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## THE JANUARY 2023 ISSUE IN BRIEF

Suddenly, in December, artificial intelligence was in the news—everywhere. One of my readers, Ken Pyle, Managing Editor of VIODI VIEW, sent me a link to something *ChatGPT* had written, which was a translation of something a Gen-Zer computer geek had said, unintelligible to the bulk of humanity. I had never heard of *ChatGPT* (*Generative Pre-trained Transformer*). It turns out that it is an AI ‘chatbot’ developed by OPENAI that specializes in dialog. It wrote a quite lucid translation of the Gen-Z gibberish. The same day, *THE ECONOMIST DECEMBER 10<sup>TH</sup> 2022* ISSUE fell through the mail slot in my office door, and there was an article in the *Business* section written by ChatGPT about ChatGPT in “Shakespearean style” (*Aye, ‘tis true that ‘tis a wondrous thing...*). On the 15<sup>th</sup> of December I read about someone who had won an art contest for digitally manipulated images, but the judges didn’t know that he had used an AI-based program to generate the image he had manipulated. Other contestants cried foul, but the judges stuck to their guns. *THE ECONOMIST*’s lead *Business* article was all about the new age of AI. It seems that for venture capitalists, AI will be the new BEV, especially since the owner of the most prominent BEV company appears to have lost his interest in the company that made him rich enough to buy his current distraction, TWITTER.

## Automotive AI Is Making Both Cars and Drivers Better

**ITU 2023 Future Networked  
Car Symposium  
13-16 March 2023  
Virtual Event**

**Session 2: Using Automotive Artificial Intelligence to Improve Vehicle Safety, Services and Transport Management  
14 March – 13.00-16.00 CET**

*For some, the goal of Automotive Artificial Intelligence is to completely remove the human from the driving task under some or all conditions. For others, it is to supplement and improve the human driver's abilities in order to make driving safer, offer new and better services, and increase the effectiveness of transport management. This has proven achievable with AI that accomplishes one or a limited set of objectives. This panel will present and discuss views on the current status of vehicle-related applications of artificial intelligence, different scenarios and timelines for their implementation, and concerns for how humans interact with Automotive AI.*

*Moderator: Michael L. Sena, Editor of THE DISPATCHER*

*Keynote Speaker: Missy Cummings, Ph.D. – DUKE UNIVERSITY (USA)*

*Panelists:*

*Bryn Balcombe – Autonomy Systems and Regulatory Expert, OXBOTICA (UK)*

*Junichi Hirose – Highway Industry Development Organization (Japan)*

*Jenny Lundahl – RISE RESEARCH INSTITUTES OF SWEDEN*

AUTOMOTIVE ARTIFICIAL INTELLIGENCE (AAI) is a term that has different meanings, depending upon who is using it. For some, it means completely removing the human from the driving task and turning over control of the vehicle to software and sensors. For others, the goal of AAI is to supplement and improve the human driver's abilities in order to make driving safer, offer new and better services, and increase the effectiveness of transport management. The latter goal, improving the driving experience, has proven achievable with AI that accomplishes one or a limited set of objectives. The former goal, removing the human from the driving task, has proven to be devilishly difficult because the car needs to drive at least as well as a human.

AI that can approximate a human, that has the ability to understand and learn any intellectual task that a human can, is called *Artificial General Intelligence (AGI)*. It is also called '*Strong AI*', with its six major branches: machine learning, neural networks, robotics, expert systems, fuzzy logic and natural language processing. AI that has proven to be excellent at accomplishing one goal at a time, like playing chess, or interpreting spoken commands or answering questions like APPLE'S SIRI, is called '*Weak AI*'.

A good friend and reader of *THE DISPATCHER*, who has spent the past forty years talking and working with both automotive and government leaders, tells me that these leaders don't understand the difference between '*Strong*' and '*Weak*' AI. For them, AI is AI, and he has cautioned me from inserting nuances when referring to automotive AI. He says they also believe that most software being used in Advanced Driver Assistance Systems (ADAS), is either totally AI-based or uses mostly AI techniques. It isn't and it doesn't, but I have learned over the years to listen to my friend. I am reminded of when all navigation systems started to be referred to as '*GPSes*', and I tried in vain to correct everyone who used the term with me. I'm not going there again. AI is AI, whether it's used to drive automobiles or helping you choose the right retirement plan.

*Here is what I intend to do in this article:*

- Identify how artificial intelligence is being used today in vehicle-related applications;
- Explain how automotive AI-based applications will interact with humans, including drivers, passengers and people outside the vehicles;
- Describe the issues these automotive AI-based applications raise over and above driver assistance systems that do not use AI;
- Explore how automotive AI applications affect data privacy, for example, with respect to the EU GENERAL DATA PROTECTION REGULATION;
- Consider how automotive AI applications affect assignment of liability in case of an accident;
- Discuss how we can be certain that the decisions being made by the automotive AI-engines are consistent with laws and follow agreed standards;
- Finally, I will attempt to identify the factors that are standing in the way of widespread adoption of automotive AI.

*Cars didn't hop from the analog cave to the digital penthouse*

The world of cars entered the digital age in 1968 when VOLKSWAGEN introduced the first vehicle with a computer-controlled electronic fuel injection systems, the *D-Jetronic*, a transistorized electronic module manufactured by BOSCH. Electronic control units (ECUs) have been standard since the 1970s. By 1981, GM equipped all of its models with a Computer Command Control System (CCC) based on a MOTOROLA 8-bit microprocessor made by DELCO ELECTRONICS (from DELCO to DELPHI to APTIV).<sup>1</sup> Since 1996, vehicles have had an on-board computer diagnostic system (OBD) to monitor all vehicle systems, sending diagnostic trouble codes when a fault is detected.

Moving beyond using computers for controlling individual vehicle functions and monitoring on-board systems required an innovation that proved to be the first step toward advanced driver assistance systems: cameras. The *1956 Buick Centurion* (pictured right) is reputed to be the first car with a back-up camera.<sup>2</sup> The 'camera' was actually a TV camera that sent images to a dashboard TV screen. The *1991 Toyota Soarer* was the first production model with a backup camera.

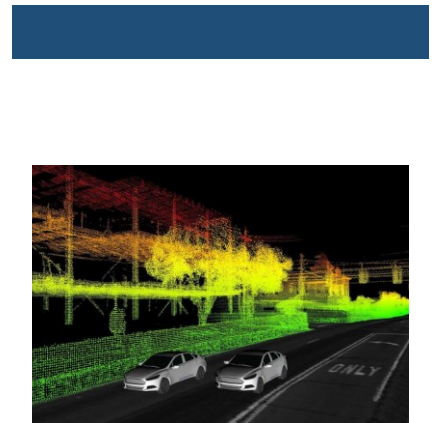


*1956 Buick Centurion*

<sup>1</sup> <https://www.motortrend.com/features/from-delco-to-delphi-to-aptiv/>

<sup>2</sup> <https://www.autoevolution.com/news/the-buick-centurion-was-so-futuristic-that-it-had-a-rear-view-camera-in-1956-156378.html>

Radio detection and ranging (RADAR) was the real game changer. It ‘sees’ things our eyes cannot see, enabling functions like automated cruise control, automated parking, blind spot detection, and collision warning. *Toyota, Nissan and Honda* models led the way in the 1980s with radar deployments.<sup>3</sup> LiDAR (Light Detection and Ranging) moved the bar higher. LiDAR sensors send out infrared light and measure the time it takes for the light to bounce off an object and back to the sensor. The result is a 3D map like the one in the image to the right. On-the-fly mapping images can be compared to previously stored images and map data to provide improved driver assistance and hands-free performance.



