Artificial intelligence (AI) is coming to revolutionize the auto industry

Exploring the increasing impact of AI as it is adopted right across the car industry

by Peter Els [See Attribution at end of Postiing)
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Self-driving cars are often touted as proof of the automotive industry's advanced state of artificial intelligence (AI) preparedness.

However, a recent report by French-based consulting firm Capgemini paints a different picture.

The report – Accelerating Automotive's AI Transformation – found that in 2018 just 10 percent of industry respondents were deploying AI-driven initiatives across all operations "with full scope and scale," up just three percent from 2017.

The result was a surprising finding given the scale of investment and enthusiasm shown by industry leaders, with more than 80 percent citing AI in their core strategy.

There is, however, a significant exception – in China, the number of automotive companies working at scale with AI almost doubled, from five to nine percent.

The report also shows a clear correlation between capital invested and the scale of an organization's AI deployments. Of those that have successfully deployed at scale, 80 percent have done so by spending more than $200million on AI.

Notwithstanding the report's findings that the industry is perhaps not adopting AI as rapidly as commonly believed, there are encouraging signs that this is changing.

Early adopters take the lead in AI deployment

Responding to the challenges posed by tech companies that are accustomed to rapid product rollouts, the traditionally conservative automotive industry is demonstrating that it is perfectly capable of deploying AI in novel applications:

- **Quality control – Audi is testing software using artificial intelligence to identify tiny cracks in sheet metal. The deep learning system, deployed in the press shop at its factory in Ingolstadt, Germany, can detect the finest cracks in door panels, hoods, fenders and other sheet metal components in an automated inspection process**
- **Sales and marketing – Volkswagen uses machine learning to predict sales of 250 car models across 120 countries, using economic, political and meteorological data**
- **Prototyping – General Motors uses machine learning in its product design operations**
- **Modeling and simulation – Continental collects 5,000 miles of virtual vehicle test data per hour**

While these specific use-case applications of AI are promising, there are many more general uses, such as predictive assurance of the 5G network for connected vehicles, which will be critical to the successful and safe rollout of AVs.

AI enables predictive assurance of the 5G network

Communication technologies, such as vehicle-to-vehicle (V2V), vehicle-to-pedestrian (V2P), vehicle-to-network (V2N), vehicle-to-infrastructure (V2I), and vehicle-to-motorcycle (V2M), are set to play an important role in the rapidly evolving highly connected and automated transport system.

In this eco-system the latest fifth generation (5G) cellular network technology is vital to the high-speed and ultra-responsive connections and scalability that autonomous vehicles rely on. However for autonomous vehicles to function safely and reliably, they need consistent 5G connectivity and performance, or they must at least be made aware, via service assurance alerts, when network conditions become unstable.

Not until quite recently have the latest big data and streaming technologies enabled a shift toward more real-time assurance that allows end users to see almost instantly what is happening in the network. In addition, growing computational power has allowed a transition from a KPI-based approach to call analysis and tracing that enables monitoring of service quality in real-time at the individual user session level.

However in mission critical systems real time may already be too late; but to make the shift from real-time to predictive assurance, service quality monitoring and fault detection need to be highly automated. This requires more advanced technologies driven by AI.

There are two important tasks that current, rule-based systems cannot perform:

1) **Prediction – for which reliable forecasting of performance levels and issues are required. Techniques such as association rule mining are an effective way to find correlations with potential failure modes within data sets collected from multiple sources**

   2) Self-learning automation for next-best actions – once an issue has been discovered or forecasted, the system needs to take appropriate action. 5G networks will be dynamic and self-organizing, and fixed conditions cannot be reliably defined

To ensure consistent and reliable predictions the right machine-learning model must be selected. It is important that the model combines data from all relevant parts of the network, including the RAN, core, backhaul, and transmission.

Moreover, to be fully effective the AI-powered system needs not only to learn the right actions, but also to accept human input and enforcement as part of the learning process.

This capacity of AI to recognize trends is also being utilized in the smart charging of EVs – most notably to stabilize the grid and manage peak demand.

