Autonomous Vehicles (AV)

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AV: Vehicles that can travel over standard roads without human intervention.
AV Hardware

• Cameras and radars/lidars map the surroundings.
• **Adaptive cruise control**
  – Adjusts speed for safe distance from vehicles ahead.
• **Collision avoidance**
  – Forward collision warning
  – Lane departure warning
  – Blind spot monitoring
  – Pedestrian/bicycles/animals detection
  – Safe distance behind cars ahead
• **Self-parking and self-charging if electric**
• Sensors around the car
Autonomous Algorithms

• 3-D imaging
• Edge detection
• Motion detection
• Tracking
Statistics

- 1.25 million deaths worldwide by vehicles 2014.
- 6% increase in traffic fatalities in U.S. in 2016.
- 94% of crashes involve human choice/error in U.S.
  - 9,262 speeding
  - 09,967 alcohol
  - 3,179 distraction
  - 846 drowsiness
- 7% crash reduction for forward collision warning.
- 15% crash reduction for automatic braking.
Tesla plans a ‘shared autonomous fleet’ for owners to make money off their Tesla.
Autonomous Cars’ Advantages

• Much safer; will save lives and injuries
• Less traffic congestion
• Less parking space; parked stacked in tall buildings when not in service
• Electric best, so zero emissions
• Electric best, so $\frac{1}{3}$ less energy used
• More free time for passengers
• More convenient for passengers
• Reaction time $>3$ times faster than humans’.
Autonomous Vehicles Safety

Nissan Goal: Zero Emissions, Zero Accidents, Zero Fatalities
VW Self-Driving-Car (Sedric)
Midsize >200-Miles BEVs in 2017-8

Tesla Model 3 (220 miles EPA range)($35,000)

Options:
- 75-kWh battery: 310 miles EPA range; $44,000 (126 MPGe)
- AWD
- Autopilot $5,000, Enhanced Autopilot (autonomous ready) $3,000
- Glass roof
- Colors other than black: $1000
Volkswagen ID BUZZ

- 111-kWh battery
- 270-miles EPA range
- AWD
- 369 hp
- Heads-up display
- 16’ length
- Autonomous capable
- Available in 2022
Autonomous Vehicles (AV)

- Audi: AV by 2017
- Tesla: AV by 2018
- Google: AV by 2018
- VW: AV by 2019
- Nissan: AV by 2020
- Ford: AV by 2020
- GM: AV by 2020
- Toyota: AV by 2020
- BMW: AV in 2021
- Worldwide: AV in 2025
- Uber: Driverless by 2030
- IEEE: 75% AV by 2040
Autonomous Vehicles Plans

• From 2017 all Teslas (Models S, X & 3) will have all the necessary autonomous hardware.

• **GM is making an autonomous version of the Chevrolet Bolt EV** (an all-electric car or BEV)

• **Ford is making an autonomous Fusion for Lyft ride service.**

• **Nissan plans autonomous vehicles by 2020.**
Projected Annual Sales of Autonomous Vehicles
Problems with Autonomous Vehicles

- Empty cars might increase traffic.
- The software might be too careful and slow traffic.
- Fast accelerating BEVs will clash with slow ICEs.
- Early software may have bugs.
- Viruses could infect the software.
- Displaced commercial drivers might “terrorize” autonomous vehicles.
- Poor performance in adverse weather.
- Who is to blame for accidents?
Autonomous Trucks (AT)

- **World’s First AT: Freightliner Testing in Nevada**
- **Could be on U.S. highways in 3-4 years.**
- All truck manufacturers are working on AT.
- **Tesla electric AT to be announced soon.**
- Platooning will be a major consideration.

Robots could replace 1.7 million American truckers in the next decade.
Autonomous Tractors

Much easier than cars and trucks.