POWER OF 2
SOLUTIONS POWERED BY PARTNERSHIP

Moving AI from Idea to Execution

RESEARCHED BY

OMDIA

Omdia was established following the merger of Ovum, Heavy Reading and Tractica with the acquired IHS Markit technology research portfolio.

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A Message from Lenovo & NVIDIA

Focused on a bold vision to deliver smarter technology for all, Lenovo is developing world-changing technologies that create a more inclusive, trustworthy, and sustainable digital society. By designing, engineering, and building the world's most complete portfolio of smart devices and infrastructure, we are also leading an Intelligent Transformation – to create better experiences and opportunities for millions of customers around the world.

Accelerating AI relies on GPUs. NVIDIA delivers GPU acceleration everywhere it's needed—to data centers, desktops, laptops, and the world's fastest supercomputers. As companies are increasingly data-driven, the demand for AI technology grows. From speech recognition and recommender systems to medical imaging and improved supply chain management, AI technology is providing enterprises the compute power, tools, and algorithms their teams need to do their life's work.

Analytics and AI are changing the way organizations do business in industries from Manufacturing to Retail, Healthcare to Finance. Nearly half of enterprises have started their AI journey but many are challenged with moving AI from research to reality.

As the Power of 2, Lenovo and NVIDIA unite to bring innovative solutions and intelligent infrastructures used to solve your greatest challenges of today and tomorrow. We equip data-centered researchers, pioneers and visionaries across all industries with the instruments of their life's work and help them to evolve, transform and implement enterprise AI solutions to deliver Smarter Technology for All.

Learn how Lenovo and NVIDIA can help you harness the value of your data and transform your business.

To find out visit www.powerof2.nvidia.lenovo.com.

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The Widening World of AI

Global adoption of AI continues to accelerate, moving from initial promise into real-world value for all types of organizations. Omdia, a powerhouse that combines Informa Tech's market leading analyst houses, of Ovum, Heavy Reading, Tractica, and the majority of IHS Markit's Technology research, predicts surging growth and investment through 2021 and beyond, as early adopters deepen investments and fast followers initiate new projects.

In fact, if AI was a country, then its GDP would place in the top #100 in 2020 (between Jordan and Congo). In less than 5 years, that swells to $200bn USD spending and a top #50 berth (between Portugal and Peru). AI is powering a global digital transformation and it's moving fast.

Global AI Spending (Software, Hardware and Data Centre)

Source: Omdia

According to the US Bureau of Labor Statistics, the US attained a 5.4% increase in productivity during Q1 2021, the second strongest quarterly growth in the past decade. Omdia believes the real-world deployment of AI technology and the spread of AI beyond hyperscalers is driving new levels of efficiency and productivity. This boost in AI continues to help businesses thrive in a COVID-affected world and AI budgets are only set to increase in the longer term.

To power that growth, AI will reach further down into the ecosystem – including to small and midsized businesses (SMBs) – as it becomes more understood, easier to implement, more scalable and more affordable.

This Omdia eBook, commissioned by Lenovo and NVIDIA, tracks that move from niche to mainstream for AI across all industries – and in particular for the verticals of Smart Cities, Retail, Healthcare, Manufacturing, Agriculture and Financial Services.

"Now more than ever, knowledge gained from enterprise data and analytics can serve as an actionable antidote to global uncertainty."

Bradley Shimmin, Chief Analyst, AI Platforms, Analytics, and Data Management - Omdia

