E-BOOK

Supercharge AI in automotive

Drive profitability and fuel innovation

NetApp

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Reshaping the automotive industry

The automotive industry is rapidly adopting artificial intelligence (AI) to expand into new markets, optimize workflows, and move ever closer to fully autonomous driving. Like Henry Ford did over 100 years ago, AI is revolutionizing the automotive industry.

Across every use case—from connected and autonomous vehicles to mobility as a service (MaaS) to smart manufacturing—AI is the motor, while a proper data infrastructure is the drivetrain.

Large datasets make it possible to gain critical insights into roadways, people, and processes. Many automotive leaders are already investing in AI for in-vehicle applications and more efficient design and production processes. Workloads range from high-performance computing (HPC) and analytics for crash simulations to machine learning (ML) and deep learning (DL) for autonomous driving and supply chain optimization. However, these workloads tend to be siloed, each with its own infrastructure and budget.

Today's AI workflows must connect across the organization, link large volumes of data from multiple sources, and extend to the cloud. Unleashing the full power of AI requires a data pipeline that can seamlessly capture and move data from devices at the edge, core, and cloud.

According to Deloitte, the global automotive AI market will culminate a total volume of around

$27 billion by 2025.[1]

Supercharge AI in automotive

Since its earliest days, the automotive industry has been characterized by a constant push for improvement and the pursuit of a competitive edge. With AI at the forefront of automotive innovation,[2] it's no longer an option; it's a prerequisite to obtaining and sustaining an upper hand in the market.

More than ever, customer needs, behaviors, and expectations are changing. Customers now expect their cars to function as an extension of themselves and their homes. They want intelligent cars that can actively keep them safe on the road, make critical decisions, adapt to their preferences, and even drive for them. With the explosion of new services like ride-sharing apps, consumers—especially those in urban environments—have new needs for mobility on demand and expect pay-per-use service options.

Autonomous vehicles and mobility as a service

As AI pushes the transfer of responsibility from human to machine, autonomous vehicles are being developed for passengers, product delivery, and mass transit solutions. It's only a matter of time before AI algorithms deliver you and your groceries.

Connected vehicles and services

Vehicles are moving to Internet of Things (IoT) platforms, connecting to the internet for seamless integration of entertainment, navigation features, and service reminders. With AI-powered in-car personal assistants and dynamic maintenance, the future of connected vehicles is much more than battery-level alerts.
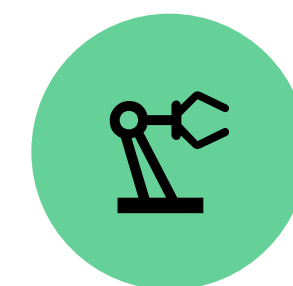
Smart manufacturing

Industry 4.0 introduces the analytical and predictive power of AI to the factory floor. Trained algorithms can speed production, perfect product lifecycle management, and offer actionable insights for teams looking to maximize profit without sacrificing quality and customer satisfaction.

Autonomous vehicles

Autonomous vehicles (AVs) are revolutionizing transportation. Mountains of data are collected from cars, trucks, and even cargo ships that are fitted with cameras and sensors.

This data, combined with trained AI software and computer vision, enables AVs to accurately see their environment and make safe, real-time decisions without the need for human intervention. Besides recognizing vehicles, pedestrians, and traffic signals, AVs can also predict external traffic behavior and hazards.

To make these actionable insights possible, you need an efficient data pipeline that spans edge, core, and cloud. Manufacturers that have prioritized their data infrastructure are now advancing beyond helping drivers stay in their lane or fixing their subpar parking attempts. Level 3 autonomous driving features allow "drivers" to take their hands off the wheel and eyes off the road by relinquishing control of steering, throttle, and brakes to the car's electronic control unit (ECU).[3] Mercedes-Benz, in partnership with NVIDIA,[4] is the world's first automaker to gain approval for producing and selling passenger vehicles that are capable of Level 3 autonomous driving.[5] Playing a key role in this achievement, NetApp supports NVIDIA's AI capabilities and massive volumes of data.

