



The Current and Future Landscape of AI in Healthcare

ADVANTECH

Enabling an Intelligent Planet

SIoT Team, Advantech

ABSTRACT

As the accessibility and volume of health data increases, machine learning is becoming an important tool in medical diagnosis. Machine learning helps structure and analyze health data, so healthcare organizations can use it to make more accurate and quicker decisions – whether it be diagnostics using genomic sequencing, early-stage cancer detection or cardiac visualizations with custom machine learning models. AI models built for specific healthcare purposes can analyze health data in minutes, instead of weeks or months, to aid healthcare workers accelerate diagnosis and enable early intervention.

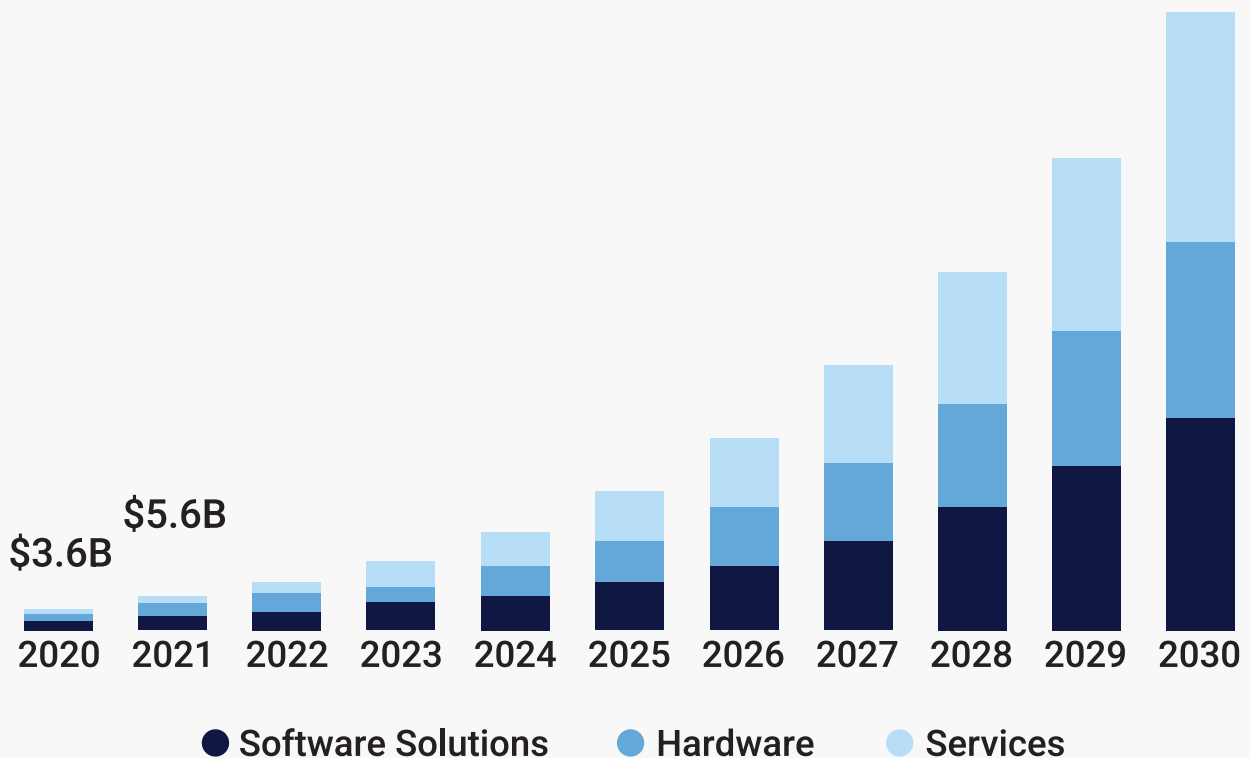
The growing datasets of patient health-related digital information, increasing demand for personalized medicine, and the rising demand for reducing care expenses are some of the major driving forces of market growth in this segment. The great news is that using AI to create intelligent processes and workflows could make healthcare more effective, personalized, and equitable, while still keeping it more affordable.