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### ***A Very Brief History of AI***

*Artificial Intelligence (AI) is a subset of computer science that focuses on machine-driven intelligence (i.e. non-human intelligence). In layman’s terms, AI is the understanding that machines can interpret, mine, and learn from external data in a way where said machines functionally imitate cognitive practices normally attributed to humans. Artificial intelligence is based on the notion that human thought processes have the ability to both be replicated and mechanized.*

*In 1950, Alan Turing published “Computing Machinery and Intelligence,” which proposed the idea of The Imitation Game – a question that considered if machines can think. This proposal later became The Turing Test, which measured machine (artificial) intelligence. Turing’s development tested a machine’s ability to think as a human would. The Turing Test became an important component in the philosophy of artificial intelligence, which discusses intelligence, consciousness, and ability in machines. (<https://www.g2.com/articles/history-of-artificial-intelligence>)*

*In the 1940s and 50s, a handful of scientists from a variety of fields began to discuss the possibility of creating an artificial brain. The field of artificial intelligence research was founded as an academic discipline in 1956 at the Dartmouth Workshop organized by Marvin Minsky, John McCarthy, Claude Shannon, and Nathan Rochester. The proposal for the conference included this assertion: “Every aspect of learning or any other feature of intelligence can be so precisely described that a machine can be made to simulate it”. In 1970, Marvin Minsky said in LIFE MAGAZINE: “In from three to eight years we will have a machine with the general intelligence of an average human being.” ([https://en.wikipedia.org/wiki/History\\_of\\_artificial\\_intelligence#Automata](https://en.wikipedia.org/wiki/History_of_artificial_intelligence#Automata))*

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*But first, what AI is and what it Ain’t*

We need to say a few words about the difference between artificial intelligence and what we have been doing with computers—and continue to do—before AI came along. It is the field called

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<sup>3</sup> <https://www.armms.org/media/uploads/p05---mark-walden---automotive-radar---from-early-.pdf>

Data Science and it pertains to data processes and data systems.

It is an interdisciplinary field that uses scientific and other methods to extract value from data. It combines skills from fields such as statistics and computer science with business knowledge to analyze data collected from multiple sources to derive useful and meaningful insights from the contents of the datasets, principally forecasting future occurrences of events or phenomena. The *FACEBOOK* service operated by META PLATFORMS, INC. currently has close to 2 billion daily active users. It uses data science methods of extraction, manipulation and visualization to better understand the behavior of its users and to improve its product. *FACEBOOK* also uses artificial intelligence. It has created detection models to identify “deepfake” content in order to detect manipulated or completely fake videos. It has applied machine learning to enable automatic translation. Image recognition software allows users to search through photos without the need to rely on text or tags. It is creating “talking pictures” for the visually impaired which can speak the content of a photo out loud. And it is looking for signs of trouble in users’ posts and comments from friends to generate alerts to help people in crisis.

While data science is not dependent on artificial intelligence, artificial intelligence is dependent on data science, in particular **BIG DATA**.<sup>4</sup> AI builds on the foundation that data science has provided with the objective to create physical or virtual machines that imitate the functions of humans, such as learning, reasoning and making decisions. This concept is important to gaining a good understanding of automotive AI, which is the objective of this article.

*In 2011, IBM’s Watson, the company’s contribution to the field of AI, defeated two human contestants in the TV game show, Jeopardy. Jeopardy’s two most successful and celebrated contestants to that point, Ken Jennings and Brad Rutter, didn’t have a chance against Watson’s massive data processing abilities combined with natural language processing and a fast (digitally wired) ‘hand’ on the buzzer. IBM collected the \$1 million prize.*

### How automotive AI is being used today<sup>5</sup>

There is a temptation to point to manufacturing robots that have become ubiquitous in automotive assembly plants and suggest

<sup>4</sup> Big Data refers to the storage and processing of massive amounts of structured, semi-structured, and unstructured data with great potential to be extracted and organised to provide valuable information for organizations and enterprises

<sup>5</sup> <https://usmsystems.com/ai-in-automotive-industry/>

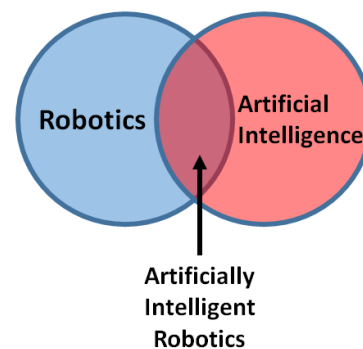


that they are the vanguard of automotive AI, when, in fact, most of them have nothing to do with AI. Artificial intelligence is not the same thing as robotics.<sup>6</sup> Robots are programmable machines that carry out one or more actions on their own, with some or no human intervention, making them semi-autonomous or fully autonomous. Robots interact with their surroundings using sensors and actuators. Thinking is not a requirement for a robot. A robot that does think, which can complete tasks that would otherwise require human intelligence, is an ‘artificially intelligent robot’. This is shown in the diagram to the right as the overlap between robotics and artificial intelligence. Therefore, a robot that paints car body panels is just a robot, but a car that can drive itself without any intervention on the part of a human is an artificially intelligent robot.

To make it simple, robotics involves building something physical, while artificial intelligence involves programming intelligence. But life is not simple (because, well, humans are not simple), so there is a complication. The term ‘robot’ has been appropriated for non-physical applications, such as search engine “bots” (for robots), and “chatbots” (for programs that pop up on web sites and “talk” to us). Just like GPS was a handy term for a navigation system, ‘robot’ or ‘bot’ has become a handy term for programs that do things on their own.



*Robots in a Car Factory*



***Robot, the word***

*The term "robot" was first used in a play published by the Czech Karel Čapek in 1921. R.U.R. (Rossum's Universal Robots) was a satire in which robots were manufactured biological beings that performed all unpleasant manual labor. According to Čapek, the word was created by his brother Josef from the Czech word robota 'corvée', or in Slovak 'work' or 'labor'. As a result of the play R.U.R, the then-popular use of the word "automaton" was replaced by "robot".*

***Driver monitoring systems (DMS)***

NHTSA estimates that in 2020, 3,142 people were killed in the United States by distracted driving.<sup>7</sup> That was around 8% of the total number of people killed in automobile-related accidents, or about 9 people every day. Drivers are distracted as a result of their emotions, levels of drowsiness, their reactions to vehicle controls, interaction with passengers, and reaction to things happening outside the vehicle. Combining cameras and microphones,



<sup>6</sup> <https://blog.robotiq.com/whats-the-difference-between-robotics-and-artificial-intelligence>

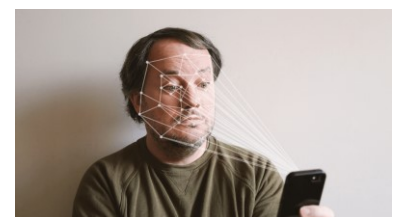
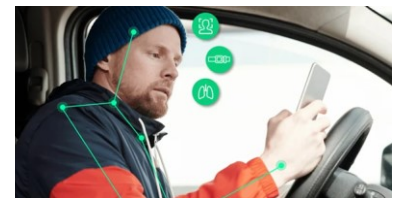
<sup>7</sup> National Highway Traffic Safety Administration (NHTSA) - <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813266>

AI is being used to measure, in real time, the emotional and cognitive states of the driver from his or her face or voice. These systems are using deep learning architectures, computer vision, and speech processing to gauge the degree of driver impairment and trigger effective vehicle adaptations to warn the driver and help to control the vehicle to compensate for the driver's reduced cognition.

How do DMS systems work?<sup>8</sup> DMS typically use a driver-facing camera equipped with infrared light-emitting diodes (LEDs) or lasers that "see" the driver's face, even at night, and see the driver's eyes even if the driver is wearing dark sunglasses. On-board software collects data points from the driver and creates an initial baseline of what the driver's normal, attentive state looks like. The software determines whether the driver is blinking more than usual, whether the eyes are narrowing or closing, and whether the head is tilting at an odd angle. It can also determine whether the driver is looking at the road ahead, and whether the driver is actually paying attention or just absent-mindedly staring. Using sensor fusion, if the system determines that the driver is distracted and the vehicle's external sensors determine that the car is about to leave the road or collide with another car, the vehicle's brakes could be engaged or steering could be taken over by the vehicle.

By uploading images and processing them by machine learning algorithms, it is possible for machines to detect the state of mind expressed by a human being by calculating the probabilities in terms of various emotions such as anger, joy, sadness, and so on. DMS is critical for self-driving functions such as automatic lane keeping in which the driver must be able to take back control of the driving task from the vehicle.

There are strong indications that DMS will become a standard feature of new cars due to regulatory and safety rating requirements (e.g. NCAP) in order to reduce the number of people being distracted and reduce the related deaths. In November 2019, The COUNCIL OF THE EUROPEAN UNION voted to adopt regulations to mandate the presence of advanced safety systems in automobiles by mid-2022. Under the new rules, all motor vehicles including trucks, buses, vans and sport utility vehicles, will have to be equipped with DMS. Functionality must include driver drowsiness



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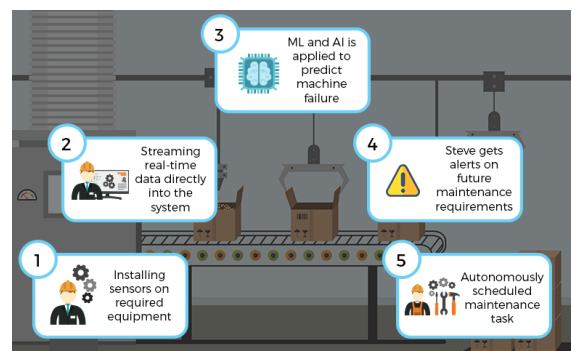
<sup>8</sup> <https://www.aptiv.com/en/insights/article/what-is-a-driver-monitoring-system>

and attention warning systems as well as advanced driver distraction warning systems. According to the *EUROPEAN COMMISSION*, with the new regulation in place, it is believed that at least 140,000 serious injuries will be avoided by 2038. In the U.S., a bill called *S.1406: Stay Aware For Everyone Act of 2021* was introduced by Senator Markey on 28 April 2021. It has not yet been voted on. Its purpose is to direct the Secretary of Transportation to conduct research regarding driver monitoring systems and to require driver monitoring systems to minimize or eliminate motor vehicle distraction.