With AI, the possibilities are endless, but building an AI infrastructure comes with its own set of challenges. NetApp automotive customers are preparing their infrastructures to handle up to 60TB per day/test car, or up to 1PB per test car/year. Autonomous driving teams can soon expect to accumulate hundreds of petabytes to exabytes of data as autonomous driving projects progress. NetApp is ready to help turn your mountains of data into actionable insights.

Saving lives with AI

- The projected benefits of autonomous vehicle technology show a reduction of 250 million hours of commuter time per year, and could **save more than half a million lives from 2035 to 2045**, just in the U.S.[6]

- A survey of the American National Highway Traffic Safety Administration reports that nearly **94% of road accidents are due to human errors**.[7]
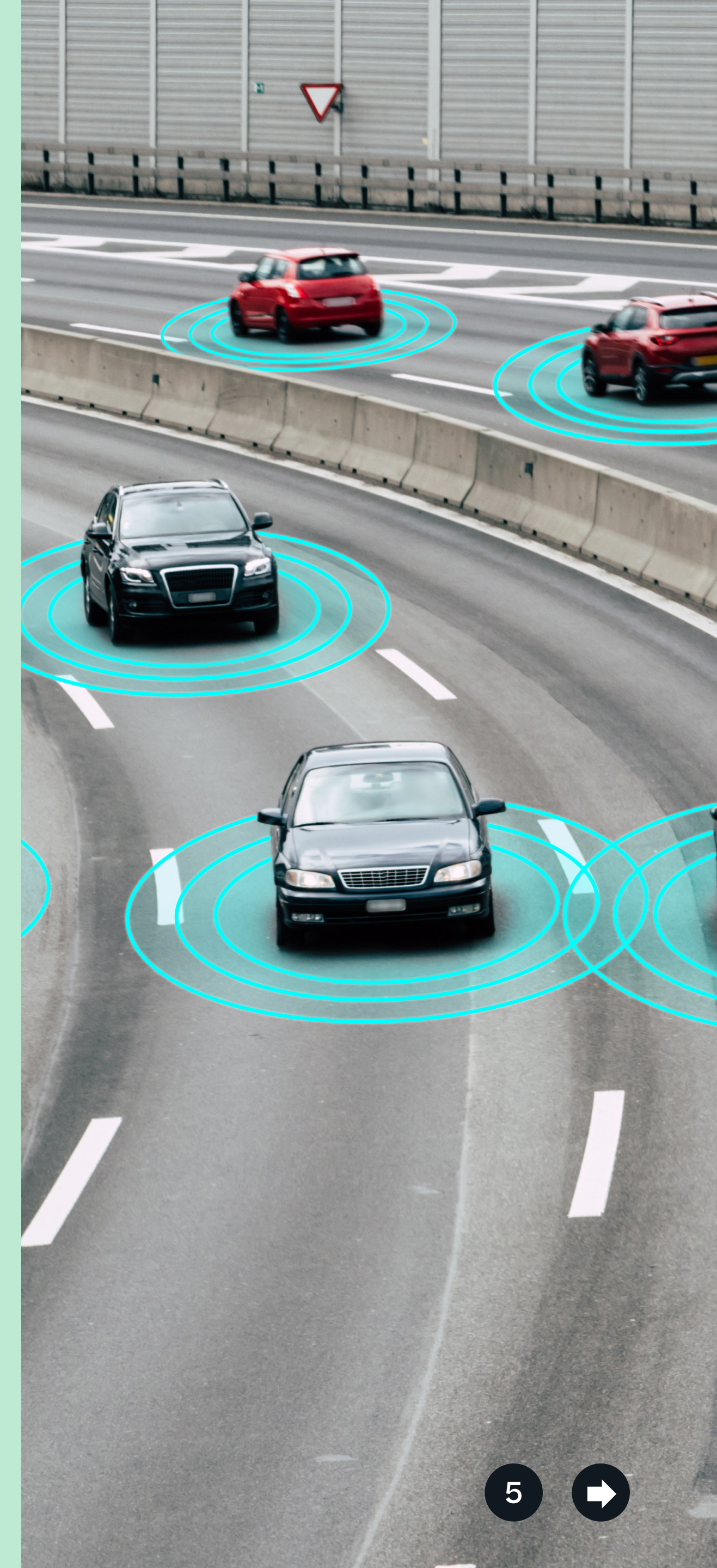
Mobility as a service