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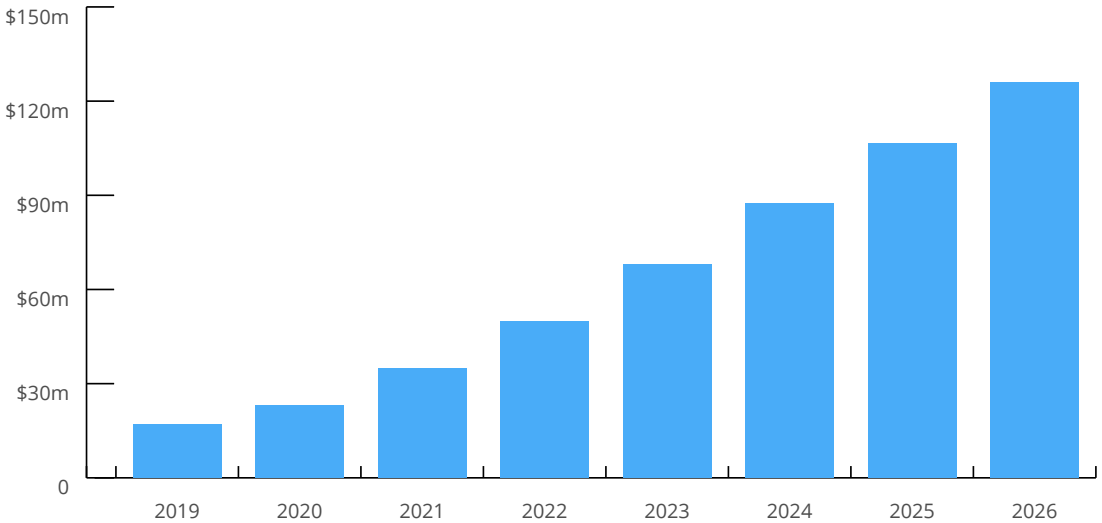
AI Moves to the Mainstream

AI spending has grown tremendously in recent years – and the global market for AI software alone is expected to increase from $17bn in 2019 to $126bn by 2026. Significant opportunity lies ahead for AI software market penetration, despite short-term economic and market turbulence.

Global AI Software Spending



Following a traditional adoption path, many enterprises first pilot the technology with proof-of-concept (PoC) projects, before later moving to full-scale implementation, and often finding AI software can help cut costs and generate new revenue streams. Yet, AI software remains a relatively small portion of overall software sales, with varying acceptance across industries.

For many, moving beyond the PoC stage has been a significant challenge – but 2020/2021 is proving to be a tipping point in attitudes (especially as COVID accelerates some of the existing trends towards digital and virtual solutions). In an Omdia survey, 24% of enterprises now say they have fully deployed AI in at least one function, as the barrier to entry for what were traditionally highly specialized data and analytics practices has fallen steadily over the past five years.

It's no longer a conversation of how AI 'could' transform businesses, but how it is already doing so. With an increasing number of players involved, the democratization of AI also moves out of the niche and into the mainstream.

24% Enterprises deployed AI in one or more functions

The AI Drivers and Challenges

A mixture of technical and non-technical challenges have held back adoption of AI in many businesses to date – with lack of qualified personnel (the human challenge), complexity (the technical challenge) and lack of budget (the monetary challenge) the top three ranked amongst enterprises.

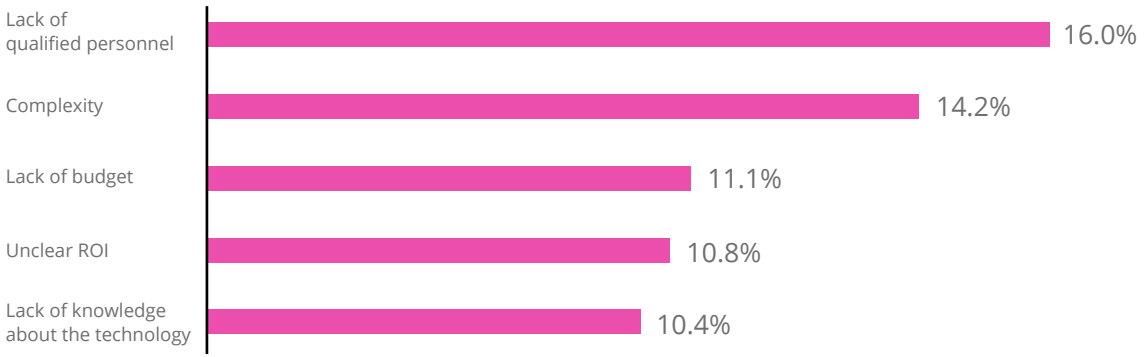
However, as adoption increases and businesses increasingly see the ROIs proven out from AI solutions and use cases, the business value becomes clearer and businesses are ready for the next wave of projects.