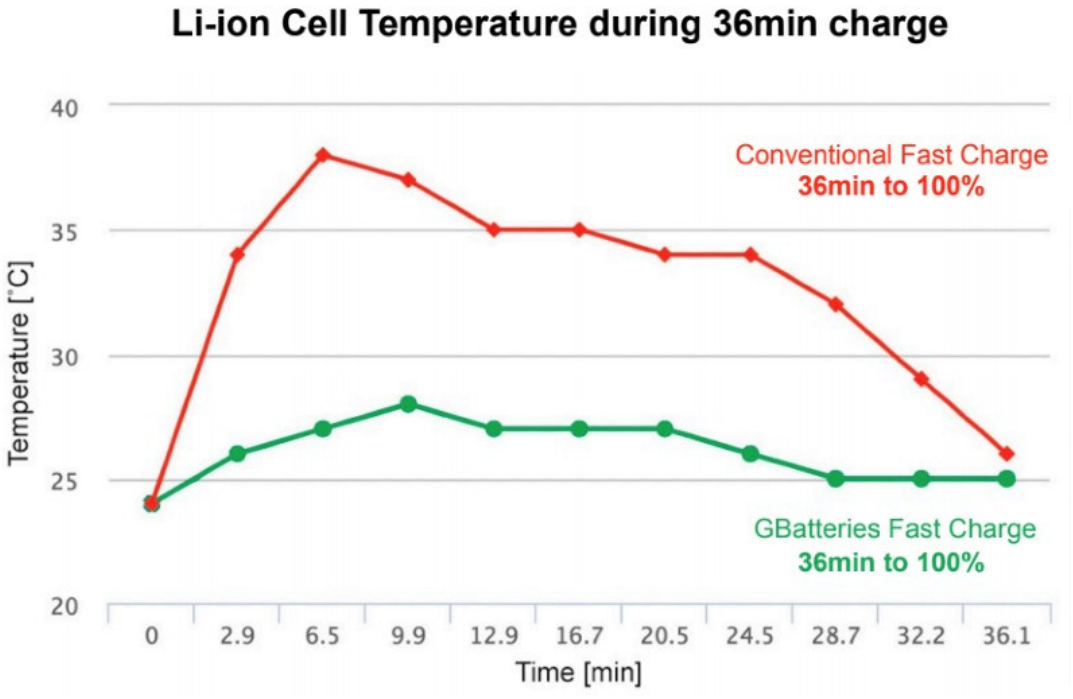
But now Canada-based GBatteries is using AI to radically reduce charge-times of lithium-ion batteries.

AI to play a pivotal role in the future of EVs

Leveraging AI and algorithms to pulse the charge intelligently, GBatteries' ChargeSense is capable of ultra-fast charging lithium-ion batteries without compromising cycle life.

By generating unique, complex charging-pulse profiles based on real-time monitoring and analysis of the battery's internal state, ChargeSense charges the battery during the low impedance phase only, until a critical point is reached where charging is paused to allow for a small amount of depolarization and a drop in impedance, thus preventing irreversible chemical changes from taking place.

Fast charging causes the battery's temperature to rise, often resulting in irreversible internal damage or even a thermal runaway event. As GBatteries' charging protocol adapts to operate in lower impedance periods, the temperature rise is significantly reduced during ultra-fast charging.



The technology works with off-the-shelf lithium-ion batteries and existing fast-charge infrastructure by utilizing a patented self-contained adapter on the car charge port, allowing users to add the equivalent of 119 miles of range to a 60kWh EV battery pack in just five minutes, as compared to the 15 miles in five minutes commonly quoted today.

AI's impact on the motor industry is however not confined to improving the on-road performance and safety of the modern car, the manufacturing process is also benefiting from the technology.

As profit margins are squeezed and manufacturers look for ways to improve efficiencies and cut costs, it is becoming increasingly apparent that technology is no longer a luxury, but is vital to remain competitive, reduce downtime, improve safety and increase profits.

Maintenance is a key area that can drive major cost savings and production value around the world. The cost of machine downtime is high – according to the International Society of Automation, $647billion is lost globally each year.

With the rise of industrial AI and the Internet of Things (IoT), manufacturing is being reimagined with software. Companies are learning how to use their data both to analyze the past and predict the future.

With AI and machine learning, manufacturers have the ability to process massive amounts of sensor data faster than ever before, giving companies an unprecedented chance to improve upon existing maintenance operations and even add something new – predictive maintenance.