### *Predictive maintenance of manufacturing systems*

The pain point for automotive manufacturing is unexpected malfunctions on the assembly line. It could be a machine breaking down, it could be defective parts feeding into the assembly, or it could be weather (or a pandemic) interrupting shipments of key parts. If any type of malfunction occurs, the line stops until the problem is fixed, and cars are not produced according to schedule.

AI-based algorithms gather and analyze data from all the machines and processes involved in manufacturing in order to detect irregularities that indicate a potential failure. If the result of the analyses points toward a potential failure, appropriate parties are informed who will attempt to address the problem before failure is a fact. Two types of data are used: images and physical quantities. These data can be one-time or temporal. In the latter case, the data are referred to as video or time-series data.<sup>9</sup> For image data analysis, computer vision systems based on convolutional neural networks (CNNs) are used to classify or label images. This is common in facial recognition systems, but it began and is heavily used for discovering product condition and quality and detecting anomalies.<sup>10</sup>



The most popular algorithm for time-series analysis is known as the *Hidden Markov Model (HMM)*. *HMMs* are widely used in speech recognition and translating a sequence of spoken words into text. An *HMM* is a statistical model in which the system being

<sup>9</sup> <https://www.sensorfy.ai/blog/the-use-of-artificial-intelligence-in-predictive-maintenance/>

<sup>10</sup> For a deep dive into neural networks, convolutional neural networks and machine learning, see this IBM tutorial: <https://www.ibm.com/cloud/learn/convolutional-neural-networks>



modeled is assumed to be a *Markov* process (or chain) with unobserved (hidden) states. In the predictive maintenance context, these states can be related to the condition and behavior of the machine or part.

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### **Markov Process**

*Markov Process is a sequence of possibly dependent random variables ( $x_1, x_2, x_3, \dots$ )—identified by increasing values of a parameter, commonly time—with the property that any prediction of the next value of the sequence ( $x_n$ ), knowing the preceding states ( $x_1, x_2, \dots, x_{n-1}$ ), may be based on the last state ( $x_{n-1}$ ) alone. That is, the future value of such a variable is independent of its past history.*

*These sequences are named for the pre-Soviet era Russian mathematician Andrey Andreyevich Markov (1856–1922), who was the first to study them systematically. Sometimes the term Markov Process is restricted to sequences in which the random variables can assume continuous values, and analogous sequences of discrete-valued variables are called Markov Chains. See also stochastic process.*

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### *Automotive testing*

Automotive manufacturers are using artificial intelligence technology for quality control checks, including acoustic testing.<sup>11</sup> Before AI-based acoustic testing, automotive engineers had to be present to perform the tests. AI with machine learning systems are able to test and measure vehicle performance 24/7. PORSCHE uses AI technology to conduct tests that can accurately detect noise, identify issues that need to be addressed, and report findings. This increases the efficiency of the acoustic testing process and frees up engineers' time for work that cannot be addressed by AI. AUDI is using artificial intelligence to detect weak points or cracks in sheets of metal, allowing AUDI to quickly identify damaged sheets of metal that should not be used in production.

### *Speech recognition*

Automatic speech recognition, or speech to text, is the first half of enabling drivers to perform functions that normally require the driver to remove his hands from the wheel, divert his eyes from the road, or both. These include finding directions, making phone calls, adjusting the radio, and adjusting any of the various controls on the instrument panel. The second half of the process uses natural language processing, machine learning and deep learning technologies that are used to execute required functions. Like

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<sup>11</sup> <https://www.evoximages.com/resources/artificial-intelligence-automotive-industry/>

many computer developments, speech recognition had its beginnings in research performed at *BELL LABS* in 1952.<sup>12</sup> Ten years later, at the World Fair in Seattle, IBM demonstrated its 16-word machine recognition solution in a shoebox. DARPA began funding speech recognition research in 1971. It took another thirty years before a working speech recognition systems showed up in a production car. It was in 2004 that HONDA with IBM delivered a voice-enabled navigation system. In 2007, FORD and MICROSOFT partnered to create *Sync* and allow drivers to interact with their mobile devices.

### Automotive AI that interacts with humans

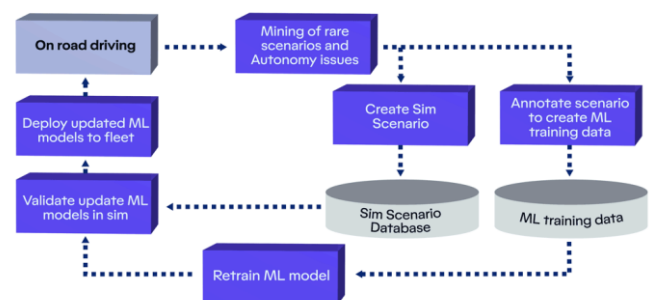
The first step in introducing automotive AI will require interaction between the AI and humans. There are two types of interaction between AI systems and humans with respect to the driving task:

- Sharing the driving task on board the vehicle between an alert human driver and an AI-based driver. The driver turns over the driving task to AI-based system when appropriate, and the AI-based systems returns the driving task to the human when it cannot carry out the driving task.
- Sharing the driving task performed on board by an AI-based driver with a human in a remote location when the on-board AI application requires assistance to continue with or complete the driving task.

The AI part of the driving task begins with training the software that will be fed massive amounts of data by the vehicle’s sensors, possibly supplemented with data from off-board data sources. The software will then direct the vehicle’s driving control systems to perform the actions of an experienced driver, including staying in its lane, stopping at crosswalks for pedestrians, not parking in handicapped zones...it’s a very long list, especially when all the anticipatory situations are added in. Training requires feeding the AI system images of driving situations and teaching the neural network algorithm what the images mean, (e.g., Red light = Stop; Green light = Go). When the car is driving, object detection, using cameras, LiDAR and RADAR, and object classification allow the vehicle to recognize objects, interpret situations, and make decisions.<sup>13</sup>



*Motional, a JV between Aptiv and Hyundai Motor Group, uses their Continuous Learning Framework to update its machine learning (ML) module.*



<sup>12</sup> [https://en.wikipedia.org/wiki/Speech\\_recognition#Pre-1970](https://en.wikipedia.org/wiki/Speech_recognition#Pre-1970)

<sup>13</sup> <https://www.aionlinecourse.com/blog/artificial-intelligence-in-self-driving-car-and-how-it-works>

As part of the on-road driving part of the training exercise, shown in the diagram above, if a situation is encountered that detection system have trouble interpreting, or which it interpreted incorrectly, the images from that situation are sent to a team of human annotators. This team manually creates training data for the detection models so that when a similar (identical?) situation is encountered, the correct interpretation will (hopefully) be made.

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### ***Machine Learning Requires Data Annotation***

*AI data annotators are called "the people behind Artificial Intelligence". "Data is the blood of AI. It can be said that whoever has mastered the data is very likely to do well," said Brian Cheong, CEO of BYTEBRIDGE.IO, an automated data labeling platform. He says Artificial Intelligence could also be called Data Intelligence because how 'deep machines' can develop will fully depend on how much data can be supplied. However, data alone is useless. For deep learning, data only make sense when it's tagged and used for machines' learning and evolution. Labeling is a must.<sup>14</sup>*

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Additional information that is required by the software is where and when the vehicle may operate, called the operational design domain (ODD). Vehicles driven by software can be restricted to certain types of roads, certain times of day, certain weather conditions, or with certain types of emergency drivers, passengers or cargo.

