

Artificial Intelligence in Cars Powers an AI Revolution in the Auto Industry

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Abstract. Artificial intelligence (AI) plus self-driving cars are commonly addressed as one in the technological realm of technology. Simply said, one cannot discuss one without discussing the other. Whilst AI is being implemented at breakneck speed in a multitude of sectors, the manner in which it is applied in the automotive industry has become a sensitive issue. Automakers all around the world are employing artificial intelligence in practically every step of the production process. Examples of AI in action include robots fitting together the initial nuts and bolts of an automobile or autonomous vehicles that use machine learning & vision to safely navigate around traffic.

Keywords: AI; Automobile; Manufacturing; Automation.

1. Introduction

There is a flood of tech businesses and startups rushing to create AI and self-driving systems, just as every vehicle manufacturer is racing to build them (Sherif et al., 2017). Whereas the preponderance of people feel that personal, autonomous automobiles are just the way of the future, AI plus machine learning are being used in a variety of ways in the design and operation of vehicles (Lin et al., 2018). Artificial intelligence will be a game changer in the automotive sector. This is a set of sophisticated abilities that allows machines to function similarly to humans. It will motivate robots to comprehend data such as photographs, sounds, and patterns in order to create automobiles. AI-driven machines will figure out how to solve difficult challenges (Morgan Stanley, 2021).

The automobile sector is undergoing a significant shift, owing in large part to the advent of artificial intelligence. Today, it is not uncommon to see self-driving automobiles on the roads and manufacturing robots at work (Sherif et al., 2017). It is projected that autonomous vehicles will be mainstream on highways worldwide in the next 20 years (Lin et al., 2018). AI has the potential to alter almost every part of the vehicle manufacturing process, from research to project management. In the global automobile sector, machines and robots are already in use, albeit on a limited number of tasks (Morgan Stanley, 2021).

The automobile business is undergoing a massive transition right now. To keep ahead of the competition in the market, ambitious manufacturers have begun implementing sophisticated technology into their products and operations. IoT technology and applications are integrated into today's automobile, including i) sensors for gathering information regarding the condition of the vehicle plus driver behaviour, ii) sophisticated algorithms for machine learning (ML) that turn the obtained data into meaningful reports, and iii) use of the data to group customers while delivering customized offers (Harvard Business Review, 2017).

The next section will highlight a few of the most common artificial intelligence applications in the automobile industry today.

2. Literature Review

Artificial Intelligence (AI) may appear to be a fresh concept. However, AI apps have long been employed in transportation. A Global Positioning System (GPS) is often used by modern cars (GPS). This technology utilizes satellite data for determining our location on the planet. GPS employs artificial intelligence to figure out the optimal route from point A to point B (Morgan Stanley, 2021).



AI algorithms have learnt to forecast the optimal paths from massive volumes of data to do this. They then integrate this knowledge with real-time user feedback data. This covers factors such as driving speed along the route. People may then use the two forms of data to get precise and accurate details on their itinerary journey (Sherif et al., 2017).

Automakers incur massive losses when machines fail. The production halts, preventing employees from timely completion of assigned tasks. AI-based algorithms offer a solid solution to preventing such catastrophic events in the automobile plant. These algorithms enable easy feeding of all types of data from vibration sensors, allowing abnormalities detection in advance of a major mechanical breakdown. The AI-based systems will be faster and more efficient than humans in detecting irregularities in the equipment. They may quickly detect a problem and provide information about the equipment's status. This will assist to reduce inspection expenses, increase equipment availability, and cut yearly maintenance expenditures (Harvard Business Review, 2017). Due to the partnership of man and robot, technological improvements and the usage of computers in the automobile sector are increasing productivity. More and better algorithms and processing capacity will aid in the development of flexible robots that can operate alongside people by adapting to changes in the production environment (Wu et al., 2018). Collaborative robots are an excellent way to conserve space and design in the car production since robot-only zones are unnecessary. As robots are able to work alongside humans, development expenses will decrease. These collaborative robots can assist people in performing tasks that aren't completely automated. This has the potential to increase productivity by up to 20% (Sherif et al., 2017).