By removing the need for a driver and looking beyond Level 3 into Levels 4 and 5, mobility as a service (MaaS) represents a huge opportunity for business growth. Creative companies are inventing new ways to autonomously transport customers and deliver consumer goods by using ML applications and trained computer algorithms.

Mobility teams know that the market is an online auction and that consumers have choices. Understanding customers and what they look for when moving from place to place is essential, but it's easier said than done. NetApp AI solutions connect vehicles in mobility fleets to data centers, so companies get access to real-time data about customers and their desired routes. We help turn mobility teams into brokers of information. Teams can use AI to enable microsecond decisions that can have a dramatic impact on the experiences of customers.

How many miles?

The United States alone is estimated to reach **108 billion** miles of demand for MaaS.[12]

Waymo has over **20 billion** real-world and simulated miles driven in its AVs.[13]

TuSimple has tested its trucks over about **3.7 million** real-world miles.[14]

Robotaxi services

Driverless taxis might seem futuristic, but they're already here. Various companies are striving to commercialize autonomous ride hailing at scale. Waymo, an autonomous vehicle MaaS company, is now offering fully autonomous rides in Phoenix and San Francisco.[8] In December of 2021, Ford, Lyft, and Argo AI launched an autonomous rideshare service in Miami, and are looking to expand into Austin, Texas.[9] Using an app, you can now order a fully autonomous ride-hailing car to take you where you need to go.

Delivery services

If Uber and Motional have their way, residents of Santa Monica, California will have their lunches delivered by AVs in 2022.[10] But what about other consumer goods? They too will soon be delivered by autonomous trucks. TuSimple, a provider of autonomous freight semitruck solutions, has completed various road tests, and the company's technology is projected to be fully operational by 2024.[11] In fact, a NetApp customer is currently using NetApp AI solutions to optimize its AI infrastructure for driverless-truck development.

Lane detection

NetApp and Run:AI, a company focused on faster AI experimentation with full GPU utilization, joined forces to offer a single unified experience in the Azure cloud. We put this future-proof platform to the test with lane-detection training experiments for AVs and it passed with flying colors.

Connected vehicles and services

AI is already used on a massive scale in connected vehicles.

By moving to IoT platforms, these vehicles are using internet-connected entertainment and navigation features, as well as service reminders and maintenance diagnostics. With widespread access to low-latency 5G networks, connected cars can help smart cities get smarter while benefiting from rich data services. Soon, connected cars will interact with one another to alleviate rush-hour congestion, and delivery trucks will be able to safely drive in tight convoys at speed to minimize wind resistance and conserve fuel.