### ***Humans and AI sharing the driving task on-board the vehicle***

***Automatic Lane Keeping Systems (ALKS), like the Mercedes-Benz Active Lane Keeping Assist, are the first step in moving toward vehicle operation without human driver control. The MERCEDES-BENZ system complies with **United Nations Regulation No. 157, Uniform provisions concerning the approval of vehicles with regard to Automated Lane Keeping Systems (ALKS)**, which was adopted in June 2020 and came into effect on the 22<sup>nd</sup> of January 2021. The regulation, that has been adopted in the EU countries, the UK, Japan, South Korea and Australia, establishes a set of uniform requirements that can be used for determining through a pre-approval (known as 'type approval') process if an ALKS should be allowed on the road. The regulation specifies 60 kph as the operational speed limit (which will gradually be increased as systems improve), on roads where pedestrians and cyclists are prohibited and are equipped with a physical separation that divides traffic moving in opposite directions.***



***Mercedes-Benz Active Lane Keeping Assist***

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<sup>14</sup> <https://finance.yahoo.com/news/human-power-behind-ai-machine-112000543.html>

A qualified driver must be present in the driver's seat, and this driver must be prepared to take over the driving task. So the car must continue to have a steering wheel and driving controls, and the driver must be physically present in the driver's seat. To ensure that this is the case, the system must have a driver availability recognition systems. This system must be able to detect if the driver is present in the driving position, if the seat belt is fastened and if the driver is available to take over the driving task (e.g., not sleeping). If the driver is not in the driver's seat for more than one second or if the seatbelt is unbuckled, a so-called 'transmission demand' is activated. A transmission demand is "a logical and intuitive procedure to transfer the Dynamic Driving Task (DDT) from the system (automated control) to the human driver (manual control)".

#### *Remote vehicle assistance*

As I have said, a car without a human driver controlling the vehicle is an artificially intelligent robot. So, while the MERCEDES-BENZ vehicle is in ALKS mode, it is an artificially intelligent robot. However, as soon as the robot must deactivate, the human driver must be ready to take over. What happens when there is no human driver present? CRUISE vehicles operating in San Francisco provide ample examples of what can happen. Here are some clips from local news sources reporting on incidents:

- *On Sept. 30 at around 11 p.m., an N Line streetcar in San Francisco ground to a halt at the intersection of Carl Street and Cole Street because an autonomous vehicle from CRUISE had halted on the streetcar tracks and wouldn't budge. 140 passengers riding the N Line that evening were stuck in place for seven minutes before a CRUISE employee arrived and moved the driverless conveyance.*
- *A CRUISE vehicle blocked Sacramento Street near Mason Street. The self-driving car was inexplicably blasting music from the stereo despite the fact nobody was inside. It's either an odd quirk or a sign that artificial intelligences are partial to watered-down pop rock tunes.*
- *A CRUISE car caused blockage. A CRUISE team arrived within 20 minutes after someone phoned them to deal with the situation. The need for a phone call raises questions as to CRUISE's in-house monitoring capabilities. One would expect the highly-connected autonomous vehicles to send warnings directly back to CRUISE HQ in the event of an unexpected stoppage.*

CRUISE spokesperson Drew Pusateri told a news source that the stoppages were due to a "technical issue." According to Pusateri, CRUISE teams arrived at each incident within 20 minutes to recover the affected vehicles. Pusateri stated that "if our cars encounter a

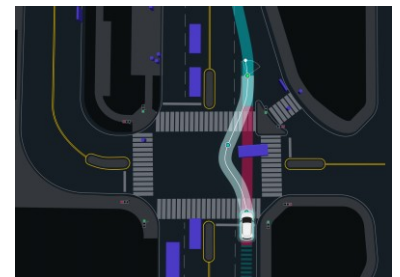


In July, 2022, a swarm of CRUISE-branded Chevrolet Bolts malfunctioned simultaneously at the same location in downtown San Francisco, resulting in a blockade of cars across a four-lane road that reportedly jammed traffic for hours.

situation where they aren't able to safely proceed, they stop and turn on their hazard lights, and we either get them operating again or pick them up as quickly as possible."

There are many reasons artificially intelligent robots like the *CRUISE* vehicles cannot "safely proceed" other than "technical issues" (meaning a software glitch), and some of them are reasons why human-driven cars cannot safely proceed either. They include heavy rain, heavy fog, heavy snow, a fault with the vehicle's electrical systems, and a fault with the vehicle's sensors. A vehicle may run out of gas/electricity. Humans also suffer brain dysfunctions in the form of blackouts or panic attacks.

Handing control of the vehicle over to an off-board human is one way to avoid twenty-minute traffic stoppages. This is what a company called MOTIONAL does. MOTIONAL is a joint venture between APTIV and HYUNDAI MOTOR GROUP. APTIV is the part of DELPHI that isn't doing ICE. DELPHI (formerly DELCO, which was once part of GM) split in two in 2017, with APTIV providing software, advanced computing platforms and networking architecture for active safety and driverless systems. MOTIONAL's *Remote Vehicle Assistance (RVA)* platform (Why call it anything else?) is staffed by humans. But these humans are not remotely driving the vehicles as if they are playing a video game. That, says MOTIONAL, is "totally impractical". The off-board assistance team members size up the situation they see surrounding the vehicle, and send a series of commands to the on-board computers to guide the vehicle toward a solution. For example, as the diagram to the right shows, a path can be drawn by the remote assistant which can then be used by the vehicle to maneuver around an obstruction.



MOTIONAL says they use the human-drawn solutions to train its convolutional Neural Network path generation model, without needing any further annotation or data labeling. When any of the vehicles get stuck in a similar situation, their machine learning model uses the stored path to generate a recommended path for the *RVA* assistant to review and approve.<sup>15</sup>

#### *Driver assistance with and without automotive AI*

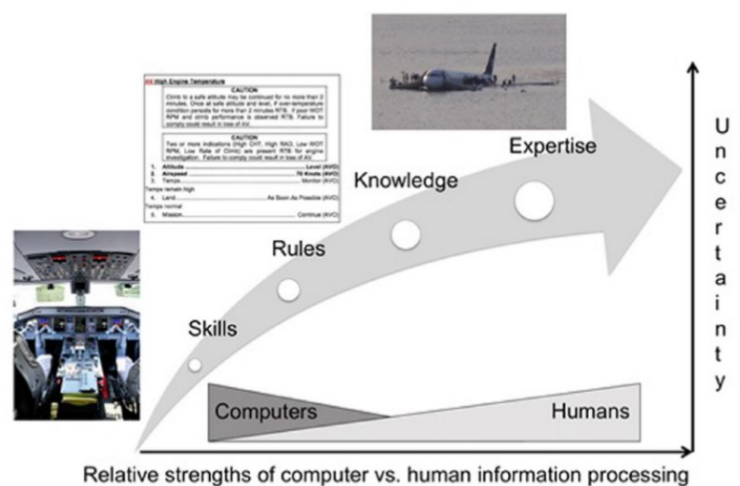
Advanced driver assistance systems (ADAS) that have been developed over the past twenty years and are now being delivered as standard on many car models, and which perform single functions such as lane departure warning/correction, automatic emergency

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<sup>15</sup> <https://motional.com/news/path-forward-using-ai-improve-remote-vehicle-assistance-avs>

breaking, blind spot detection, and adaptive cruise control, do not use AI-based algorithms that require training for machine learning and neural network operation. They use rules-based algorithms to perform a task. They are not designed to perform without a driver who is expected to stay engaged at all times. An *Automatic Lane Keeping System* like the MERCEDES-BENZ one described above, does use AI. ALKS is a combination of lane departure correction, automatic emergency braking, blind spot detection, and adaptive cruise control with the driver releasing total control of the vehicle to the ALKS when it is engaged. In order for ALKS to work without the human in control, the on-board systems must substitute for the human engagement, recognizing when to brake or perform evasive maneuvers.

Humans are not perfect drivers, especially when they have natural (e.g. poor night vision) or induced (e.g. drugs, alcohol, distraction) impairments. But AI-based systems are not perfect drivers either. Humans and AI-based systems both have their strong points. Humans work well when uncertainty is at its highest, applying their knowledge and expertise to solving complex problems. AI-based systems excel when uncertainty is at its lowest with rules-based operation and well-defined skills. Driving a vehicle involves both routine skills and snap judgments. For driverless cars to work safely, they must be designed to seamlessly transfer control back and forth between computers and humans.<sup>16</sup>



The fact that CRUISE’s test cars get stuck or TESLA cars crash when their Full Self-Driving systems are engaged indicates that we are still in the pre-commercial phase of Automotive AI. But technical issues are only one, albeit important, part of the entire transformation of the automotive driving experience, especially when moving to Automotive AI-based systems that have no interaction with humans for the driving task. Like a present which has many layers of wrappings, from the tissue paper around the present to the ribbon and a bow on the box, Automotive AI requires various layers to complement the basic technology.

