placed on the self-driving cars. Through these pictures only, neural network identifies various objects such as traffic lights, sign boards, trees and other parts of the surroundings.

Give

As of now, there are two companies providing self-driving cars:

COMPANY	MODEL	PICTURE
Tesla	Model S	
Tesla	Model X	
Tesla	Model 3	
Tesla	Model Y	
Google	Waymo	

TESLA COMPANY

TESLA MOTORS is considered appropriate to be one of the leaders in the field on automobile manufacturing industry. The company placed their milestone in 2003 by our enlightenments: - MARTIN EBERHARD, MARC TARPENNING, JEFFERY B. STRAUBEL, IAN WRIGHT. ELON MUSK, a man with a bright, sharp vision, joined THE CHAIRMAN OF THE BOARD in February 2004, where he shared the first major sales.

As per the records, in the first half of 2016, the company holds the second rank in the sale of electric cars (21.6 thousand hatchbacks of Model S) as compared to the world leader Nissan. A speedy rapid development can be seen by the shared part of NICOLA TESLA, financial investment and innovation policies.

Tesla Company develop and deploy autonomy on a wider spectrum and believed in the approach which is built on AI for the vision and planning which is quite supported by the efficient use of hardware to achieve the goal of self-driving.

Hardware

Build silicon chips that power our full self-driving software from the ground up, taking every small architectural and micro-architectural improvement into account while pushing hard to squeeze maximum silicon performance-per-watt. Perform floor-planning, timing and power analyses on the design. Write robust, randomized tests and scoreboards to verify functionality and performance. Implement compilers and drivers to program and communicate with the chip, with a strong focus on performance optimization and power savings. Finally, validate the silicon chip and bring it to mass production.

Neural Networks

Cutting edge research, I being applied for the deep neural networks on problems which ranges from perception to control. The per camera networks analyze the raw images for performance of semantic segmentation, object detection and monocular depth estimation. The birds-eye-view networks take video from all cameras to output the road layout, static infrastructure and 3D objects directly in the top-down view. The networks learn from the most complicated and diverse scenarios in the world, iteratively sourced from our fleet of nearly 1M vehicles in real time. A full build of Autopilot neural networks involves 48 networks that take 70,000 GPU hours to train. Together, they output 1,000 distinct tensors (predictions) at each timestep.

AUTONOMY ALGORITHMS

Develop the core algorithms that drive the car by creating a high-fidelity representation of the world and planning trajectories in that space. In order to train the neural networks to predict such representations, algorithmically create accurate and large-scale ground truth data by combining information from the car's sensors across space and time. Use state-of-the-art techniques to build a robust planning and decision-making system that operates in complicated real-world situations under uncertainty. Evaluate your algorithms at the scale of the entire Tesla fleet.

CODE FOUNDATIONS

Throughput, latency, correctness and determinism are the main metrics we optimize our code for. Build the Autopilot software foundations up from the lowest levels of the stack, tightly integrating with our custom hardware. Implement super-reliable bootloaders with support for over-the-air updates and bring up customized Linux kernels. Write fast, memory-efficient low-level code to capture high-frequency, high-volume data from our sensors, and to share it with multiple consumer processes— without impacting central memory access latency or starving critical functional code from CPU cycles. Squeeze and pipeline compute across a variety of hardware processing units, distributed across multiple system-on-chips.

EVALUATION INFRASTRUCTURE

Build open- and closed-loop, hardware-in-the-loop evaluation tools and infrastructure at scale, to accelerate the pace of innovation, track performance improvements and prevent regressions. Leverage anonymized characteristic clips from our fleet and integrate them into large suites of test cases. Write code simulating our real-world environment, producing highly realistic graphics and other sensor data that feed our Autopilot software for live debugging or automated testing.

Fatal crashes of Tesla Self-driving cars since launch:

- **Handan, China (January 20, 2016)**
- **Williston, Florida (May 7, 2016)**
- **Mountain View, California (March 23, 2018)**
- **Kanagawa, Japan (April 29, 2018)**
- **Delray Beach, Florida (March 1, 2019)**
- **Arendal, Norway (May 29, 2020)**
- **The Woodlands, Texas (April 17, 2021)**
- **Fontana, California (May 5, 2021)**

WAYMO – GOOGLE's SELF DRIVING CAR

Google being a multinational, technological company, is also nailing the world by introducing its first self-driving car project named Waymo. It uses the creative technology which consists of sensors, detection of light and its range and cameras originated by humans. All together giving the information to rectify the object in its way and how to react. The duration of this work takes place in milliseconds. More data is incorporated when the system is being driven more and more.

WORKING OF WAYMO

- **The person sets the destination point. When he/she sets the destination point, the software of the car will automatically calculate the distance and the best route.**

- **Lidar, which is a rotating, roof-mounted light detection, monitors the range of 60 meters around the car. Through this a 3D map which is dynamic is created.**

- **A sensor is already placed on the left rear wheel. It has the responsibility for monitoring the sideways movements to detect the position of the car, relative to the 3D dynamic map.**

- **For calculating the distance between the car and the obstacles, radar systems are already installed in the front and rear bumpers.**

- **All the sensors in the cars are connected to Artificial Intelligence through the inputs are being collected from Google Sheet and video cameras present in the cars.**

- **Using Deep Learning, AI stimulates human perceptual and decision-making which helps in controlling the brakes and steering.**

- **If a human wants to take over the control, then he/she can access the override facility.**

CONCLUSION

In the world of technology, AI is playing a crucial role in every field, leading to the growth of industry. AI in self-driving cars has not only reduced the fatal accidents but also reduced the level of carelessness of the drivers. Every company is running and implementing on their own ideas from sensors to training of AI in self-driving cars and with the advent wheel of time, the technology is at its exponential growth which is easing the lifestyle of the human race.

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