The most common AI project KPIs (% of total)

A critical element of this learning is identifying and deploying the best performance metrics. With so much investment at stake and the early-stage nature of AI market adoption, key performance indicators (KPIs) for AI are the most important guardrail for senior management to use to guide their AI strategies. Predictably, the most common KPIs focus on cost reduction, engagement and time reduction.

Most encouragingly, the payoff period for AI is also moving closer – a particularly important consideration for the SMB community who can drive the next wave of adoption. In a recent Omdia survey, 72% of small and midsized businesses (SMB, Less than $1bn revenue) respondents said they were confident/very confident AI will deliver positive results towards their business goals within the next 12-24 months. Omdia expects this confidence to translate into surging growth of AI applications in 2021.

What is the biggest factor slowing your organisation's adoption of AI?

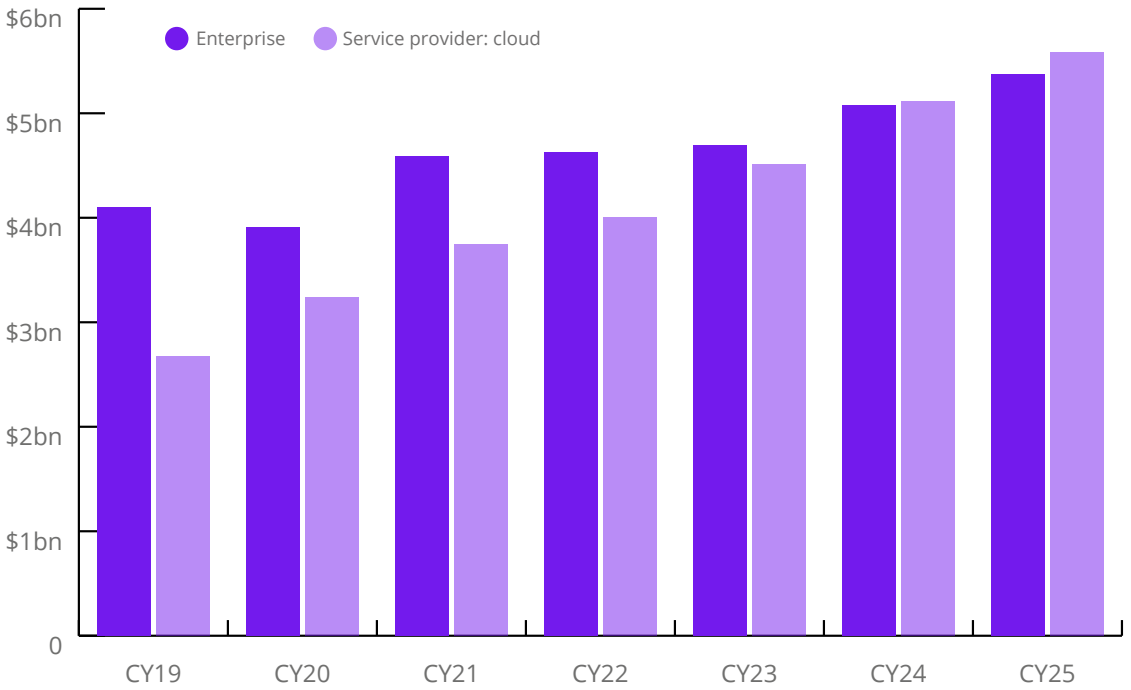


Notes: 2020 State of AI Survey (in conjunction with Information Week and ITPro Today; n=288. Source: Omdia

Breaking Down AI Barriers

Early adopters of AI may gain a competitive advantage, but fast followers can quickly close the gap. In particular, fast followers can game plan potential acceleration of their AI deployment, develop specifications and RFPs to channel AI vendor proposals, learn from the process to choose their vendors/find tools, and move to deployment (and ROI) with ever increasing speed. This is true for both Large Enterprise and SMBs.