<sup>16</sup> <https://hal.pratt.duke.edu/sites/hal.pratt.duke.edu/files/members/Inform-ing%20Autonomous%20System%20De-sign%20Through%20the%20Lens%20of%20Skill-%2C%20Rule-%2C%20and%20Knowledge-Based%20Behaviors.pdf>

## Putting the wrappings on the Automotive AI package

### *Automotive AI and issues of data privacy*

It's not a question of AI-enhanced cars knowing too much about their drivers, passengers or owners; it's a question of those cars passing that information on to parties who might use the information without the knowledge or approval of their drivers, passengers or owners. Since our computers and phones have started collecting data about us and enriching companies like Google and META (formerly FACEBOOK), governments have been slow to establish ground rules for what is and is not acceptable. The European Union with its *GENERAL DATA PROTECTION REGULATION*, and the State of California with its *CALIFORNIA CONSUMER PRIVACY ACT*, have shown how governments can lead the effort to bolstering individual privacy.

AI and the *GENERAL DATA PROTECTION REGULATION* are closely tied to one another. *GDPR* affects AI development in Europe and other regions which have adopted *GDPR* principles. The Regulation explicitly covers automated, individual decision-making and profiling, and protects consumers from the legal consequences of both. Automated, individual decision-making in this case includes decisions made by AI platforms without any human intervention. Profiling means the automated processing of personal data to evaluate individuals. For automotive applications, this primarily affects content delivery systems and user interfaces. While a driver may authorize an AI-based driver monitoring system in connection with the driving task, it does not mean that a company behind the *DMS* may use the data for other types of profiling. This is what *GDPR* is aimed at preventing.

The European Union is preparing an AI regulation similar to *GDPR* passed in 2018. It is a new rule that is likely to have as broad an impact as *GDPR*. A draft proposal representing a legal framework for regulating AI was released in April 2021. The so-called *ARTIFICIAL INTELLIGENCE ACT*—officially known as the *PROPOSAL FOR A REGULATION LAYING DOWN HARMONIZED RULES ON ARTIFICIAL INTELLIGENCE*, represents an attempt for the EU to ensure that AI systems operating in the single market respect the EU's fundamental rights and values. The EU proposal seeks to identify high-risk AI technology and its applications aimed at critical infrastructure such as transportation that could endanger citizens. This means vehicles employing AI techniques and systems will be a target of AI regulation. The *EUROPEAN COMMISSION* has chosen a broad and neutral definition of AI systems, designating them as software "*that is developed with*



one or more of the techniques and approaches listed in Annex I and can, for a given set of human-defined objectives, generate outputs such as content, predictions, recommendations, or decisions influencing the environments they interact with".<sup>17</sup>

Fines under the EU proposed AI legislation could run as high as up to €30 million, or 6 percent of a company's global revenue, whichever is higher. Maximum fines under *GDPR* are €20 million, or 4 percent of global revenues.

#### *Automotive AI and issues of liability*

As soon as the topic of driverless cars arises, the issue of liability is mentioned. Who is liable for damages if a car being driven by Automotive AI with no human driver engaged in the driving task, someone asks. Another suggests producing a set of ethical rules to be included in the Automotive AI software stack so that it would be able to appropriately solve the "trolley problem".<sup>18</sup> In the [May 2022 issue of THE DISPATCHER](#), the lead article is titled *Legal Framework for Driverless Cars Already Exists: We need compliance, not disruption*. What I say in this article is that the liability issue for driverless vehicles, or even for functions that assist a human driver, is not an issue. If a car manufacturer sells a product which it claims performs a function, it is the manufacturer's product liability responsibilities that cover any damages to persons or property if the function does not perform "as advertised". I sent a request for information specifically about this topic to MERCEDES-BENZ when the company announced that it had received authorization to sell its *Active Lane Keeping Assist* in Germany. Here is their response:

*"Mercedes-Benz as the manufacturer may be liable under product and producer liability for damage caused by a product defect. This applies equally to automated and conventional vehicles. For automated driving, we as manufacturers consider the existing, traditional liability regime for road accidents with the combination of owner, driver and manufacturer liability to be unrestrictedly suitable."*

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<sup>17</sup> Because the EU recognizes that there is no such thing as a widely agreed-upon definition of AI, so the EU AI Act provides an Annex that defines the techniques and approaches which fall within its scope. <https://www.zdnet.com/article/the-eu-ai-act-what-you-need-to-know/>

<sup>18</sup> The trolley problem is a thought experiment in ethics about a fictional scenario in which an onlooker has the choice to save 5 people in danger of being hit by a trolley, by diverting the trolley to kill just 1 person. The term is often used more loosely with regard to any choice that seemingly has a trade-off between what is good and what sacrifices are "acceptable," if at all.



MERCEDES-BENZ assumes full product liability for the safe performance of its ALKS where it is authorized to be used. Currently, it can only be activated on selected roads in Germany, the *Autobahn*, and the liability laws of Germany apply. If the ALKS fails when it is activated, M-B's product liability insurance applies. M-B is NOT taking out personal liability insurance or any other insurance product to cover personal injury or property damage. It is using the "existing, traditional liability regime" for accidents if they occur while ALKS is active.

#### *Ensuring that automotive AI follows the laws*

There's no point in having a door on a barn if the farmer only closes it after the horses have run out. NHTSA is trying to rein in TESLA because of the accidents resulting in injuries and deaths from using its *Autopilot* and *Full Self-Driving* functions. NHTSA also has GM's *CRUISE* division in its sights because of the traffic disruptions it has caused in San Francisco. My May 2022 article referenced above argues that the U.S. has had the ability to prevent vehicles that contain functions which are not fully and properly tested from being placed on the roads. It has not used those regulatory restraints. Why not? NHTSA regulators have been convinced by business and venture capital representatives that a heavy regulatory hand would hamper innovation and turn the field over to competing nations (read that China). One part of the U.S. government is still operating under the spell of the Consumer Welfare Standard, while the other part attempts to bring back the guiding principle that consumer prices were secondary to anti-competitive practices.<sup>19</sup>

A major problem with AI systems that use neural networks is that once the systems are on the streets, it is impossible to know how they will operate. These systems are not restricted by sets of *If-Then* specifications. The Automotive AI systems will make decisions using AI logic, not using rules-based logic. This is why the example of Germany is important, with its two sets of laws for automated driving, one for general applications and the second specifically for Automatic Lane Keeping Systems. It is an example of why regulations must precede testing and guide development.

Black-box solutions should not be allowed. It must be possible to understand which data is required to enhance model accuracy and which data has been used to inform decisions. The *DEFENSE ADVANCED RESEARCH PROJECTS AGENCY (DARPA)* has been working on

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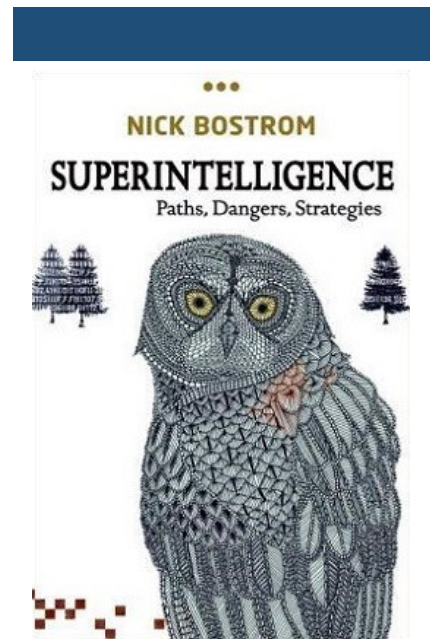
<sup>19</sup> See the lead article in the February 2022 issue of The Dispatcher

developing machine learning technologies that produce more explainable models, while retaining a high level of learning performance and accuracy. Their goal is to enable human users and regulators to understand, trust and manage AI models, and to enable the AI to characterize its own abilities and provide insights into its future behavior.

## What is standing in the way of Automotive AI?

It's what AI 'ain't' or isn't yet that is standing in the way of its full and faster adoption. As GEORGETOWN UNIVERSITY'S CENTER FOR SECURITY AND EMERGING TECHNOLOGY (CSET) says in its report, Automotive AI requires much greater safety than other consumer segments. Therefore, greater emphasis on AI safety and R&D are a must.<sup>20</sup> The CSET report identifies three basic types of AI failures: robustness, specification, and assurance failures. Robustness failure means AI systems receive abnormal or unexpected inputs that cause them to malfunction. In specification failure, the AI system is trying to achieve something subtly different from what the designer intended, leading to unexpected behaviors or side effects. Assurance failure means the AI system cannot be adequately monitored or controlled during operation. AI algorithms operate like a black box which makes it difficult to determine why certain decisions were made. Therefore, validating functionality is statistically possible via the numerous test cases only. The report released in July 2021 includes examples of unintended AI "accidents", and recommends actions to reduce the risks while making AI tools more trustworthy.

