intervene within limited amount of time

- Level 4: "Mind off"
  - No driver attention required for safety
  - Geofenced
  - Safely abort trip

- Level 5: "steering wheel optional"
  - No human intervention required at all
  - All road, everywhere, anytime, all weather

Challenges & impact

- Safety

- Hacking

- Regulation

- Disruption

- ...

TESLA

- Car company?
- Energy company
    - Solar
    - Battery tech
    - mining
- Robotaxi / software / FSD
- Insurance
- mining
- VTOL

hits blunt

DUDE, WHAT IF...WHAT IF WE LAUNCHED MY CAR INTO SPACE?
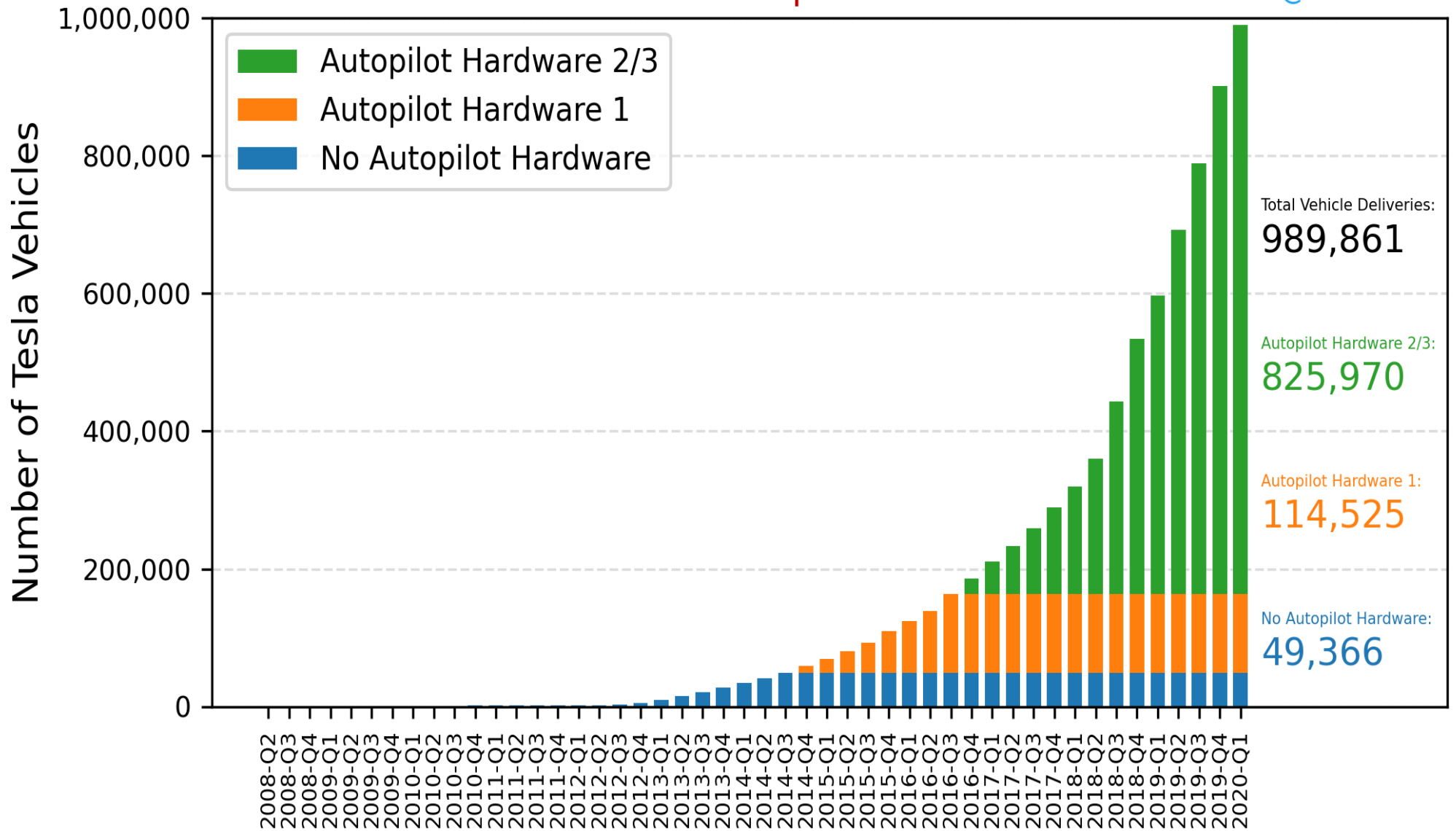
Andrey Karpathy