Data center server equipment by market segment worldwide forecast ($)



As the market grows, the abundance and ubiquity of data coupled with the maturation of self-service analytics has helped companies democratize data among business users and break down data silos between departments. The democratization of AI also extends to the vendor community. For example, where AI hardware used to be the reserve of cloud hyperscalers, AI is now firmly within the broader market for enterprise data centres – with massive potential for AI-enabled servers.

Most adopted AI professional services (% of total) – Omdia end-user survey

23% Integration services

21% Customization services

20% Training services

Fast followers can reap the benefit of seeing AI-enabled hardware offered to them in accessible and affordable options, with familiar-looking approaches and solutions. For enterprises and SMBs where the human challenges of knowledge/staff training remains a barrier, buying in ready-made AI expertise and professional services provides a clear and easy adoption path. In fact, vendor expertise is the top reason why enterprises selected a particular commercial AI solution vendor (selected within the top 3 by 79%), with spending on AI professional services split across the spectrum of solution types.

Vendor-led, affordable, accessible and scalable solutions are key in accelerating the AI growth path through the SMB community.

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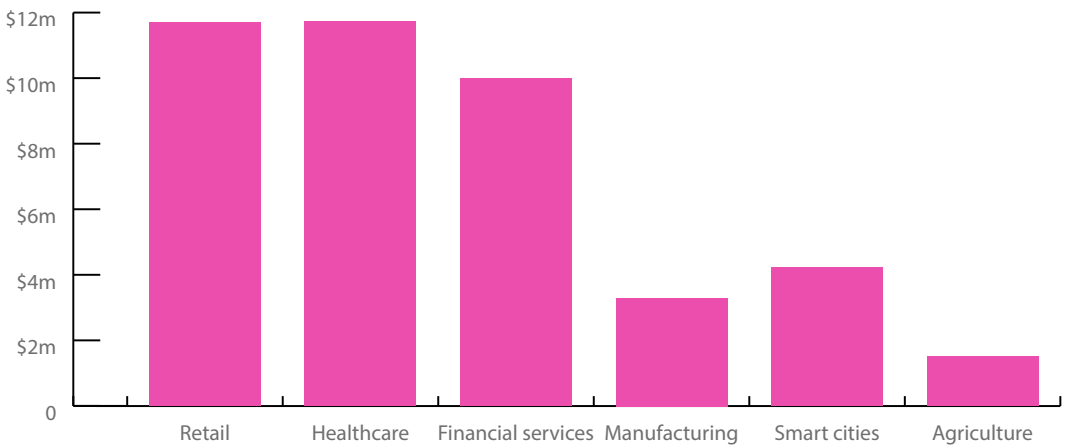
AI Verticalization

The democratization of AI, the move from niche to mainstream, and the increasing proven business value all point towards surging growth in the adoption of AI. The widening reach of AI is what will power growth to over $200bn USD annual spend by 2025, across software and hardware.

Each vertical (and enterprise) has unique considerations and drivers for AI adoption, but the industries most driving the market forward feature several commonalities:

- Large potential user base
- Massive amount of user or customer-generated data
- Challenges with human labor force in terms of costs, efficiency, or accuracy
- Demand for more automation and automated, data-driven decision-making

2026 AI software forecast spend by sector



The rest of this eBook takes a deeper look at six of the leading markets for AI adoption, exploring the unique factors and case study examples of the transformational capability of AI within industry.