Bryan Reimer, Ph.D., MIT Researcher, explained in his 2022 ITU FUTURE NETWORKED CAR SYMPOSIUM keynote address, we need a broader systems level view for safe and successful deployment of Automotive AI. "Many engineers look to AI as the solution. However, in reality, it is a component of a broader system where AI is brittle and requires, except in the narrowest of conditions, human supervision." Dr. Reimer went on to explain that there is still a major gap between what both Advanced Driver Assistance Systems (ADAS) and Automated Driving Systems (ADS) require from drivers and what drivers are able to provide. "While many systems require driver management and oversight," he said, "drivers may not have the understanding and skills necessary to successfully leverage technologies." Unfortunately, technologists often assume ideal performance of both the human and the system. Dr.



*While I was writing this section of the article, Nick Bostrom was being interviewed on Swedish radio. Born Niklas Boström, he was home for a holiday visit from the University of Oxford where he is the founding director of the Future of Humanity Institute, known for his work on the philosophy of artificial intelligence. Bostrom believes that superintelligence, which he defines as "any intellect that greatly exceeds the cognitive performance of humans in virtually all domains of interest," is a potential outcome of advances in artificial intelligence. He views the rise of superintelligence as potentially highly dangerous to humans, but nonetheless rejects the idea that humans are powerless to stop its negative effects. During the Swedish Radio interview he talked about the developers of ChatGPT not being able to control its tool from making racist statements. I highly recommend reading his book, [Superintelligence](#).*

<sup>20</sup> <https://cset.georgetown.edu/publication/ai-accidents-an-emerging-threat/>

Reimer's principal message was that a systems perspective is "often in view but slightly out of focus when the emphasis is centered on technology alone as a solution".

### **Conclusions: Where we are with Automotive AI**

I firmly believe that Automotive AI, when it is ready to be used for driving applications beyond the limited ALKS implementations, will make both cars and drivers better. Better means more attentive, more capable of avoiding the situations that cause accidents, more able to minimize severe consequences once an accident is unavoidable. Better means more knowledgeable about how to use vehicles more effectively, to minimize traffic congestion, and to reduce negative environmental effects. Automotive AI is already at work monitoring driver attention and combining the results of multiple rules-based advanced driver assistance systems. Responsible automobile manufacturers are moving cautiously to integrate Automotive AI, working closely with their suppliers, regulators and customers.

What the automotive industry must do now is ensure that the narrative of Automotive AI is not captured by companies for which transport and vehicles are a means to generate income for their primary business, such as selling advertising or selling information to organizations—even governments—that will use the information for their own purposes. I have written about both the advantages and disadvantages of allowing tech companies like Google, APPLE, and MICROSOFT (and especially their equivalents in China) to take over the infotainment, connectivity, and communications functions in vehicles. Unlike vehicle manufacturers, these companies see vehicles as a channel for their product, not as a product in and of itself. One of the biggest disadvantages of allowing them inside the vehicle is the possibility that they will take control of the data that will be developed for and used by Automotive AI systems. Google/Waymo may help a car company arrive at the Automotive AI goal line faster, but one, quick win doesn't mean a successful season or ensure a team's long-term legacy.

We need standards, regulations, development, testing, evaluation, revisions, certification, driver training, implementation, evaluation, revisions, recertification, etc...in that order.



## ***We are already in the age of AI***

*“Aye, ‘tis true that ‘tis a wondrous thing, these Generative Artificial intelligences, or GPTS as they be known.*

*‘Tis a marvel of modern science, and ‘tis no wonder that ‘tis taking the world by storm.*

*But what are they truly? And why should we care?”*

As *THE ECONOMIST Business* editor notes, ‘tis and ‘hath does not Shakespearean make. But it’s not bad. The question *THE ECONOMIST* editor put to *ChatGPT* was not one for which it had prepared. It seems clear that *ChatGPT* had not been trained on vast amounts of Shakespeare’s text. Its answer was off the cuff, so to speak.

*“GPTS be a type of AI technology that can generate natural language in response to input.*

*‘Tis a form of deep learning, wherein a computer system is trained on vast amounts of text data.*

*And then can generate its own text based on what it hath learned.”*

The judgment is that it reads like a “pastiche of information found on the Internet”. But, actually, ‘tis more than just rehashed facts. The *OPENAI* application couldn’t resist moving beyond just informing, as the closing text shows.

*“Thus, ‘tis clear that GPTs are more than mere hype.*

*They be a powerful tool that can be used to provide services to companies and individuals alike.*

*‘Tis an exciting time for AI, and ‘tis certain that GPTs will be at the forefront of this revolution.”*

Thus, it ends with an advertisement for *ChatGPT* and *OPENAI*. *OPENAI* is an artificial intelligence research laboratory consisting of the for-profit corporation *OPENAI LP* and its parent company, the non-profit *OPENAI INC*. The company conducts research in the field of AI with the stated goal of “promoting and developing friendly AI in a way that benefits humanity as a whole”. It was founded in San Francisco in late 2015 with investments by Elon Musk, among others, who collectively pledged \$1 billion. (Musk resigned from the board in February 2018 but has remained a donor.) It is co-located with Musk’s *NEURALINK*<sup>21</sup> in a building in San Francisco. In 2019, *OPENAI LP* received a \$1 billion investment from *MICROSOFT*.

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<sup>21</sup> *NEURALINK CORPORATION* is a neurotechnology company that develops implantable brain–computer interfaces.



It was announced at the same time that OPENAI would commercially license its technology with MICROSOFT as its preferred partner. OPENAI claims that within weeks of it being released to the public for testing its *ChatGPT* already had one million users.

A 2022 report by MCKINSEY found that the percentage of companies in the world that have tried to use AI in some way has risen from 20% in 2017 to 50% in 2022.<sup>22</sup> In 2022, venture capitalists handed over \$67 billion to firms that claim to specialize in AI, this according to *THE ECONOMIST* which attributes the information to PITCHBOOK, a data firm.<sup>23</sup> Google, left out of the OPENAI cabal, is reported to be investing \$200 in COHERE, a competitor. It already has its own AI lab in *DEEPMIND*, which developed *AlphaGo*. In 2016, the *AlphaGo* program beat a human professional *Go* player, Lee Sedol, a world champion, in a five-game match. Where is all of this money going, you might ask. One is to buy startups. In the past twelve months, U.S. companies have gobbled up 52 startups. The second place where the money is going is to pay salaries to AI super stars at levels that rival those of the top football players (either of the American or rest of world (aka soccer) variety). I guess the folks investing other people's money have convinced their clients that the payback will be similar to owning a top-level football team like PARIS ST. GERMAIN, which has on its team the two top players who competed against each other for the World Cup title.<sup>24</sup>

Big Tech is not playing games with AI. They are using it in earnest in their businesses. AMAZON operates its warehouses; META and Google delivers ads; MICROSOFT lets users of *PowerPoint* generate drafts of presentations from basic commands. They are also putting their tools up in their clouds so that customers, actual and prospective, can experiment with their own applications. Companies, both established and new, are working on the next phase of AI development that will make using them more common. They are building what are called Foundation Models. Rather than training an AI to work on a specific task by feeding it prodigious amounts of data for working on that task, Foundation Models “use self-supervised learning and transfer learning, and the model can apply information it has learned about one situation to another. While the amount of data is considerably more than the average



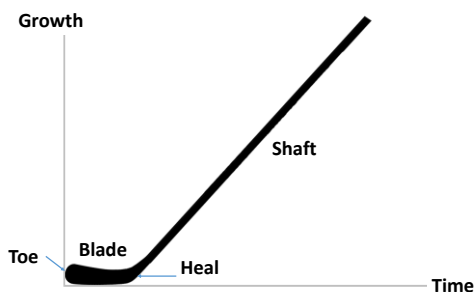
<sup>22</sup> <https://www.mckinsey.com/featured-insights/artificial-intelligence/global-ai-survey-ai-proves-its-worth-but-few-scale-impact>

<sup>23</sup> I could not find a direct quote from PITCHBOOK on this claim.