How Artificial Intelligence Is Changing the Landscape of Healthcare

Artificial intelligence (AI) and machine learning solutions continue to transform the way healthcare is delivered. Healthcare organizations have over the years, continued to accumulate vast data sets in the form of health records and images, population data and clinical trial data, which has led to it becoming the obvious candidate for AI applications. AI technologies are well suited to analyze this abundant data to uncover patterns and insights that otherwise would not have been possible to analyze. Now with deep learning from AI, healthcare organizations are able to develop algorithms to help them make better clinical decisions and improve healthcare experiences.

The global artificial intelligence in healthcare market size was valued at USD 10.4 billion in 2021 and is expected to expand at a compound annual growth rate (CAGR) of 38.4% from 2022 to 2030⁽¹⁾. One thing is certain: from hospital care to clinical research, drug development to the operating room, AI applications can potentially revolutionize how healthcare is delivered-- to boost productivity and dramatically improve patient experiences and outcomes.

U.S. Artificial Intelligence in Healthcare Market Size, by component, 2020-2030 (USD Billion)



Section 2

Benefits of using AI in healthcare

AI has the possibility to have an unsurpassable and hugely positive impact for clinicians and patients alike. Because of the ability to collect and analyze a massive amount of varied data, AI is perfectly suited to yield significantly faster

and more accurate diagnoses for a broader segment of the population. Populations currently without access to highly specialized healthcare could gain the benefit of that experience through AI.

Providing patient-centric experiences

By applying machine learning to large datasets, healthcare organizations can find accurate insights faster and more accurately with AI, enabling improved satisfaction to both internal stakeholders as well as patients.