Connected-car development is often based on a continuous integration and continuous deployment (CI/CD) model. It relies on access to data from vehicles all over the world to make improvements and enhancements. However, global sharing of data between vehicles and data centers isn't easy. This is where NetApp shines. A secure data infrastructure that spans hybrid cloud environments can provide the instant, always-on access to data that's needed. It can blast the silos that spotty connectivity creates when data is collected and computed at the edge.
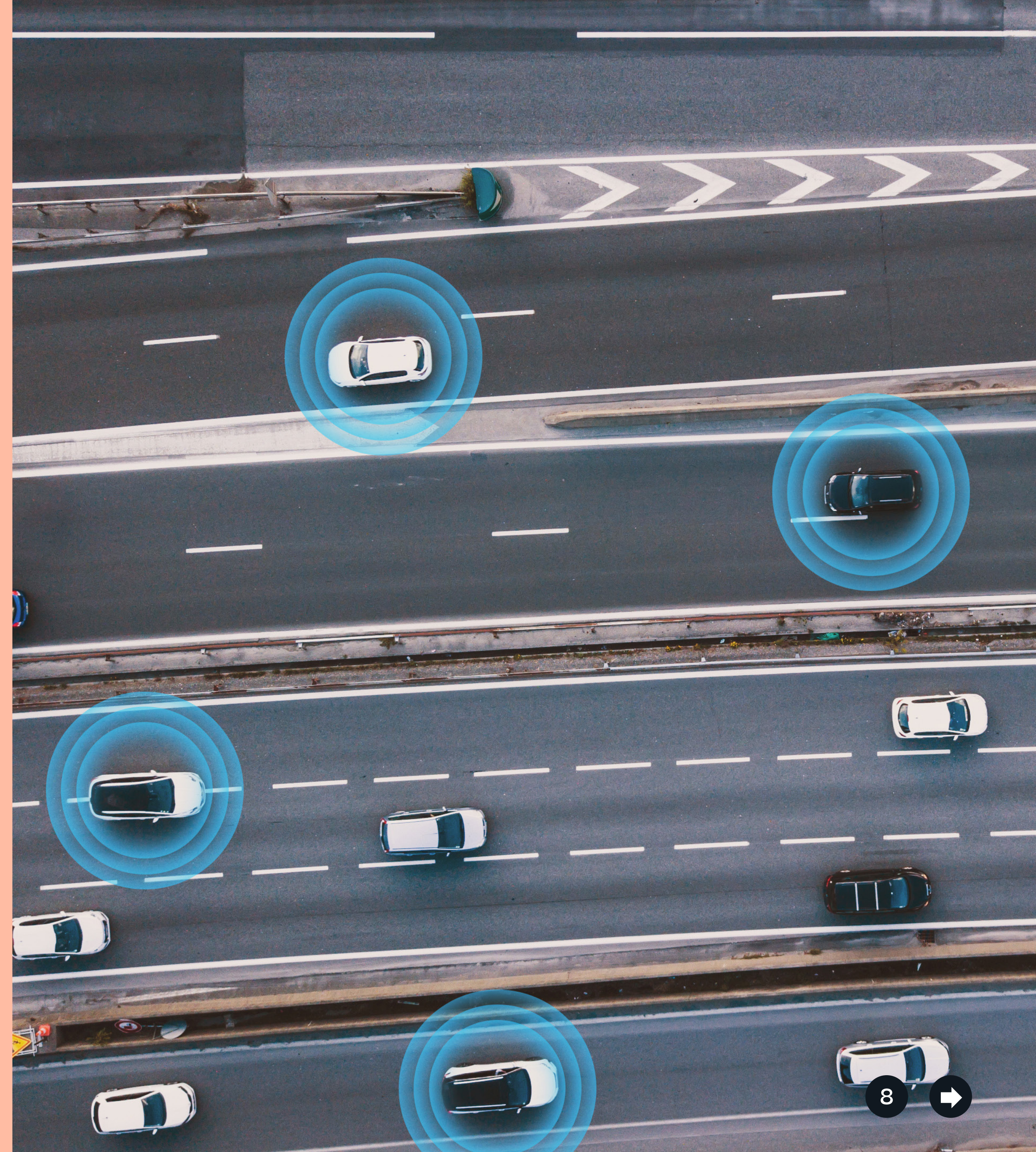
In-car personal assistants

Voice-controlled personal assistants have become increasingly popular among most major automotive brands. Natural language processing (NLP), powered by AI, makes it all possible. Beyond making phone calls for you and giving directions to recommended restaurants, these assistants can remember your preferred settings, and over time, proactively suggest changes.[15]

