



TOP TEN TECHNOLOGY TRENDS IN 2022

DAMO ACADEMY

Data source: <https://damo.alibaba.com/>

BACKGROUND

The DAMO Academy released its **“Top Ten Technology Trends in 2022,”** marking the fourth time that the institution has offered a forecast of cutting-edge science and technology trends.

Operated by Chinese tech giant Alibaba, DAMO Academy analyzed 7.7 million public papers and 85,000 patents covering 159 fields in the past three years, and interviewed nearly 100 scientists in depth. The top ten technology trends covered artificial intelligence, chips, computing, communication and other fields.

ABOUT DAMO ACADEMY

Founded on October 11th, 2017, Alibaba DAMO Academy is dedicated to exploring the unknown through scientific and technological research and innovation. The driving force behind the Academy is the pursuit of the betterment of humanity.

DAMO stands for Discovery, Adventure, Momentum and Outlook, which are the key tenets of this academy dedicated to shining light on the unknown through scientific and technological research. The main topics explored by DAMO Academy include machine intelligence, data computing, robotics and financial technology.

Over the next two decades, Alibaba Group's goal is to become the world's fifth-largest economy by creating 100 million jobs worldwide, serving 2 billion people, and maintaining a profitable platform for 10 million companies. However, achieving these goals and serving the global economy requires solving countless challenges. The Alibaba DAMO Academy was founded to address these challenges through the philosophy of "research for solving problems with profit and fun".

01. ALL FOR SCIENCE



AI WILL BE BROADLY APPLIED IN THE RESEARCH PROCESS OF APPLIED SCIENCE AND BE USED AS A PRODUCTION TOOL IN SOME BASIC SCIENCES

Experimental science and theoretical science have been the two basic paradigms of the scientific community for hundreds of years, and artificial intelligence is giving birth to new scientific research paradigms. Machine learning can process massive amounts of multi-dimensional and multi-modal data, solve scientific problems in complex scenarios, and lead a scientific exploration to new areas that were untouchable in the past.

Artificial intelligence will not only accelerate the scientific research process but will also help discover new scientific laws. It is expected that in the next three years, artificial intelligence will be widely used in applied sciences and will begin to become a production tool for scientists in some basic sciences.

02. COEVOLUTION OF LARGE- AND SMALL-SCALE COMPUTING MODELS



SWITCH FROM THE LARGE-SCALE MODEL COMPETITION TO THE CO-EVOLUTION OF LARGE AND SMALL MODELS

The ultra-large-scale pre-training model is a breakthrough exploration from weak AI to general AI, which solves the application fragmentation problem of traditional deep learning. However, the efficiency problem of disproportionate improvement in performance and energy consumption limits the continued expansion of the parameter scale.

AI research will move from large model parameter competitions to the co-evolution of large and small models. The large model outputs model capabilities to the side and end small models. The small model is responsible for the actual reasoning and execution. At the same time, the small model feeds back the algorithm and execution results to the large model. Let the capacity of the large model continue to be strengthened to form an organic cycle of the intelligent system.

03. SILICON PHOTONIC CHIPS



OPTOELECTRONIC FUSION HAS THE ADVANTAGES OF BOTH PHOTONS AND ELECTRONS, BREAKING THROUGH THE LIMITATIONS OF MOORE'S LAW

With the development of electronic chips approaching the limit of Moore's law, it is hard to meet the increasing data throughput demand of high-performance computing. Silicon photonic chips use photons instead of electrons for information transmission, which can carry more information and transmit longer distances and has the advantages of high computing density and low energy consumption.

With the explosion of cloud computing and artificial intelligence, silicon photonic chips have ushered in rapid technological iteration and the rapid development of the industrial chain. In the next three years, the academy can expect to see the widespread use of silicon photonic chips in the implementation of high-speed data transmission in large-scale data centers.

04. AI FOR RENEWABLE ENERGY

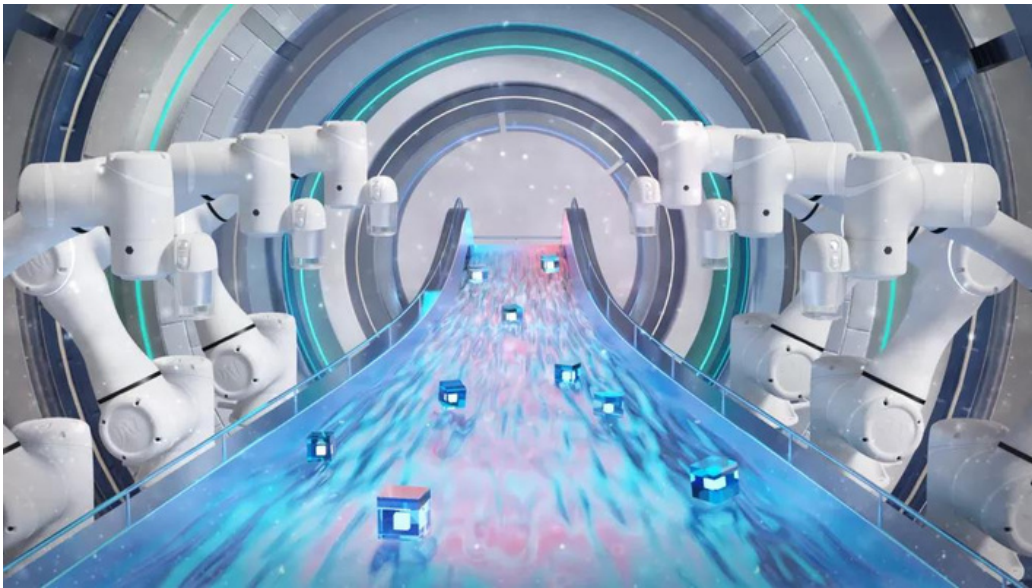


AI HELPS LARGE-SCALE CONSUMPTION OF GREEN ENERGY AND REALIZES A MULTI-ENERGY COMPLEMENTARY POWER SYSTEM

Recently, the rapid development of green energy such as wind power and photovoltaic has also brought about problems such as difficulty in grid connection and low consumption rate, and even the phenomenon of "abandoning wind" or "abandoning light." The core reason is that green energy has the characteristics of volatility, randomness, and anti-peak shaving. Large-scale grid connections may affect the safe and stable operation of the power grid.