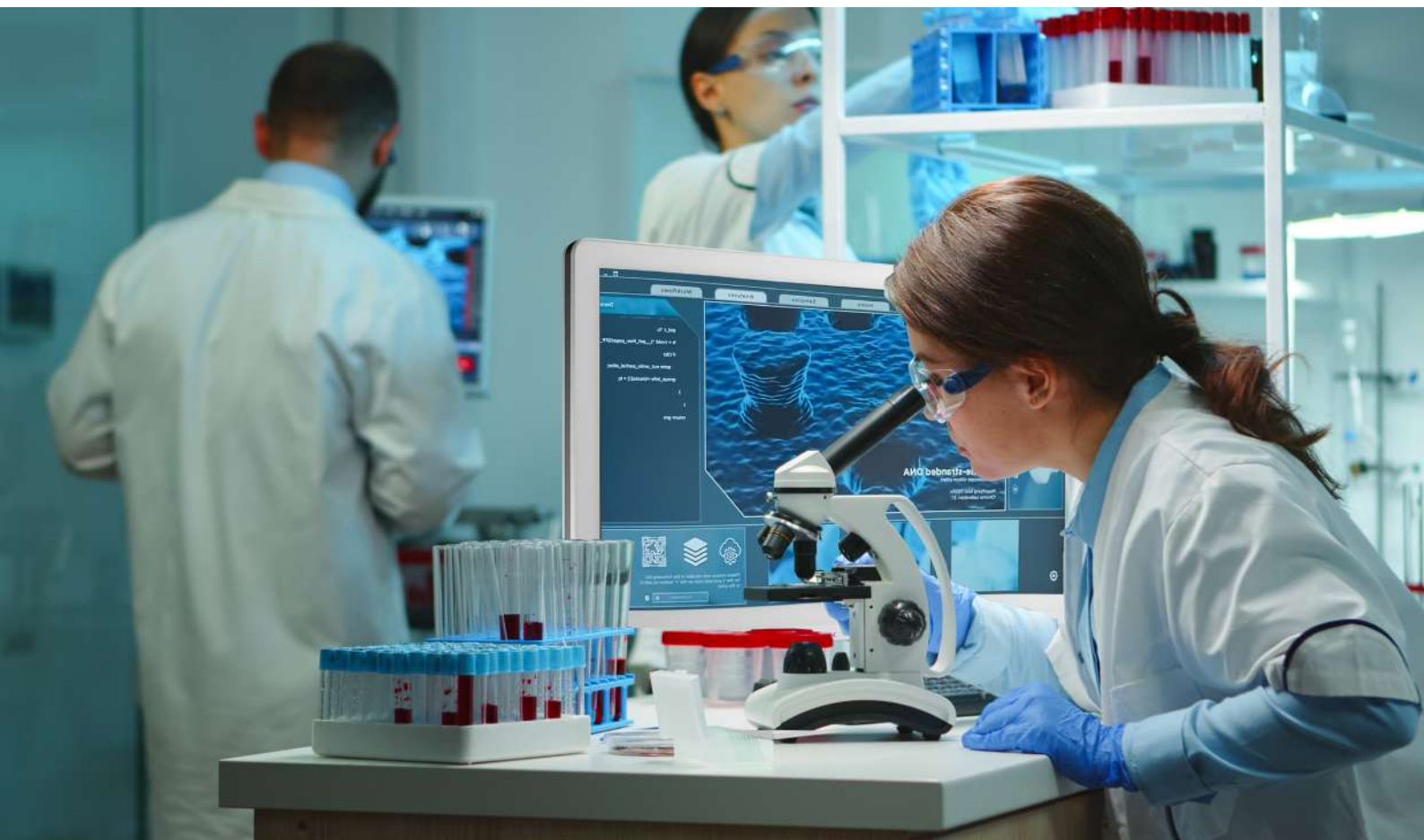
Improving efficiency in operations

By analyzing patterns in data, AI technologies can help healthcare organizations make the best out of their data resources enabling an increase in efficiency and performance of clinical and operational workflows, processes, and financial operations.

Making sense of disjointed healthcare data

Healthcare data is often fragmented, collected and stored in different formats. By using AI and machine learning technologies, organizations are able to connect disparate data to get a more unified picture of their patients behind the data.





Current Applications of AI in Healthcare

For the entire spectrum of chronic diseases – from cancer to radiology, AI is being leveraged to increase efficiency and deploy precise innovations that will ultimately help in enhancing the complete patient caregiving experience. AI provides huge advantages over traditional methods of data analytics and clinical decision-making. AI algorithms can help

make systems more precise as they get the opportunity to train on data, which further helps them get unprecedented insights into treatment variability, care processes, diagnostics, and patient results.

Some of the current applications of AI in Healthcare include:



1

Diagnosis

Ailment diagnosis requires analyzing previous data points, current information and connecting the dots. This makes it a well-suited candidate for the usage of Artificial intelligence, since deep learning and AI can analyze a lot more cases and elements when compared to live-health workers.

For example, a UK-based team has developed machine-learning technology that can spot several of the underlying red flags for a future heart attack. Using machine learning, the model can detect biological red flags in the perivascular space lining blood vessels which supply blood to the heart⁽²⁾.

Additionally, equipped with AI-enhanced microscopes, doctors are now able to scan for harmful indicators in blood samples, such as Staphylococcus, E. coli, etc., at a significantly faster rate when compared to the speed of manual scanning.



2

Robotic Surgery

Robotic Surgery is a perfect application of AI in healthcare as surgical robots can control their movements, trajectory, depth, and speed with great accuracy and precision. They are well suited for procedures that require the same repetitive movements and can work without fatigue.

Coupled with AI, manufacturers see the potential to use deep learning data to automate rather than program behavior into the robot. Thanks to AI, we can now determine patterns within surgical procedures to improve best practices. AI is also used with machine vision to analyze scans and detect cancerous cases. Laparoscopic video analysis of surgeries, like sleeve gastrectomy procedures, helps to identify missing or unexpected steps in real-time.



3

Chatbots for Customer Service

Healthcare Organizations are utilizing AI-enabled virtual agents to automate their routine procedures and provide clients the 24x7 attention in areas like payments, client service, and appropriate redirection. Most patients are not medically trained for understanding the extremity of their diseases, which is where chatbots could be very useful. They gather primary data related to their condition and symptoms from patients and depending on the input can make recommendations on further steps.



4

Virtual Health Assistants

Virtual assistants can unburden healthcare customers navigate the health system or a website. A recent Accenture study⁽³⁾ showed that more than half (52%) of consumers are unable to navigate the health system on their own, which drives nearly \$5 billion in avoidable customer service calls.