Smart Cities

Manufacturing

Agriculture

Financial Services Industry

Retail

Healthcare

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Vertical Market - Healthcare

Healthcare – An Introduction for AI

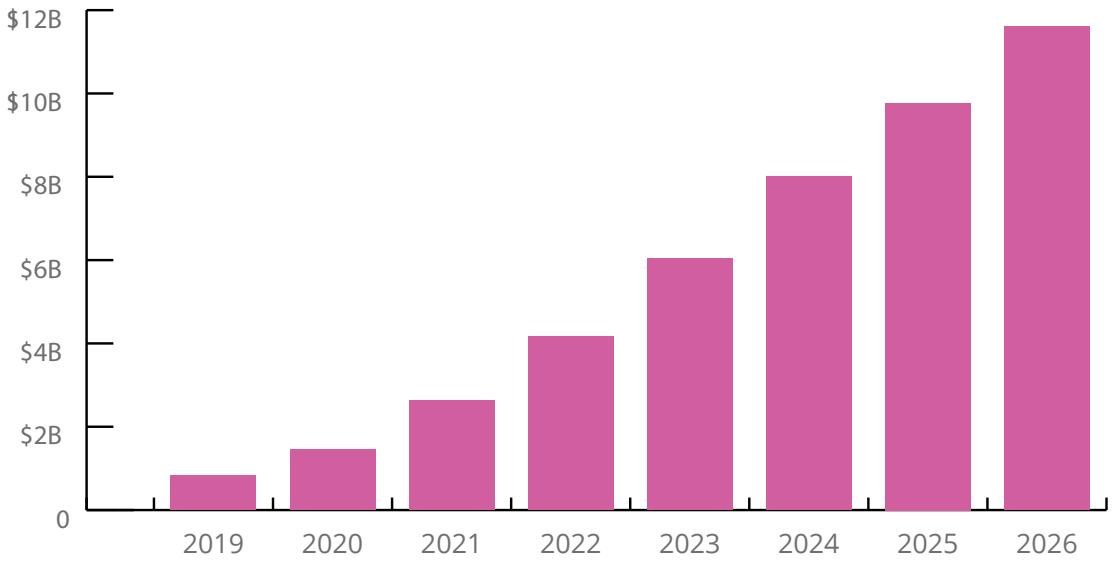
The development, delivery, and optimization of healthcare requires a complex ecosystem of patients, providers, and payers that are supported by R&D organizations, backend data storage and privacy structures, and delivery networks. AI is perhaps one of the few technologies that has the power and applicability to affect the entire healthcare value chain, not only today, but for years or decades into the future.

Omdia forecasts over $11.6 billion will be spent on AI software in Healthcare in 2026. Already one of the largest verticals pre-pandemic, COVID is also acting as a catalyst/accelerator of growth too. In fact, healthcare saw a near 25% increase in the updated Omdia forecast post-pandemic, and is the only vertical with a CAGR over 40%. However, many of the technology adoption trends are simply accelerated, rather than being in totally new directions in the last 18 months.

With increasing pressures on healthcare systems worldwide (e.g. through an ageing population), AI is therefore largely being implemented as a tool to more efficiently and accurately review data and uncover patterns that can be used to improve analyses, uncover inefficiencies, and streamline care—from both clinical and operational perspectives. The main underlying driver is to provide better care for patients while reducing costs and administrative headaches and bottlenecks.

AI is therefore set for adoption from Cloud/High Performance Computing applications, right down to the device edge. Omdia forecasts around 1.1 million edge AI appliances in the medical imaging/laboratory & life sciences sector by 2025, where the edge will serve an estimated 25% of AI workloads. This represents both the opportunity, but also the challenge, in bringing AI-driven value to the immense amount of data (and sensitive information) within the healthcare sector.

AI Software Spend ($M) in the Healthcare sector (2019-2026)



Healthcare – Applications & Challenges

AI in healthcare has the potential to transform many applications – such as through genomics, computational chemistry and drug discovery - but much of the current focus is on imaging. Of the predicted 1.1 billion AI-enabled edge devices in 2025, around 80% of these will be imaging equipment. Similarly, the AI software forecast shows that 23% of spend will be on the 'Medical Image Analysis' use case.