The rapid development of technology in renewable energy forms such as wind and solar power in recent years has made renewable a tempting energy source to add to the power grid. However, issues such as difficulty in grid integration, low energy utilization rate, and storage of excess energy are major roadblocks along the way. The application of AI in the industry is pivotal in improving the efficiency and automation of electric power systems, maximizing resource usage and stability. This will be conducive to achieving carbon neutrality.

05. PERCEPTIVE SOFT ROBOTICS



THE ROBOT WILL HAVE BOTH FLEXIBILITY AND HUMAN-LIKE PERCEPTION, AND CAN COMPLETE MULTIPLE TASKS ON ITS OWN

Traditional robots rely on pre-programming and are limited to scenarios such as large-scale production lines. Now flexible robots have perceptual capabilities such as perception, vision, and sound, and their versatility to cope with multi-tasking and adaptability to environmental changes have been greatly improved.

Robots will move from large-scale and standardized production lines to small-scale and non-standardized scenes.

It is expected that in the next five years, the perceptive soft robot will gradually replace the traditional industrial robot, become the mainstream equipment on the production line, and start the large-scale application in the field of service robots.

06. HIGH-PRECISION MEDICINE



AI AND PRECISION MEDICINE ARE DEEPLY INTEGRATED TO HELP IMPROVE THE ACCURACY AND EFFICIENCY OF DIAGNOSIS AND TREATMENT

Traditional medicine relies on doctors' experience, just like manual way-finding, with uneven results. Via the organic combination of expert experience and new auxiliary diagnosis technology will become a high-precision navigation system of clinical medicine, help medical decision-making faster and more accurately, and realize the quantifiable, calculable, predictable, and preventable of critical illnesses.

Shortly, people-centered precision medicine will become the main direction, and artificial intelligence will fully penetrate all links of disease prevention and diagnosis and treatment, becoming a high-precision navigation synergy of disease prevention and diagnosis and treatment.

07. PRIVACY-PRESERVING COMPUTATION



SOLVE THE DILEMMA OF DATA PROTECTION AND CIRCULATION, AND MOVE TOWARDS ALL AREA PRIVACY-PRESERVING COMPUTATION

For a long time, the application of privacy-preserving computation has been limited to a narrow scope of small-scale computation due to performance bottlenecks, lack of confidence in the technology, and standardization issues. However, as more and more integrated technologies, such as dedicated chips, cryptographic algorithms, whitebox technology, and data trusts, are emerging, privacy-preserving computation will be adopted in scenarios such as processing massive amounts of data and integrating data from all domains.

08. SATELLITE-TERRESTRIAL INTEGRATED COMPUTING



STC INTEGRATED COMMUNICATIONS AND CALCULATIONS AND DIGITAL SERVICES CAN BE MORE ACCESSIBLE AND INCLUSIVE ACROSS THE GLOBE

Satellite-Terrestrial Integrated Computing (STC) connects high-Earth orbit (HEO) and low-Earth orbit (LEO) satellites and terrestrial mobile communications networks. STC also creates a computing system that integrates satellites, satellite networks, terrestrial communications systems, and cloud computing technologies. This way, digital services can be more accessible and inclusive across the globe.

It is expected that in the next three years, the number of low-Earth orbit satellites will usher in explosive growth, and satellites and their ground systems will become new computing nodes.

09. CLOUD-NETWORK- DEVICE CONVERGENCE



CLOUD-INTERNET-DEVICE CONVERGENCE FORMS THE NEW COMPUTING SYSTEM, AND BRINGS NEW APPLICATIONS

The rapid development of new network technologies will fuel the evolution of cloud computing towards a new computing system: cloud-network-device convergence. In this new system, clouds, networks and devices have a more clearly defined division of labor. The cloud functions as a “brain,” which is responsible for centralized computing and global data processing. Networks serve as the interconnecting “tracks” that converge various forms of networks on the cloud to build a ubiquitous, low-latency network. Devices offer lightweight, cost-effective interfaces on various forms of applications to deliver a smooth, reliable and immersive user experience.

Cloud-internet-device convergence will create new applications such as high-precision industrial simulation, real-time industrial quality inspection, and virtual real integration space. It is expected that in the next two years, many new applications will run in the new computing system of cloud network convergence.

10. EXTENDED REALITY (XR)



XR GLASSES WILL BECOME A PRIMARY INTERACTIVE INTERFACE, DRIVING THE DEVELOPMENT OF THE NEXT GENERATION OF INTERNET

With technological developments such as cloud collaboration computing, network communications, and digital twins, the XR (Future Virtual and Reality Convergence) Internet with an immersive experience at its core will usher in an explosive period. Glasses will become a new human-computer interaction interface, promote the formation of the XR internet, which is different from the flat Internet, and spawn a new industrial ecology from components, equipment, operating systems to applications.

XR Internet will reshape the form of digital applications and change the way of interaction in entertainment, social, work, shopping, education, medical and other scenarios. In the next three years, the academy expect to see a new generation of XR glasses that have an indistinguishable look and feel from ordinary glasses entering the market.