Virtual health assistants are responsible for a number of things, including responding to the queries of routine patients via calls and emails, managing medical records of patients and covering sensitive data, scheduling appointments with doctors and sending follow-ups to the patients.



5

Treatment of Rare Diseases

AI has the potential to transform the way we diagnose and treat rare diseases. For example, AI can be used to develop new methods for diagnosing rare diseases, identifying effective treatments, and predicting how patients will respond to different treatments.

BERG is an AI-based clinical-stage biotech platform that works on mapping diseases to speed up the finding and creation of advanced breakthrough medicines and vaccines, changing the approach to healthcare ⁽⁴⁾. It uses research and development (R&D), along with interrogative biology, which allows medical professionals to create robust products for patients fighting rare diseases. BERG uses Artificial Intelligence to tie up the links between human body chemicals that were not known earlier.



6

Targeted Treatment

No two patients are ever the same, even within the same disease state. Sounds obvious, yet often doctors treat patients with the same diagnosis in a very similar way. AI can enable doctors to personalize treatments for different patients –even ones with the exact same diagnosis. The use of AI in medical records can help identify patterns and perform outcome predictions. Subsequently, this information can be used to tailor specific treatments to an individual, even down to the level of what physician may be best suited to cater to their needs and outcomes that matter most to them.



7

Automation of Redundant Healthcare Tasks

Another significant role of Artificial Intelligence and its tools in healthcare is the automation of redundant, time-consuming tasks. This leaves healthcare administrators to focus on more important and patient-centric tasks. For example, Olive.ai⁽⁵⁾ is an AI-based platform that automates several processes such as checking the eligibility of un-adjudicated medical claims, transferring the necessary medical data to the respective medical professionals, and so on. Olive integrates with the existing tools and software of a hospital easily, eradicating the requirement for expensive downtimes and integrations.



8

Management of Medical Records

Healthcare is a data-heavy sector that makes it a perfect candidate for AI applications. Like a needle in a haystack, significant and valuable data points may get lost, leading to the loss of billions of dollars a year for the industry. Moreover, without being able to connect significant data points, the development of proper diagnosis and new medicines and drugs slows down. AI is being used to analyze large amounts of data to improve productivity, accelerate digital health, improve personalized care and support the clinical decision-making process.



9

Reduction of Dosage Errors

Even a single extra dose of a medicine or a drug can have some dire consequences on a patient's body, which is why it is important that the patient take only the amount of medicine as prescribed. That said, the instances of medication dispensing mistakes are particularly troubling. Every day, millions of Americans rely on pharmacies to properly dispense medications by providing accurate drugs, dosage, strength, quantities, label information, and instructions. This dispensing process is manual, and there are tens of millions of errors annually. This leaves many patients at risk. Here is where AI comes in. AI Tools can now immediately alert pharmacy technicians and staff to medication dispensing mistakes. This is done with machine learning and video capture⁽⁶⁾.

Barriers to AI Implementation ⁽⁷⁾

Although leading in the adoption of AI, not all healthcare organizations have implemented AI. Challenges faced while deploying AI solutions are still holding back some healthcare organizations from leveraging the technology to its full potential.

Despite the advantages that AI brings to healthcare systems in terms of efficiency and patient care, there remain fundamental barriers to implementing AI. Every patient is a reliable source of data but no one wants their sensitive personal data to be exploited for negative means. Data privacy and security are top concerns when it comes to providing AI models access to sensitive health data. Authorities are also still grappling with how to regulate an ever-changing AI system. Moreover, creating a usable and understandable AI for healthcare workers while structuring the variety of healthcare data into usable inputs will require personnel trained in both data science and healthcare, which is currently lacking.

Another huge barrier is the core-computing infrastructure needed to efficiently run the vast amounts of patient data and health records collected and processed by healthcare systems.