<sup>24</sup> Lionel Messi playing for his home country of Argentina and Kylian Mbappé for France. PSG is owned by QATAR SPORTS INVESTMENTS.

person needs to transfer understanding from one task to another, the end result is relatively similar: You learn to drive on one car, for example, and without too much effort, you can drive most other cars — or even a truck or a bus.”<sup>25</sup> *ChatGPT* did a passable job with its Shakespearean version of describing itself because it is a Foundation Model for creating content for any topic, not just one about which ‘The Bard of Avon’ actually wrote.

Although all the chatter about *ChatGPT* makes it look like there is a rush to implement AI, this is definitely not the case. OPENAI took seven years to get *ChatGPT* ready for sub-prime time. Returning to the MCKINSEY study, of the firms that responded to its survey, only one-quarter reported that AI had benefited the bottom line, defined as a 5% increase on earnings. Less than 10% of these firms



(10% of 25%) reported a benefit of over 20%. We are still on the blade of the hockey stick, somewhere between the toe and the heal, not on the shaft. But we are on the hockey stick, not on the ice.

*THE ECONOMIST Business* editor closed his piece on an upbeat-for-humans note. “It will be a while before your correspondent has to look for a new field of work,” he avowed. “He will pen the next article by himself.” I plan on doing the same. And I am also planning on driving my own car until I have to turn in my driver’s license. But I will applaud and use any tools that make my driving safer and more comfortable, and if those tools are based on AI, I will definitely not dismiss them, especially if I know they have met a regulated process of making them ready for the road with human drivers.



<sup>25</sup> <https://research.ibm.com/blog/what-are-foundation-models>

THE NEW YORKER Cartoon



*“There’s another route that’s ten minutes faster, but we won’t get to see what’s causing this slowdown.”*

## US FTC Safeguards Rules

THE FEDERAL TRADE COMMISSION *SAFEGUARDS RULE* requires financial institutions under FTC jurisdiction to have measures in place to keep customer information secure. In addition to developing their own safeguards, companies covered by the *RULE* are responsible for taking steps to ensure that their affiliates and service providers safeguard customer information in their care.<sup>26</sup> The COMMISSION first issued its *SAFEGUARDS RULE* in 2003 for financial institutions to protect consumer data. In the autumn of 2021, the FTC amended it to specifically include automobile dealerships with more than 5,000 customer records. This includes the vast majority of auto dealerships in the U.S. The *RULE* was to become effective for auto dealerships on the 9<sup>th</sup> of December 2022, but it was extended in November 2022 until the 9<sup>th</sup> of June 2023. Many dealerships will struggle to meet that deadline as well.

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### *FTC Safeguards Rule*

*Purpose.* This part sets forth standards for developing, implementing, and maintaining reasonable administrative, technical, and physical safeguards to protect the security, confidentiality, and integrity of customer information.

*Scope.* This part applies to those “financial institutions” over which the Commission has rulemaking authority pursuant to section 501(b) of the GRAMM-LEACH-BLILEY ACT. This part applies to all customer information in your possession, regardless of whether such information pertains to individuals with whom you have a customer relationship, or pertains to the customers of other financial institutions that have provided such information to you.

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### *What auto dealerships have to do to comply*

Dealerships must designate a “qualified” individual to implement and enforce the information security program required by the *RULE*. The individual can be an employee or a service provider, but the individual must meet the specific requirements for training and knowledge specified in the *RULE*. This individual must report in writing at least once per year on the status of compliance. If outside service providers are used they must be required by contract

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<sup>26</sup> PART 314 - STANDARDS FOR SAFEGUARDING CUSTOMER INFORMATION; Authority: 15 U.S.C. 6801(b), 6805(b)(2). Source:67 FR 36493, May 23, 2002, unless otherwise noted.

to implement and maintain safeguards to ensure data record security. An individual in charge of the program can receive a penalty for a single violation of around \$50,000. It seems that the reason for the FTC targeting car dealerships for extending the *SAFEGUARDS RULE* is that dealerships have been an easy target for scammers and fraud.

The FTC *SAFEGUARDS RULE* is one of many laws and regulations that affect car dealerships.<sup>27</sup> The *GRAMM-LEACH-BLILEY ACT* mentioned above is the principal federal law that establishes a dealership's obligations for safeguarding and protecting consumers' nonpublic personal information, which includes names, addresses, phone numbers and social security numbers. The *MAGNUSON-MOSS WARRANTY ACT* is a U.S. federal law enacted in 1975 which governs warranties on consumer products. The law does not require any product to have a warranty, but if it does have a warranty, the warranty must comply with this law. The law was created to fix problems as a result of manufacturers using disclaimers on warranties in an unfair or misleading manner. This will increase in importance as auto makers seek to limit their liability in the fuzzy zone of handovers between automated systems and human drivers.

### ***Tesla's 2021 Christmas toy decommissioned***

LAST CHRISTMAS, TESLA decided that 5,000 kids whose parents could afford a Christmas present with a \$1,900 price tag needed their own TESLA to sit in the garage next to their parent's. So they offered a battery-powered vehicle called *Cyberquad* (pictured right), which has a 15-mile range and a top speed of 10 mph. It is designed to have only one occupant, has a steel frame, cushioned seat, adjustable suspension, rear disc braking and LED light bars. The *Cyberquad*, which was made by RADIO FLYER, maker of the classic children's wagon, was sold through TESLA's website.

All 5,000 *Cyberquads* have now been recalled by RADIO FLYER for failing to meet federal safety standards. The CONSUMER PRODUCT SAFETY COMMISSION says the toy is classified as an all-terrain vehicle (ATV), but doesn't adhere to federal vehicle requirements for mechanical suspension and maximum tire pressure. It also was produced without a mandatory CPSC-approved ATV action plan, which includes rider training, distribution of safety information, age recommendations and other measures. Buyers have been



<sup>27</sup> <https://www.jmagroup.com/resources/operations/tdawa/8-important-dealership-regulations-how-to-protect-yourself-and-your-customers>



instructed to permanently disable the vehicle by removing the motor controller. They can get a full refund by sending the motor controller to RADIO FLYER.

TESLA'S CEO Elon Musk first broached the idea of a *Tesla ATV* as part of the *Cybertruck* reveal in 2019, saying buyers of the pickup would be able to add an ATV as an option. The *Cybertruck* was due to go on sale in 2021, but has been delayed. *"The ATV is an interesting design challenge because ATVs are pretty dangerous,"* Musk told shareholders last year, *"and so we want to make an ATV that is the least-dangerous ATV."* (ED: Where was the CPSC when this statement was made?) They'll have to try again when their *Cybertruck* finally makes it out of the starter blocks. TESLA'S part-time CEO (he is very busy with TWITTER as I write, while TESLA'S share price continues its race to the basement<sup>28</sup>) has confirmed that *Cybertruck* production will begin "before mid-2023". It will be more expensive than originally promised due to "supply chain issues".<sup>29</sup> We all trust it will be safer than the *Cyberquad*.

## Quick Transactions

### *AURORA'S Urmson sees driverless shakeout, but not his own*

CHRIS URMSON WAS among the first to start working on developing driverless vehicles. He was part of the team that won the 2007 DARPA *Urban Challenge*. He joined Google's X effort in 2009 and led the team from 2013 until he left in 2016 to found AURORA INNOVATION, INC. with Sterling Anderson and Drew Bagnell. *"I've been saying for six to seven years that we're going to see consolidation,"* he said in early December to Pete Bigelow of *AUTOMOTIVE NEWS*. *"It doesn't mean that it's not an interesting space. It just means some people had the combination of capabilities, capital and technology, then made the partnerships to go and succeed."*

Unlike competitors *CRUISE*, *ZOOX*, and *ARGO AI* until it was closed by VW and FORD, AURORA remains footloose and fancy-free. It went public with a SPAC in November 2021, valuing the company at \$11 billion, and is traded on NASDAQ. It has been making a shift from cars to trucks as the principal market for its *Aurora Driver* product. *Aurora Driver* is a system that consists of sensors, software and



Here is the *Cyberquad* nestled into the *Cybertruck*, with the built-in ramp ready for a roll off.