Dynamic maintenance

AI can take the guesswork out of routine maintenance. Low tire pressure warnings or sensors that tell you when you're due for an oil change are convenient. But dynamic maintenance applications scan the vehicle for indications of large problems before they result in loss of safety or function. AI can even adapt maintenance timing based on how the vehicle is driven. Customers will know to schedule a repair before it's too late.
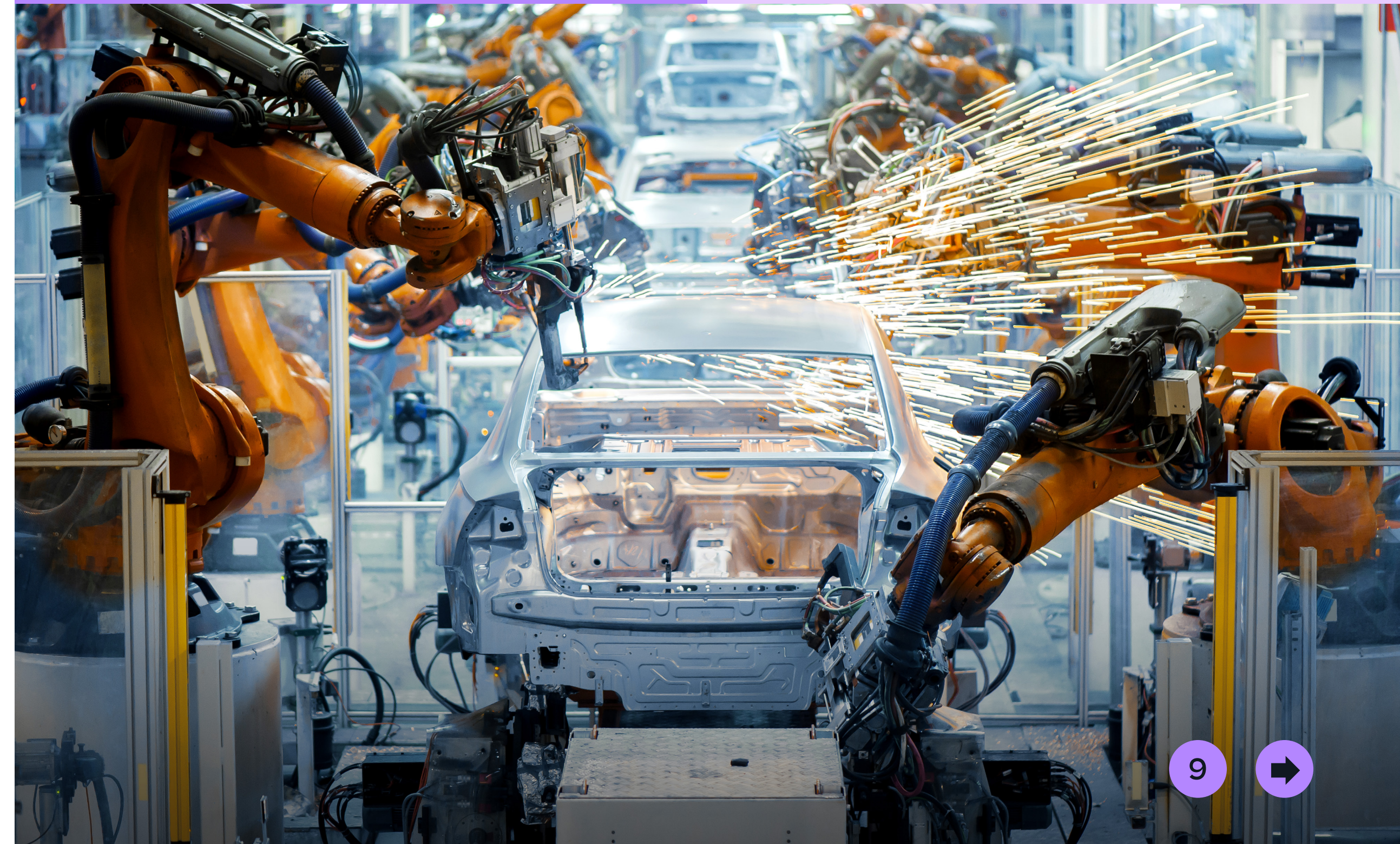
By 2025,

70.1%

of licensed drivers in the United States will be driving a connected car.[16]

The global connected-car market is projected to reach

$56.3 billion

by 2026.[17]

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Smart manufacturing

The arrival of <u>Industry 4.0</u> means that using <u>AI as part of a smart manufacturing</u> design is a prerequisite for staying competitive.