However, high performance computing coupled with AI framework solutions, are worthwhile long-term investments for hospitals that can be used for surgery and radiology. High performance processing is crucial to support this digital twinning – computer simulated visualization of real-world objects and processes used in surgical planning or in imaging such as CT or MRI scans. Additionally, displaying the results of AI systems and digital virtualization require the use of medical grade displays such as [Advantech's PAX series](#) of monitors that can accurately display traditional surgical and diagnostic imaging alongside AI visualizations. High performance computers will become highly beneficial for hospitals to be able to store and retrieve information from a single established library DB as AI vendors integrate themselves within the healthcare system and expand further to provide a comprehensive solution across multiple technologies. In summary, the medical imaging and informatics market is growing steadily – a growth that is expected to continue as AI increasingly plays a role in imaging diagnostics and in operation rooms.



PAX-327

27" Medical-Grade Touch Screen LCD Surgical Monitor



Key Trends in Application of AI In Healthcare

1. AI in diagnostics and Imaging ⁽⁸⁾

The first key trend in the evolving AI application trend in Healthcare is how AI algorithms are being developed for use with traditional diagnostic equipment throughout the imaging process. For example, there are AI systems that aid positioning of patients before imaging to increase consistency. These systems then utilize deep-learning neural networks to reconstruct images with better low-contrast detectability, reducing radiologist-reading time, while also achieving a lower radiation dose and noise. Additionally, there are diagnostic AI technologies that come into play towards the end of the imaging process. This can be seen through a solution developed by Advantech and its partner, whereby the solution analyzes chest X-rays to detect problems and highlights patients with life threatening lesions to radiologists for immediate treatment. This is highly beneficial for patients as it allows them to receive prompt care, which could not have been achieved in the traditional first come, first serve workflow.

2. Increasing implementation of AI imaging solutions in surgery

Surgical workflows (pre, during, and post) and AI systems that support better surgical outcomes are increasingly being implemented. Pre-surgery, AI is supporting surgeons in their planning by turning traditional CT or MRI scans into 3D reconstructions. The National Health System (NHS) in the United Kingdom has recently collaborated with a company that uses identified scans from NHS clinicians to create 3d reconstructions. The 3D image segmentation is used to reconstruct the organs and it is checked for accuracy before reconstruction. The model is then used by surgeons to assess a patient's anatomy as part of their pre-operative planning. Moving forward in the surgical process, AI systems are being used to improve the consistency of treatment between surgeons.

Applications such as OrthoGrid's surgical navigation applications assist orthopedic surgeons in real time and help them to reduce errors and improve patient outcomes. It is able to do so with unmatched efficiency as it utilizes Advantech's USM-500, a medical-grade high performance computer, to capture real-time images for AI processing to provide instantaneous feedback. OrthoGrid's AI ecosystem of procedure specific apps aims to interpret, assess, and process critical data from fluoroscopic X-ray images so surgeons can make faster and more reproducible clinical decisions. Before, during, and after surgery, Theator's Surgical Intelligence Platform supports post-surgery analysis of the recorded surgery videos to generate analytics from surgical videos. Its send-to-end Surgical Intelligence Platform captures intraoperative surgical video using, NVIDIA certified, USM-500 to record surgeries in 4K. All surgeries are anonymized, uploaded to the cloud; from the cloud, videos are analyzed to provide insights such as procedural challenges and annotations that improve consistency and performance variability in surgical performance and opportunities for improvement. Overall, the platform contributes to reduced surgical variability and improved patient care as well as operational efficiency.

3. AI-powered Predictive Care

Using AI with predictive analysis can help us understand more about how our larger, less studied world influences our health. This type of analytics focuses not just on the obvious – like the medical conditions one can inherit based on our genetics, but also things relating to geography of our birth, eating habits, place of work, income levels, family situations and state of mind – mainly factors that the World Health Organization labels as the “the social determinants of health” (SDoH) ⁽⁹⁾.

What this would mean is the evolution of AI-powered predictive systems that can anticipate when a person is at risk of developing a chronic disease based on their “extended” data and suggest preventive measures, before the conditions escalate. This use case has seen decline in the rates of diabetes and congestive heart failure—conditions that are strongly correlated to SDoH.

