Computer, Drive My Car!

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Autonomous vehicles will lead to a safer, cleaner world.

Thanks to autonomous driving technologies, our future vehicles, roads, and even the world at large will be safer, run more efficiently, and suffer far less from combustion-related pollution. Join us as we envision our future lives as this exciting innovation takes hold.

THE DAWN: PRESENT–2020

It's estimated that autonomous driving will be a reality by 2020, but enormous research and development efforts must be undertaken. Artificial intelligence (AI) is the centerpiece of autonomous driving, but driverless vehicles also require complicated systems engineering that consists of the following divisions of R&D:

- *Algorithms*. This includes sensing to extract meaningful information from raw sensor data, localization to precisely orient and control the vehicle, perception to understand the vehicle's surrounding environment, and planning for vehicles to safely reach their destinations.
- *Client system*. This consists of the OS and hardware, which integrate the algorithms to meet real-time, reliability, safety, and energy-consumption requirements.
- *Cloud platform*. This provides offline computing and storage capabilities to support testing new algorithms, generating high-definition maps, and training deep-learning models.

Figure 1. Baidu autonomous vehicle. (Source: Baidu, used with permission.)

Many companies and new ventures are working on innovations in all of these areas to bring autonomous vehicles into everyday life (see Figure 1).

THE MIXED-MODE ERA: 2020–2040

We'll enter the mixed-mode era in 2020, in which manned and driverless vehicles will coexist. Given that a vehicle's average lifespan is around 10 to 15 years, we foresee that this era will last about two decades. Early versions of autonomous vehicles will be designed to understand and cope with current traffic systems that are made for human driving. New traffic systems will gradually be installed to facilitate autonomous vehicles, and traffic lights, lanes, and stop signs will coexist with on-road sensors. In addition, communication between driverless vehicles must increase so that they can coordinate with each other dynamically. In this era, enormous amounts of data will be generated to fuel the continued improvements of AI algorithms.

THE AUTONOMOUS ERA: 2040 AND BEYOND

By 2040, all vehicles will be completely driverless, and it might even be illegal for humans to drive on public roads. By then, we could have completely new traffic ecosystems in which all vehicles are centrally controlled. Autonomous transportation will become a basic utility like electricity and water. Driving-related fatalities will drop to almost zero from more than a million per year globally today, due not only to improved navigation and systems but also to sensors that detect natural wear and tear on roads and the vehicles themselves. Of course, we will need far fewer vehicles, as they will be shared efficiently, and air quality will vastly improve because vehicles will maximize fuel efficiency and utilize new energy resources instead of fossil fuels. We eagerly await the future of autonomous driving!

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