Small add-ons aren't enough. Staying relevant—and profitable— in the automotive industry today means either building a new manufacturing model from the ground up or retooling traditional factory floors.

Smart manufacturing depends on AI to process data from across the stack and maximize production while minimizing loss of profits. As robotics and smart devices become more commonplace, AI analyzes data from hundreds of individual endpoints to make sure that equipment is running optimally and the workforce is operating efficiently. But many infrastructures struggle to keep up. <u>NetApp AI solutions</u> integrate with your existing IT infrastructure, delivering the performance, mobility, protection, and scalability you need to reap the benefits of operating a smart factory.

Process and efficiency management
AI-based automation, like robots on the factory floor, can help manufacturers increase production quality and yield, which ultimately results in revenue growth. Robots can improve workplace safety by performing dangerous tasks such as welding.

Quality control
Product quality can make or break your business. Quality-control processes span the entire manufacturing lifecycle—from design to final product. Computer vision and trained algorithms on the factory floor can be used to detect anomalies in production and performance that the human eye simply can't see.

Supply chain management
Automated planning helps you make more informed, agile business decisions. Instead of planning for a month at a time, you can use AI to make more accurate, real-time predictions such as raw material price forecasting or demand for specific products.
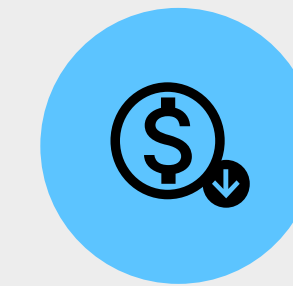
Intelligent maintenance
Intelligent maintenance uses AI to continuously monitor and predict when a machine failure might occur. This capability gives engineers time to order a part and schedule downtime to install it.

The cost of downtime

Unplanned downtime costs manufacturers **$50 billion** each year.[18]

Missteps at any point in the quality-control process can end up costing manufacturers **millions (or even billions) of dollars**.[19]

When done the right way, predictive maintenance can eliminate **70% to 75%** of failures while boosting production by **20% to 25%**.[20]

AI in supply chain management can reduce logistics costs by **30%**.[21]

Four keys to AI success

Successful AI deployments in the automotive industry create new workflows to link business units that are usually isolated: High-performance computing, analytics, and core IT workflows at the edge and in the cloud. These business units often have their own specialized platforms, protocols, and architecture. Below are four keys to building an AI infrastructure that sparks innovation and drives revenue.

1 More accurate models

Data is key to identifying patterns, developing predictive insights, and enabling increasingly accurate autonomous systems. Typically, the more data, the more accurate the model. But more data means larger AI models—some with millions or billions of parameters. Training models of this size can take weeks of compute time and require the best-of-the-best ML and DL frameworks.

Not only does all this data need to be managed—it also needs to be protected within the strict parameters of internal and external compliance regulations.

2 Seamless data movement

Effective AI requires a data pipeline that spans the entire ecosystem, from ingest and data preparation all the way to analysis and tiering. Data must be able to flow quickly and freely throughout the pipeline at every step. If access to this data is limited by a siloed infrastructure, DL only scratches the surface.

3 Speed

AI infrastructures must be able to respond in a heartbeat. Applications such as in-car virtual assistants that use NLP must be able to ingest, process, and respond instantly.

Whether you're training a vehicle to understand and respond to human language, or designing Automated Driving/Advanced Driver Assistance Systems (AD/ADAS) functionalities, fractions of a second matter.

4 Efficient utilization

With massive amounts of data, even a small change in efficiency can have a big impact on optimizing costs and performance. You need to be able to monitor and enact efficient utilization of resources and AI workload distribution.

Extending the data center to the public cloud, as well as building automated AI pipelines and provisioning infrastructure for advanced workloads can help you maximize efficiency.

Why NetApp for AI in automotive?