4. Networked hospitals and connected care

Alongside patient care, predictive care breakthroughs will be experienced in where the care takes place as well. By 2030, a hospital will no longer be that singular building that treats a broad range of illnesses. Instead caregiving will become more distributed with larger complex hospitals focusing on highly complex procedures, while less urgent cases will be monitored and treated through smaller establishments, such as health clinics, same-day surgery centers, specialist treatment clinics or even people's homes⁽¹⁰⁾.

How will this be made possible? These locations will be connected to a singular digital infrastructure with a Centralized command centre that will analyze clinical data to monitor supply and demand across the network in real time. In addition to using AI to spot patients at risk of deterioration, this network will also have the information to be able to circumvent bottlenecks in the system and ensure that patients and healthcare professionals are directed to where they can best be cared for or where they are most needed.

5. Better patient experiences

Being able to learn from the data available for every patient, every procedure and every diagnosis, AI models can create experiences that adapt to the patient leading to better healthcare experiences and improved health outcomes. A side benefit is a reduction in clinician shortages and burnout that enables the system to remain financially sustainable.

These kinds of networked systems will span communities, powered by connected care and will encompass people, places, hardware, software and services – creating true networks of care that will have the potential to improve lifelong health and well-being.

How Advantech's USM-500 is helping change the landscape of Hospital AI with medical Grade PCs

The USM-500 was developed based on Advantech's extensive experience in the medical industry. USM-5 series is a medical-grade platform for real-time software-defined medical devices, aimed at providing AI at the edge for healthcare applications. This innovative edge AI platform supports the NVIDIA RTX A6000 graphics card and NVIDIA's AI tools and frameworks like RAPIDS, TensorRT and Triton

Inference Server. The USM-501 can support two video capture cards and one NVIDIA RTX A6000 graphics card to capture large amounts of video data while executing real-time AI algorithms and analysis.

Example

1

Theator, a surgical solutions provider, is pioneering advanced applications that integrate AI into the surgical workflow.

Recently, Theator developed a surgical intelligence platform based on Advantech's USM-500 medical computer. This platform uses AI to analyze surgical procedures and provide objective metrics for variations in surgical techniques and outcomes⁽¹¹⁾.

LINK [Read Full Application Story: A Giant Step Forward for the Application of AI in Surgery - Advantech](#)



Theator Surgical Intelligence Platform

Example

2

OrthoGrid Systems

Orthogrid was designing a software platform for streamlining healthcare workflows. For this, they needed medical-grade hardware that could support real-time surgical imaging and AI processing. OrthoGrid's AI-powered orthopedic software provides real-time imaging guidance during surgery, offering the potential for surgeons to improve accuracy and efficiency and minimize intraoperative errors. Advantech's hardware provided a stable, reliable, and futureproof platform that allowed OrthoGrid to focus on application development.

LINK [Read full Application Story: OrthoGrid Reshapes Orthopedic Procedures with AI-powered Platform - Advantech](#)

About Advantech

With decades of proven experience, Advantech is a leading player in the global healthcare market. Advantech iHealthcare has developed its core competencies and collaborated with international medical equipment manufacturers and system integrators, to assist hospitals with advancing patient-centered healthcare. Starting with high-performance as well as medical-grade products, Advantech iHealthcare branches out into integrated platforms and services aimed at mission-critical healthcare applications.

References

1. [Shaping The Future of the Healthcare Industry with Artificial Intelligence \(AI\) Technology | HackerNoon](#)
2. [Artificial Intelligence in Medical Diagnosis \(sma.org\)](#)
3. [U.S. Health Plans Can Save Billions by Helping Patients Navigate the System \(hbr.org\)](#)
4. [BERG | Back to Biology for a Healthier Tomorrow \(berghealth.com\)](#)
5. [Olive | The automation company creating the Internet of Healthcare \(oliveai.com\)](#)
6. [Preventing medication errors: using AI to avoid mistakes and save lives - Microsoft Life](#)
7. [Barriers to AI Implementation](#)
8. [Increasing implementation of AI in diagnostics](#)
9. [Social Determinants of Health - Global \(who.int\)](#)
10. [Artificial Intelligence In Healthcare Market Size Report, 2030 \(grandviewresearch.com\)](#)
11. [Advantech Medical-Grade Edge Computing Platform Building AI for Healthcare Applications - Advantech](#)