- PHD Stanford 2015

- Deep learning and computer vision

- 2017 research scientist open AI
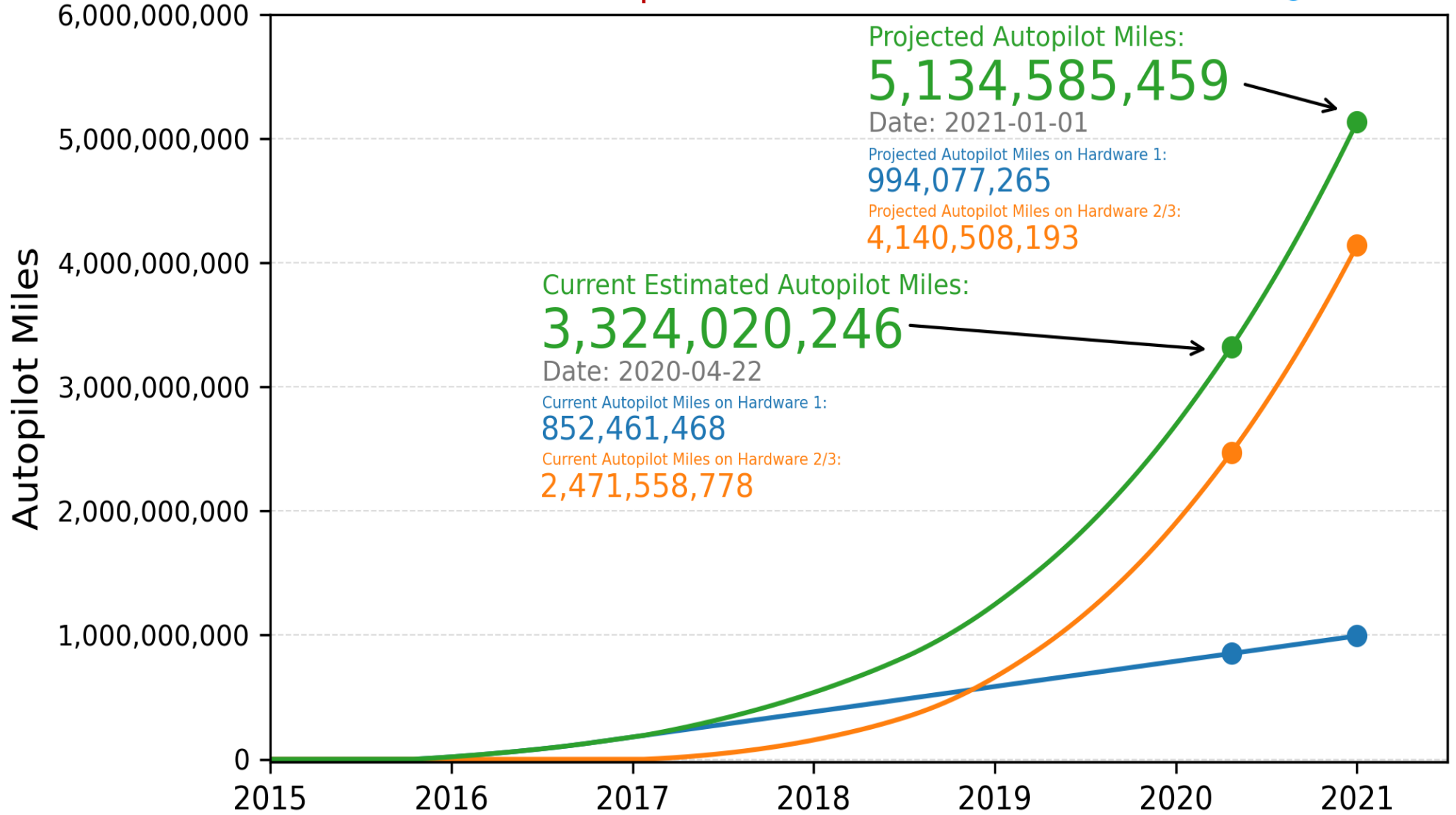