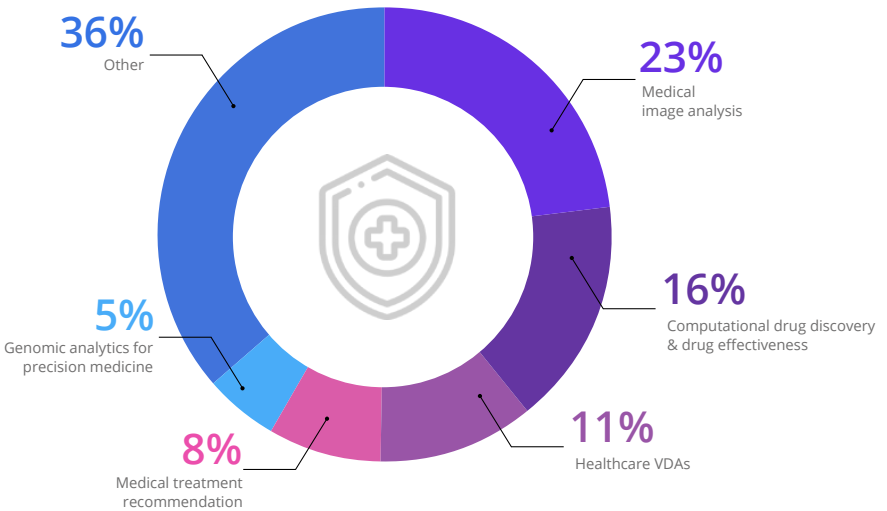
This is driven partly by the size of the underlying imaging market – but also by the close fit between the use case and the technology package of deep learning and GPU compute. These represent an interesting overlap between imaging, laboratory, and clinical systems. Many laboratory and clinical systems are actually imaging systems in the sense that what they capture is an image, and are therefore also potentially interesting on this point.

However, adoption of AI of all types is limited by the extreme caution of the healthcare sector – in particular around patient data security/privacy. Data governance issues are a driver of centralization, pulling data and models into central systems to facilitate management, while trust, resilience, and responsiveness are drivers of distribution, encouraging the integration of AI into instruments that can work without relying on offboard infrastructure.

The competing priorities and opinions of different personas can also be a challenge. For example, the final customer is usually a clinician or scientist, whether in a hospital or a service provider context. Whether they initiate AI adoption or not, they can be expected to have a veto over the decision to buy. Decisions are typically made by both IT and clinical teams, with integration to current infrastructure just as important as AI model accuracy and usage.

These factors often mean that much of AI adoption to date has been focused on the research sector, rather than directly on clinical outcomes. For example, the single largest use case for High Performance Computing software (across all verticals, 2020-2025) is on 'Computational Drug Discovery and Drug Effectiveness' at 14% of the total. Again, the transformational potential of AI within healthcare is huge, if the more human and monetary challenges can be overcome.

Percentage of AI Software Spend by use case (2019-2026)



Healthcare – Case Study

Developing AI models for better clinical outcomes

Atrium Health Wake Forest Baptist is an academic health system based in North Carolina, US, with 40 hospitals, more than 1,400 care locations and over 2,700 physicians. In addition, it includes a research organization with aims to discover new technologies and solutions to translate from the bench (lab) to the bedside (clinic).

With rising aging populations, healthcare providers are feeling the burden of seeing more patients and completing more after-patient reporting in less time. For example, radiologists spend time finding, measuring and analyzing studies in order to help diagnose patient conditions. This process can be optimized by AI to enhance the reading of studies. Therefore, researchers at Atrium Health Wake Forest Baptist are focused on ways to help ease this bottleneck.