NetApp helps you build a data pipeline to fuel digital transformation and improve manufacturing agility and data mobility. We remove data silos so that you can deliver real-time connected vehicle insights, enable AVs to make split-second decisions, and bring Industry 4.0 to your factory floor.

Can you handle the massive volume of data from AVs? NetApp AFF A-Series systems sure can. These arrays hum under pressure and deliver consistent low latency.

Is your AI processing data in real time? The NetApp ONTAP® AI architecture, powered by NVIDIA DGX and NetApp cloud-connected storage, meets the most demanding AI training needs. Streamline the flow of data reliably; speed analytics, training, and inferencing; predict and respond to customer demand; and spot that faulty airbag before it leaves the factory.

Do you have instant, always-on access to data across the hybrid cloud? NetApp cloud data services and the NetApp DataOps Toolkit deliver instant productivity and management built for the complex multicloud world. Efficiently move data from vehicles across the globe to train your neural networks.

NetApp and NVIDIA
NetApp has long partnered with NVIDIA, the leader in AI compute, to help speed your journey to AI. Our joint solutions combine NVIDIA DGX systems with NetApp® cloud-connected all-flash storage to simplify, integrate, and accelerate your data pipeline for ML and DL.
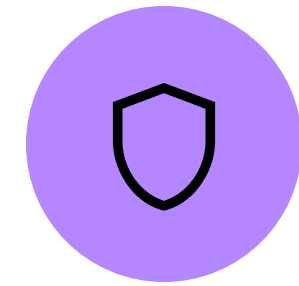

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From infrastructure to cloud integration, NetApp enables you to:

Optimize

Operate with greater efficiency and speed than you ever thought possible.

Protect

Keep data secure and remain compliant, without sacrificing availability or performance—whether data is at rest, in motion, in the data center, or in the cloud.

Innovate

Seize every opportunity to transform experiences and create new value by unlocking the power of all your data.

n NetApp

NetApp understands your business challenges and can bridge the gap between infrastructure and business applications.

AI infrastructure. Simplify procurement, configuration, installation, and support for AI workloads with NetApp ONTAP AI, powered by NVIDIA DGX systems and NetApp cloud-connected all-flash storage. With this unified AI environment, you can speed up analytics, training, and inference for faster return on investment.

Operations. Make it simpler and faster for your developers, data scientists, and data engineers to perform numerous data management tasks. These tasks include provisioning a new data volume or development workspace, cloning them almost instantaneously, and creating a NetApp Snapshot™ copy of them for traceability and baselining. It's all possible with the NetApp DataOps Toolkit.

Resource efficiency. Improve efficiency by simplifying and automating cloud infrastructure. With Ocean for Apache Spark (part of Spot by NetApp), you can continuously optimize Spark clusters, choosing the right infrastructure for an application, based on real-time requirements.

Cloud integration. Establish a hybrid cloud data layer for your data pipeline from edge to core to cloud. Increase data mobility and overall flexibility for your AI infrastructure needs.

Make AI easier with NetApp

5x Run 5 times more data through your pipeline.

<60 seconds Copy datasets in seconds rather than hours or days.

~20 minutes Configure your AI infrastructure with Ansible integration.

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Start your revolution today

Are you ready to revolutionize the automotive industry? Learn more about NetApp solutions for AI:

- NetApp AI solutions for automotive
- NetApp AI solutions
- NetApp AI solutions for manufacturing
- NetApp AI solutions for computer vision
- NetApp AI solutions for natural language processing
- NetApp ONTAP AI
- NVIDIA DGX Foundry with NetApp

Questions? Our AI solution specialists are standing by.

→ **NetApp AI for automotive**

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About NetApp

In a world full of generalists, NetApp is a specialist. We're focused on one thing, helping your business get the most out of your data. NetApp brings the enterprise-grade data services you rely on into the cloud, and the simple flexibility of cloud into the data center. Our industry-leading solutions work across diverse customer environments and the world's biggest public clouds.

As a cloud-led, data-centric software company, only NetApp can help build your unique data fabric, simplify and connect your cloud, and securely deliver the right data, services, and applications to the right people—anytime, anywhere.

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