- Director of AI @ Tesla
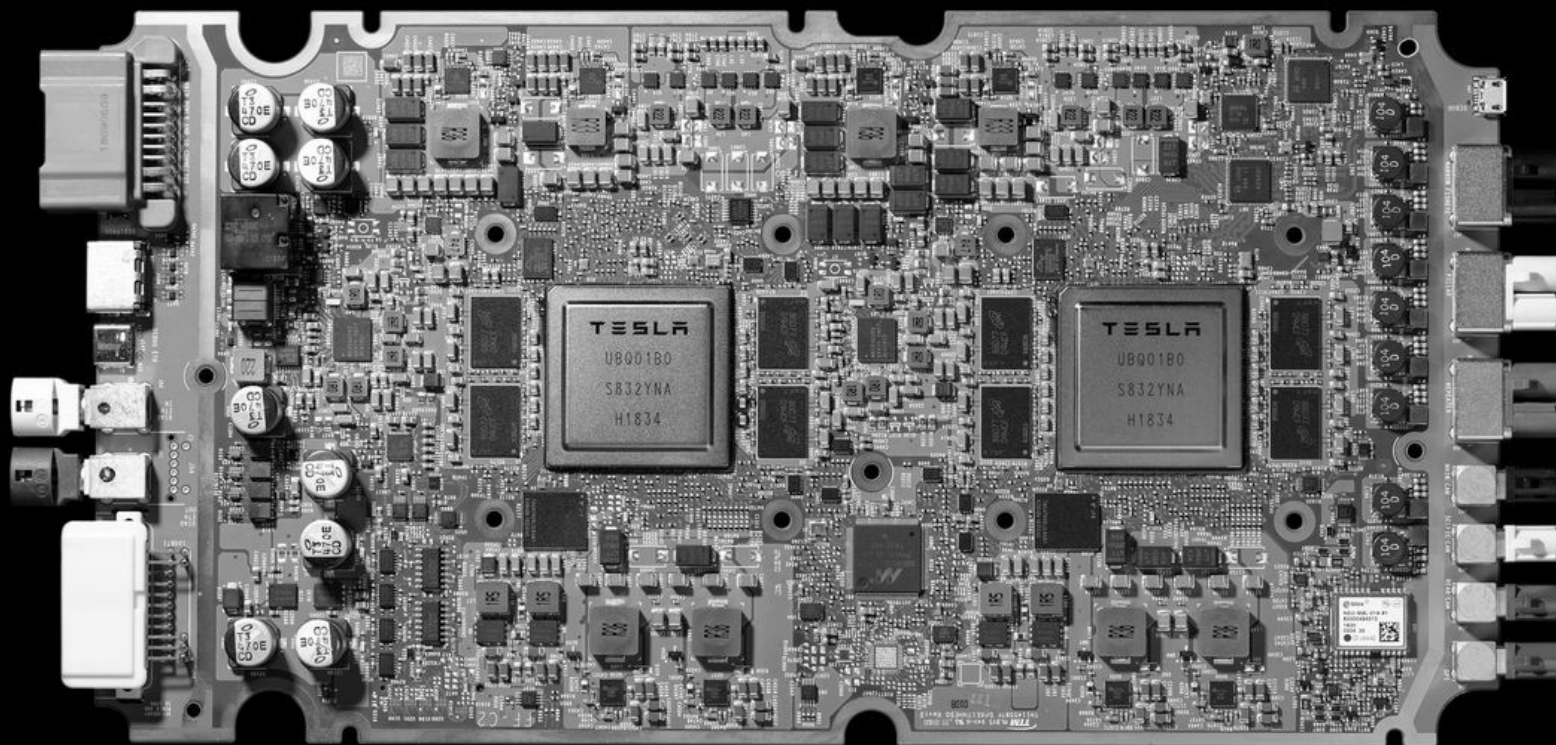
Tesla Vehicle Deliveries and Autopilot Hardware