AI and preventive and predictive maintenance

As connectivity and data accessibility become cheaper and more widespread, many companies are turning to predictive, or condition-based, maintenance powered by machine learning and analytics.

	TOTAL PRODUCTIVE MAINTENANCE (TPM)	PLANNED PREVENTIVE MAINTENANCE (PPM) OR PLANNED MAINTENANCE (PM)	PREDICTIVE MAINTENANCE
Description	A holistic system of maintaining and improving critical assets and operational processes that results in fewer breadowns, less downtime, increased production and improved safety.	A main component of TPM, PPM is scheduled maintenance that's driven by time or events that necessitate repairs.	Uses high-frequency raw data readings, data science, machine learning, historical performance data and contextual data to alert you to condition-based maintenance needs.
Data Used	Uses historical maintenance data to budget better for repairs.	Uses historical maintenance data to budget better for repairs.	Uses historical data, sensor data and contextual information like weather and geographic data to provide real-time, condition-based alerts.
How AI Can Help	Enables the adoption of Autonomous Maintenance (AM) in which equipment maintenance is carried out by the machine operators themselves.	Helps businesses aggregate and interpret their machine data faster.	Takes massive amounts of data and translates it into meaningful intelligence and actionable insights.

Planned Preventive Maintenance (PPM) is largely driven by time-based data. However in this model, data simply forecasts what might happen, based on historical performance. Most maintenance technologies focus on transporting data, not aggregating it into real-time analytics. This is where AI and machine learning step in as game-changers, by aggregating and analyzing data automatically.

Predictive maintenance, on the other hand, uses data from various sources like historical maintenance records, sensor data from machines, and weather data to determine when a machine will need to be serviced.

Leveraging real-time asset data plus historical data, operators can make more informed decisions about when a machine will need repair. Predictive maintenance takes massive amounts of data, and, through the use of AI and predictive maintenance software, translates that data into meaningful insights and data points, circumventing data overload.

Sensor data and machine learning models are making it possible to extract information from large volumes of random data quickly so that predictive maintenance tools, using AI, keep mission-critical assets running at peak performance.

So far we've examined AI's ability to improve efficiencies, cut costs and enhance safety. But AI can also be instrumental in adding a financial benefit to consumers while stabilizing the electricity grid.

As distributed power supplies such as solar panels, secondary batteries and electrified vehicles become increasingly widespread, global electricity supply systems are in a state of transition as they shift from traditional large-scale consolidated systems to distributed systems in which individuals and businesses own their own power supply.

In June 2019, Toyota, Trende and the University of Tokyo started trials at Toyota's Higashi-Fuji Technical Center and the surrounding area on an electricity system that will enable homes, businesses and electrified vehicles connected to the electricity grid to trade electricity using blockchain and AI.

The objective of the experiment is to assess the feasibility of a two-way, autonomous electricity supply system that would enable 'prosumers' (who generate electricity with their own distributed power supply) to trade electricity with electricity consumers via an electricity exchange market that reflects supply and demand conditions.

The testing will involve the establishment of an electricity exchange, accessible to households and businesses participating in the test, and the installation of an AI-powered electricity management system – an electricity trading agent – in each household and business.

The electricity trading agent places orders to buy and sell electricity in the exchange based on electrical consumption, and forecasts the electrical power requirements of households and businesses. Electricity transactions between individuals are implemented using a defined AI algorithm that matches buy and sell orders collected in the electricity exchange from each household and business.

The test aims to verify the economic advantage of having electricity consumers and prosumers trade electricity through market transactions. It will also simulate electricity consignment fees based on distance, and verify an algorithm for predicting the electricity demands of electrified vehicles, thus determining their contribution to stabilizing the grid.

So while the automotive industry may appear to be cautious in implementing AI-powered technologies the transformation is ramping up. As companies come to the realization that AI is far more than just a 'plug-in' module and begin to see it as a core technology that they have to adopt, we can expect to see the industry embracing AI across not just the product, but also at the service, and the organization levels.

Note: Here is the link to the entire article by Peter Els, Automotive IQ:

https://www.automotive-iq.com/electrics-electronics/columns/artificial-intelligence-ai-is-coming-to-revolutionize-the-auto-industry