Humans do quality inspections in the majority of cases, and there are several mistakes that occur throughout this process. In addition, the quality check takes a long period. Using AI-enabled visual quality control is the greatest way to accelerate the quality management system. This will aid in the reduction of human mistakes as well as the detection of flaws and concerns. On automobile bodywork, metal surfaces, machine components, and other items, the hardware will visually evaluate the product and provide top-notch quality control (Wu et al., 2018). The AI system is capable of updating its evaluation as well as quality control by incorporating input. People can identify a few of quality control issues, whereas AI-based computers can identify up to 90 percent of quality concerns (Sherif et al., 2017). Business support operations are an important element in a company's success. AI may be used to automate support services such as IT, finance, vehicle payment calculators, and human resources. In terms of business support tasks, the car sector may benefit from automation and the effective use of artificial intelligence (AI). The firm may profit from improved accuracy and consistency, faster speed, expanded scalability, and the outcomes can be easily traceable thanks to automation (Harvard Business Review, 2017).

3. Analysis

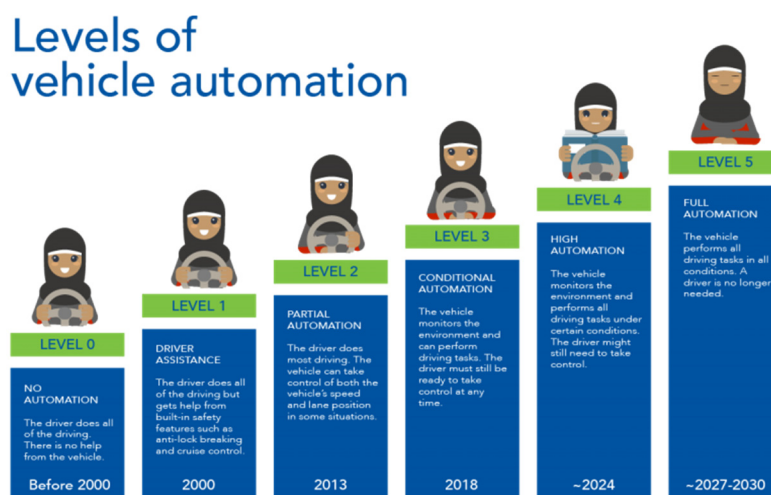


Figure 1. Automation levels in auto industry

Vehicle automation is divided into six tiers. At 0 level there is no automation with the motorist being responsible for all the driving. The first level involves driver assistance, in which the driver receives aid from built-in safety systems. Level 2 automation is when the driver handles the majority of the driving but the vehicle takes over in certain scenarios. Conditional automation is the third level of automation, in which the vehicle handles some driving activities. The driver must be prepared to take over at any time. The fourth level is the pinnacle of automation, with the automobile doing the majority of the driving activities. It's possible that the motorist will still have to take charge. The fifth level describes full automation, in which the automobile does all driving activities without any assistance from the driver (Wu et al., 2018).

With nearly 80 million vehicles produced in 2020, it is clear that automakers are looking for equipment and strategies to improve production. Not only is AI transforming the vehicles on highways, but also the manufacturing plants that build those vehicles. The table below shows the total number of vehicles produced between 2012 and 2020 (OICA, 2021).

Table 1. Total Number of Vehicles Produced between 2012 and 2020

Year	Total Number of Vehicles Produced	Percentage Change
2012	84,236,171	5.5%
2013	87,595,998	4.0%
2014	89,776,465	2.5%
2015	90,780,583	1.1%
2016	94,976,569	4.5%
2017	97302534	2.36%
2018	95634593	-1.1%
2019	91786861	-5.2%
2020	77621582	-16%

From the above statistics, it is clear that the production of cars has been improving steadily through the years, courtesy of improvements in technology at the manufacturing plants. The negative percentage change from 2018 can be attributed to the financial crisis as well as the coronavirus pandemic. However, the global production provisional data for 2021 forecasts increased vehicle production as shown in Figure 1 below.

