

AUTO ELON MUSK: TESLA PILOT | AI PODCAST [W/ LEX FRIDMAN]

Autopilot Design

Center Stack Display → to provide a health check on the vehicle's perception of reality

- Vehicle's taking in Info from → sensors, cameras, radars, ultrasonics, GPS, IMU.
- This info is rendered into vector space with bunch of objects with properties like lane lines, traffic lights, other cars.
- In vector space, this is then re-rendered on to the display so you can confirm whether the car knows what's going on or not by looking out the window.

Showing the uncertainty (on the display)?

- Debug Views: (1) Augmented Vision - draw boxes, labels around objects that are recognized.
- (2) Visualizer - vector space representation summing up the inputs from all sensors (car's view of the world in vector space)

How to best distribute effort between Algo, Data, Hardware?

- 5000 cars with the sensor suite ⇒ we have 99% of all the data ⇒ huge inflated data

fully self-driving computer - 2 computers on a chip which are redundant. the system with

Why? - the system will operate best if both systems are operating but it's capable of operating on one.

Edge cases:

- traffic detours, unplanned rerouting, traffic cop encounter,
- lane change, highway interchange, exiting a freeway, near-
- vast majority of them go away with the 2019's release.

Big leaps through the development of Autopilot?

- navigate on autopilot without having to confirm
- automatically overtakes slow cars, seeking the fastest lane.
- exit freeways, traffic light recognition

Biggest technological roadblocks to full self-driving?

- fully Self Driving (FSD) computer - has enough base computation
- refining the neural net and the control software
- Currently, the hardware is capable of full-self driving. As we refine the software, the capabilities will increase dramatically, reliability \uparrow regulatory approval \checkmark

"Buying a car today is an investment in the future"

"You're buying an Appreciating asset, not a Depreciating asset."

? If the hardware is capable enough, that's the hard thing to upgrade. Then, the rest is software problems. Software has no marginal cost really.

Intuition on the software side of ^{challenges?} ~~problems~~

How hard are the remaining steps to get it to where the experience, not just the safety but the full experience is something that people would enjoy?

- Currently, it's a game changer for quality of life on the highway.
- Need to extend that functionality to city streets, adding traffic light recognition, navigating complex intersections, parking lots,

The 'human' aspect or side of things:

Does it require supervision or safety driver in fully autonomous era (years) to come?

- it requires detecting hands on wheel (at least 6 months from now)
- you need large amount of data that can prove with high confidence that the car is dramatically safer than a person. \Rightarrow it might need to be ~~5, it might~~ 200 to 300% safer than a person

How to prove this?

- 'Incidents per mile'! (Crashes & fatalities) ^{there's not enough cases to be statistically significant at scale}
- probability of injury, crash, death } better than a person by at least 200%

Healthy discourse with the Regulatory bodies?

- Regulatory's attention \rightarrow Press' attention
(say 4 Tesla accidents out of 40,000 annually will receive a lot of press/attention than any other cause)
 \hookrightarrow Psychology of this is just interesting!

Lex Fridman et al. (@MIT)'s paper on functional vigilance of drivers while using Autopilot:

description:

- collecting video of driver faces, driver bodies

results/findings:

- drivers are maintaining functional vigilance such that (18,900 disengagements from Autopilot) were they able to take control in a timely manner.

Fridman's question:

- does a minority or some % of population exhibit a vigilance decrement?
 - the system's improving so fast that it will not affect overall statistics, etc on safety
 - pretty soon, having humans intervene will in fact decrease safety!

Operational Design Domain of Autopilot: (ODD)

- where autopilot is able to be turned on
- Tesla's ODD is wider (as opposed to most of its competitors)
- whether this ODD decision by Tesla was philosophical or by intent.

Questions about the human psychology, behavior and so on...

- 'most' totally 'most' (uncertain, subject to debate)

Recently back on autopilot to act in unexpected ways for adversarial examples:

Neural Nets are very sensitive to minor disturbances (these adversarial as input).

How do you defend against something like this?

- "Neural Nets is just a bunch of matrix math. You have to be very sophisticated and basically reverse-engineer how the matrix is being built, and then create a little thing that's just exactly causes the matrix math to be slightly off.

Solution: Easy to block [↑]this by having Negative Recognition.

Negative Recognition — if the system sees something that looks like a matrix hack, exclude it.

⇒ so learn both on the valid data & the invalid data (train for: 'this is a car' 'this is definitely not a car')

What ideas or new approaches take us to AGI (Artificial General Intelligence)?

- we're missing a few key ideas for AGI
- AGI is way more sophisticated than ANI (computer & toaster)
- With 'Tesla' to becoming the world's best toaster → it's Game, Set, Match !!!

Can AI love you back like humans do?

- From physics standpoint, if it loves you in a way that you can't tell whether it's real or not, it is real! (Haha)

Elon's question to AGI systems:

- What's outside the simulation?