Chris Urmson, right, speaking with Pete Bigelow of *Automotive News*: *"We're seeing our customers solve real problems. When we look in this freight space, we see a very clear direction."*

<sup>28</sup> Elon Musk, who lost his No. 1 spot on Bloomberg's ranking of the world's richest people this week, unloaded TESLA stock for the fourth time this year. Tesla's CEO sold almost 22 million shares for \$3.58 billion. The transactions happened between Dec. 12 and December 14<sup>th</sup>. Its stock is down 64% since the Twitter mess began. (<https://www.autonews.com/executives/elon-musk-sells-36b-worth-his-stake-tesla>)

<sup>29</sup> [HTTPS://WWW.TOMSGUIDE.COM/NEWS/TESLA-CYBERTRUCK](https://www.tomsguide.com/news/tesla-cybertruck)

hardware that can be installed in passenger cars or commercial vehicles. It has working relationships with VOLVO TRUCKS, FEDEX, DAIMLER AG, and PACCAR.

*“We’re seeing our customers solve real problems,” he said. “When we look in this freight space, we see a very clear direction.”*

Urmsen says that AURORA’s pilot projects with real customers is proof that *“self-driving technology is viable”*, and he points to expected shortages of commercial drivers as a reason for trucking to be a *“particularly lucrative place to begin driverless service”*.

### *Bosch is not giving up on ICE*

YOU MIGHT THINK that a company which has made electric appliances, from tooth brushes and power drills to vacuum cleaners and washing machines, would have already produced its own battery electric vehicle. It hasn’t. It is the number one tier one supplier to the global automotive industry, delivering powertrain solutions, chassis systems controls, steering, connected mobility solutions, multimedia electronics as well as electrical drives.<sup>30</sup> So, not only is it not developing its own BEV, it is not giving up its ICE business.

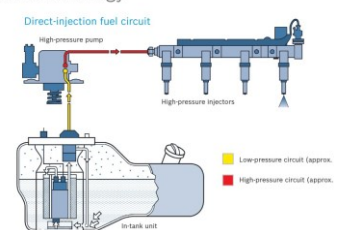
Paul Thomas, Executive VP of BOSCH NORTH AMERICA said recently that the company has invested \$6 billion so far in 2022 on electric vehicle and fuel cell technologies, but it has no intention of abandoning its core ICE products. *“We want to be in all industries as long as we can,”* said Thomas. *“We believe there is a future for the internal combustion engine and that each region will approach the ICE in different ways.”* He said that customers are keeping their vehicles longer—more than twelve years in the U.S.—and Bosch will continue to support those customers who have ICE vehicles.

Heiko Weller, BOSCH Senior Vice President Engineering, in an interview with *AUTOMOTIVE NEWS* explained that the main reason BOSCH continues to concentrate on improving and optimizing gasoline and diesel powertrains is that even in the future, two-thirds of all new cars worldwide will still be driven by an internal combustion engine, either on its own or as part of a hybrid design. *“ICE vehicles will continue to offer both affordability and availability compared to BEVs in large parts of the world,”* said Weller. *“BOSCH will work on optimizing fuel consumption and reducing emissions,*



### Gasoline direct injection

Product technology



GD I is a key technology in the latest generation of ultra-efficient gasoline vehicles, delivering improved performance, increased economy and enabling engine downsizing.

<sup>30</sup> <https://www.bosch-mobility-solutions.com/en/mobility-topics/powertrain-and-electrified-mobility/gasoline-engine/>

*and their direct-injection system, will still be the key technology to make those improvements.”*

Gasoline direct injection offers many advantages for drivers and vehicle manufacturers alike, Weller explained. Downsizing and turbocharging make fuel consumption and CO<sub>2</sub> emissions much lower while maintaining the same output. Thanks to the high level of torque, drivers benefit from an improved vehicle response and more dynamic handling. Increasing the charge-air pressure while reducing the displacement ensures a specific output of 60–100 kW/l. BOSCH has kept on developing gasoline direct injection since 1951, offering not only the very best technology to vehicle manufacturers, but also many years of technical expertise.<sup>31</sup>

### *Close loopholes for commercial EVs, says Senator Manchin*

U.S. Senator Joe Manchin (D. West Virginia) sent a letter to the Treasury Secretary Janet Yellen asking that the tax credit for commercial electric vehicles be implemented in *“a manner that strengthens domestic manufacturing while ensuring economic and national security”*, and that it does not allow companies to *“cheat the system”*.

What’s Manchin’s beef? *The Inflation Reduction Act of 2022* was signed into law on the 16<sup>th</sup> of August 2022, and some of its provisions will go into effect in 2023. One provision of the *Act* is a requirement that a vehicle’s final assembly take place in North America. The *Act* extends the tax credit provided for new electric vehicles (Section 30D) and adds a new tax credit for used EVs (Section 25D). Also, a new tax credit for commercial vehicles has been added for the first time (Section 45W).<sup>32</sup> Manchin has several concerns. One is that the Biden administration will direct the Treasury Department to allow exceptions from the North American assembly requirement for companies located in foreign countries that are friendly to the U.S., such as Japan, South Korea, and Germany. South Korea has officially requested an exemption. Second, used and commercial vehicles are not subject to the stringent sourcing and assembly requirements of passenger cars in the *Act*, and RIVIAN, HYUNDAI/KIA, and other auto makers have asked the administration to let consumer vehicle leasing qualify for the commercial EV tax credit. South Korea has asked Treasury to broaden the



*U.S. Senator Joe Manchin*

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<sup>31</sup> <https://www.bosch-mobility-solutions.com/en/mobility-topics/powertrain-and-electrified-mobility/gasoline-engine/>

<sup>32</sup> [https://www.electrificationcoalition.org/wp-content/uploads/2022/08/SAFE\\_1-sheet\\_Webinar.pdf](https://www.electrificationcoalition.org/wp-content/uploads/2022/08/SAFE_1-sheet_Webinar.pdf)

interpretation of the commercial vehicle tax credit to allow it to be applied to rental cars, leased vehicles and vehicles purchased in UBER or LYFT fleets.

The Treasury Department has stated that it would issue a proposed guideline by the 31<sup>st</sup> of December that will further define how the eligibility restrictions shall be applied. The result will determine whether Senator Manchin will have a festive New Year celebration.

### *China Inc. Global Automobile Monopoly Update*

Fred Fishkin, Host of TECHSTATION and Co-host of the SMARTDRIVING CARS PODCAST, took our December *SDC PODCAST* to heart and has been sending me regular feeds about the astounding rise of automobile exports by CHINA, INC. Under the headline, *China Is Shipping Cars Like Never Before*, one article reported that auto exports from China “have surged this year as domestic automakers look to establish themselves beyond their home market”.<sup>33</sup> During the first nine months of 2022, Chinese car companies shipped 2.2 million passenger cars, trucks, buses and other vehicles out of the country. That is a 54% increase over the same period last year, and more than 100% up from the average from 2012 through 2020.

It will be no surprise to readers of *THE DISPATCHER* that the bulk of the increase comes from BEVs and PHEVs, with 342,000 passenger vehicles exported from China in the 2022 nine-month period. That is 29% of all vehicles. In 2019, EVs accounted for 2% of exports. Another 314,000 of the 2.2 million exported vehicles are low-speed EVs and 4,000 electric buses.<sup>34</sup> It’s not only Chinese companies doing the exporting. TESLA shipped nearly 165,000 vehicles from its Shanghai plant to international markets during the first nine months of 2022. RENAULT and BMW are also exporting from China. Of the 1.8 million EVs sold in Europe in the first three quarters of this year, 11% came from Chinese automakers, up from 2% in 2020. Putting this into further perspective, in 2015, 66% of all vehicle sales in China were from JVs between Chinese and foreign makers. Today, 60% of global EV sales are now in China. Its share of the battery supply chain is even higher.



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<sup>33</sup> Bloomberg Hyperdrive. December 15, 2022.

<sup>34</sup> Sweden, with two of its own bus producers, Scania and Volvo, and several others within the EU, has been a major contributor to BYD’s electric bus success.

## ***About Michael L. Sena***

Through my writing, speaking and client work, I have attempted to bring clarity to an often opaque world of highly automated and connected vehicles. I have not just studied the technologies and analyzed the services. I have developed and implemented them, and have worked to shape visions and followed through to delivering them. What drives me—why I do what I do—is my desire to move the industry forward: to see accident statistics fall because of safety improvements related to advanced driver assistance systems; to see congestion on all roads reduced because of better traffic information and improved route selection; to see global emissions from transport eliminated because of designing the most fuel efficient vehicles.

This newsletter touches on the principal themes of the industry, highlighting what, how and why developments are occurring so that you can develop your own strategies for the future. Most importantly, I put vehicles into their context. It's not just roads; it's communities, large and small. Vehicles are tools, and people use these tools to make their lives and the lives of their family members easier, more enjoyable and safer. Businesses and services use these tools to deliver what people need. Transport is intertwined with the environment in which it operates, and the two must be developed in concert.



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