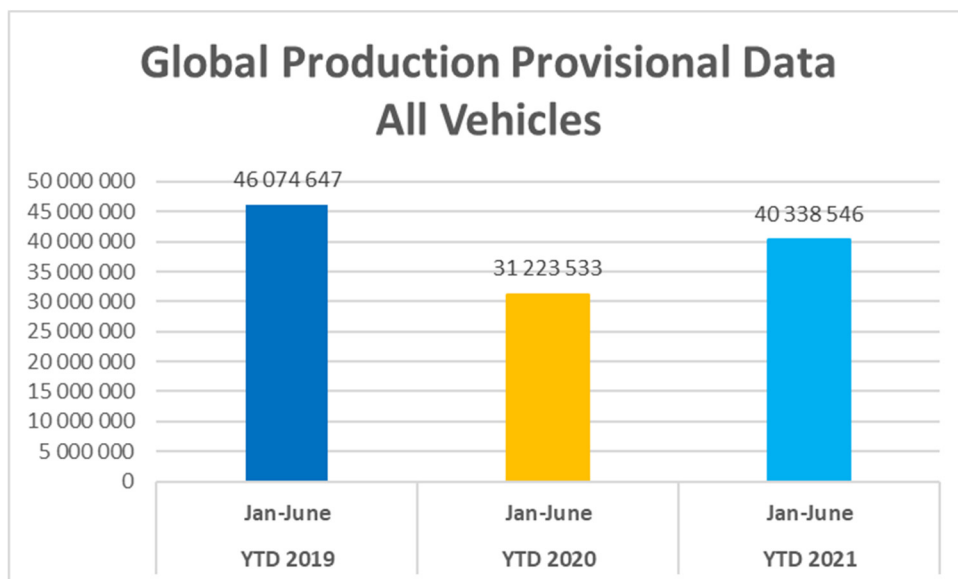


Figure 2. Global provisional data for production of all vehicles in 2021

4. Predictive Maintenance

One of the best examples of how data science can be used to provide value to the automobile industry is predictive maintenance. The data acquired by a vehicle's sensors, for example, might suggest progressive overheating, friction, or noise. These faults may also cause a specific car part to fail in the future. The machine learning system tracks these occurrences on a regular basis and analyzes the frequency with which they occur. Based on the data, it also properly forecasts when the automobile or part will break down. To mitigate a malfunction, the driver might take preventive precautions such as having the car examined and service operations arranged. This is a notable case of car predictive maintenance.

Fleet management businesses also use predictive maintenance to minimize costly repairs and safeguard each vehicle's return on investment. Automotive OEMs are progressively incorporating predictive maintenance into their cars in order to increase compliance of customers with auto maintenance schedules, promote customer happiness, as well as promote brand recognition (Wu et al., 2018). Through the years, engineers have collaborated with worldwide OEMs to build software that accurately estimates vehicle part maintenance needs. Driver Behavior Statistics Automotive apps based on AI and Deep Learning can provide a wealth of useful in-car analytics (Harvard Business Review, 2017).

5. Conclusion

Growing competition, pricing pressures, as well as instability are all factors affecting the automobile industry. Even little actions can help automakers achieve significant gains in share of the market. Data science is growing as a game-changer in the automobile sector, which means there are several chances (Wu et al., 2018). In the manufacturing value chain, analytics has shown to be a very strong tool. It is critical to evaluate and gather data from many functions across the industrial life cycle in order to fully exploit the promise of data science. This means that having an end-to-end analytics approach that includes workforce analytics, managing inventory or assets, as well as production strategy is critical for creating insights (Sherif et al., 2017). Machine learning algorithms may be used to deliver developing car maintenance suggestions to drivers. It is possible to forecast when an event or issue will occur again based on previous occurrences.

References

- [1] Harvard Business Review. (2017, July 18). The business of artificial intelligence. <https://hbr.org/cover-story/2017/07/the-business-of-artificial-intelligence>.
- [2] Lin, P., Wooders, A., Wang, J. T., & Yuan, W. M. (2018). Artificial intelligence, the missing piece of online education? *IEEE Engineering Management Review*, 46(3), 25-28. <https://doi.org/10.1109/emr.2018.2868068>.
- [3] Morgan Stanley. (2021, November 15). *Auto industry is ripe for disruption*. <https://www.morganstanley.com/ideas/car-of-future-is-autonomous-electric-shared-mobility/>.
- [4] OICA. (2021). *2012 statistics* | www.oica.net. <https://www.oica.net/category/production-statistics/2012-statistics/>.
- [5] Sherif, A. B., Rabieh, K., Mahmoud, M. M., & Liang, X. (2017). Privacy-preserving ride sharing scheme for autonomous vehicles in big data era. *IEEE Internet of Things Journal*, 4(2), 611-618. <https://doi.org/10.1109/jiot.2016.2569090>.
- [6] Wu, K., Sasidharan, L., Thor, C. P., & Chen, S. (2018). Crash sequence-based risk matrix for motorcycle crashes. *Accident Analysis & Prevention*, 117, 21-31. <https://doi.org/10.1016/j.aap.2018.03.022>.