@lexfridman

Legend:
- Autopilot Hardware 2/3 (green)
- Autopilot Hardware 1 (orange)
- No Autopilot Hardware (blue)

Y-axis: Number of Tesla Vehicles (0 to 1,000,000)

X-axis: 2008-Q2 through 2020-Q1

Total Vehicle Deliveries:
989,861

Autopilot Hardware 2/3:
825,970

Autopilot Hardware 1:
114,525

No Autopilot Hardware:
49,366

Estimated Tesla Autopilot Miles

@lexfridman

Projected Autopilot Miles:
5,134,585,459
Date: 2021-01-01

Projected Autopilot Miles on Hardware 1:
994,077,265
Projected Autopilot Miles on Hardware 2/3:
4,140,508,193

Current Estimated Autopilot Miles:
3,324,020,246
Date: 2020-04-22

Current Autopilot Miles on Hardware 1:
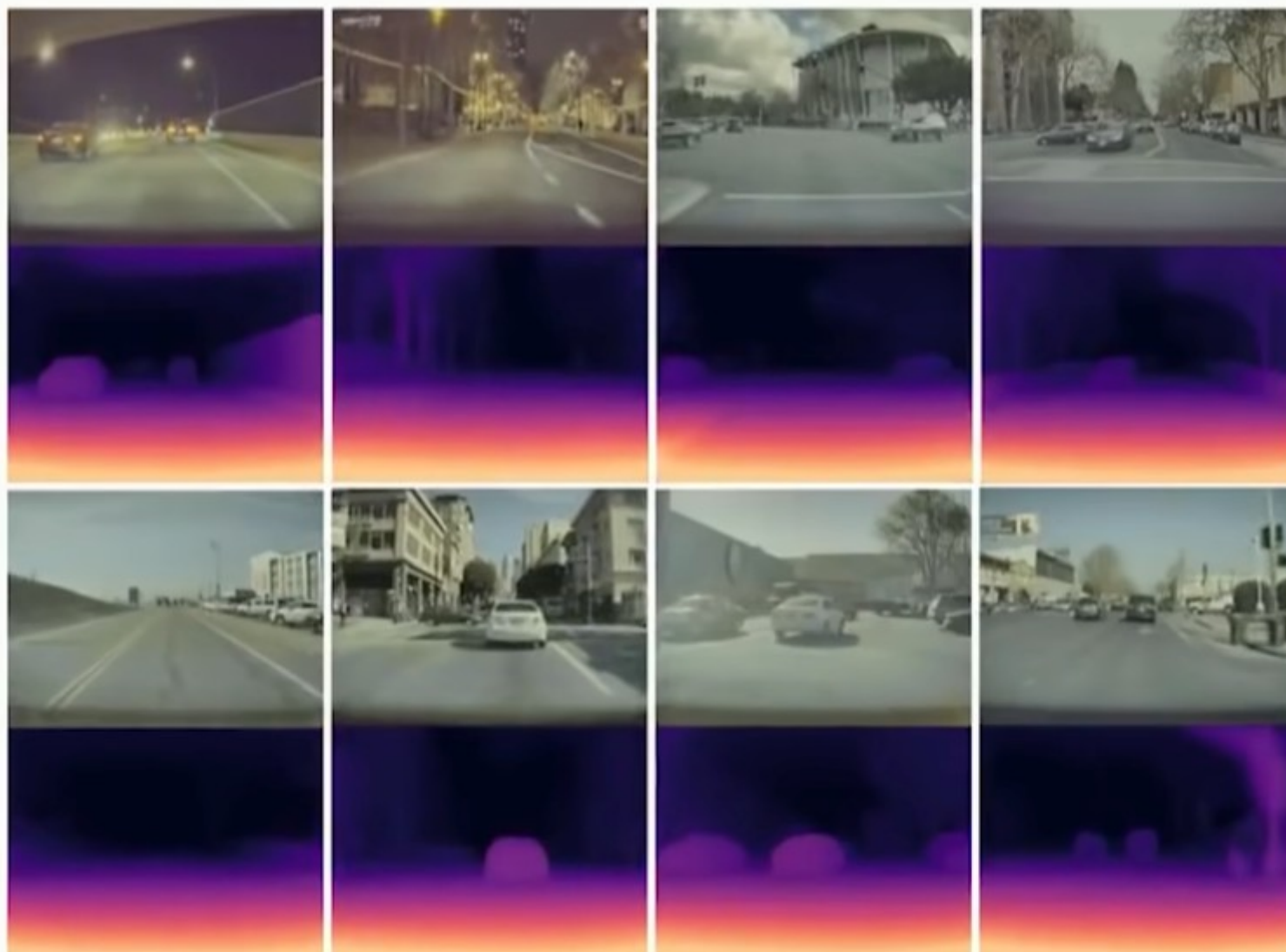852,461,468
Current Autopilot Miles on Hardware 2/3:
2,471,558,778

Per-pixel depths from vision, without Lidar

FLEET SENDS IMAGES OF ANIMALS ON THE ROAD

FLEET SENDS IMAGES OF MORE BIKES ON CARS

FLEET SENDS IMAGES OF DEBRIS ON THE ROAD