- In particular, the team has recently been using an on-premise Lenovo ThinkStation P920, powered by NVIDIA RTX GPUs, to speed up the time it takes to develop new AI models for two different applications:
- The BedpostX white matter tractography model has many potential clinical use cases, for example, helping to diagnose Alzheimer's and Multiple Sclerosis. On CPUs, it took 15 hours per subject to run the models. On the NVIDIA RTX GPU, the team used a parallelized version of the algorithm to complete the assessment of white matter tractography in just 6 minutes.
- As part of the MICCAI Brain Tumor Segmentation (BraTS) competition, the research team developed an AI semantic segmentation tool for brain scan images – essentially using AI to draw around aggressive brain tumours in preparation for radiation therapy treatment. The team was able to simultaneously train three semantic segmentation algorithms, two for brain tumor (GBM) segmentation, one on each NVIDIA GPU, and a CPU based tissue segmentation algorithm. All three model training efforts were completed in around 3 days, even while a hippocampal shape analysis also ran inside a few hours during the process.
- Although not the primary purpose of moving to the NVIDIA RTX solution, the ability to run these models on-premise also eases any stress around protecting Patient Health Information, because the data stays behind the firewall rather than moving outside the building (e.g., to the cloud).

While both applications are still in development and are not yet ready for clinical deployment, the speed up in developing, modifying, training and iterating the models will help bring forward the day where AI eases the burden on clinicians. In most cases, the aim is not to have AI replace the clinician's role – but have human-in-the-loop solutions that bring them something that is already 80-90% complete. Ultimately that means getting to the right outcome for the patient more quickly in the future.

"AI has the potential to transform diagnostic and prognostic capabilities in healthcare, particularly through medical imaging. It has the capacity to facilitate physician's work while simultaneously improving patient outcomes"

Ryan C. Godwin, Ph.D. - Sr. Research Associate, Department of Radiology, Translational Imaging Program, Atrium Health Wake Forest Baptist

Appendix

About Lenovo

Focused on a bold vision to deliver smarter technology for all, Lenovo is developing world-changing technologies that create a more inclusive, trustworthy, and sustainable digital society. By designing, engineering and building the world's most complete portfolio of smart devices and infrastructure, we are also leading an Intelligent Transformation—to create better experiences and opportunities for millions of customers around the world.

About NVIDIA

In 1999 sparked the growth of the PC gaming market, redefined modern computer graphics, and revolutionized parallel computing. More recently, GPU deep learning ignited modern AI — the next era of computing — with the GPU acting as the brain of computers, robots, and self-driving cars that can perceive and understand the world.

NVIDIA AI

NVIDIA Virtualization (vGPU)

NVIDIA Data Center

About Omdia

Omdia is a global technology research powerhouse, established following the merger of the research division of Informa Tech (Ovum, Heavy Reading, and Tractica) and the acquired IHS Markit technology research portfolio*. We combine the expertise of more than 400 analysts across the entire technology spectrum, covering 150 markets. We publish over 3,000 research reports annually, reaching more than 14,000 subscribers, and cover thousands of technology, media, and telecommunications companies.

Our exhaustive intelligence and deep technology expertise enable us to uncover actionable insights that help our customers connect the dots in today's constantly evolving technology environment and empower them to improve their businesses – today and tomorrow.

* The majority of IHS Markit technology research products and solutions were acquired by Informa in August 2019 and are now part of Omdia.

References/Further Reading

Analysts

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Methodology

The Technology team at Omdia is the leading source of information, insight and analytics in critical areas that shape today's technology ecosystem—from materials and components, to devices and equipment, to end markets and consumers. Businesses and governments in more than 150 countries around the globe rely on the deep market insight we provide from over 300 industry analysts in technology sectors spanning IT, telecom, media, industrial, automotive, electronics, IoT and more. What sets Omdia's AI research Practice apart is our team of technical, experienced analysts, and our end-to-end coverage of the industry.

This eBook pulls together insights from the Omdia AI analyst team, alongside quantitative research highlights from syndicated reports from the Analytics & Data Management Intelligence Service, Artificial Intelligence Applications Intelligence Service, and Artificial Intelligence Business Toolkit Intelligence Service. Some of the key publications within those are listed to the right.

References

- Artificial Intelligence Software Market Forecasts – 2Q21 Analysis
- AI Business Performance Metrics Database – 2Q21 Analysis
- AI Market Maturity Survey
- AI for Healthcare Applications Report – 2021

The Omdia team of 400+ analysts and consultants are located across the globe

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