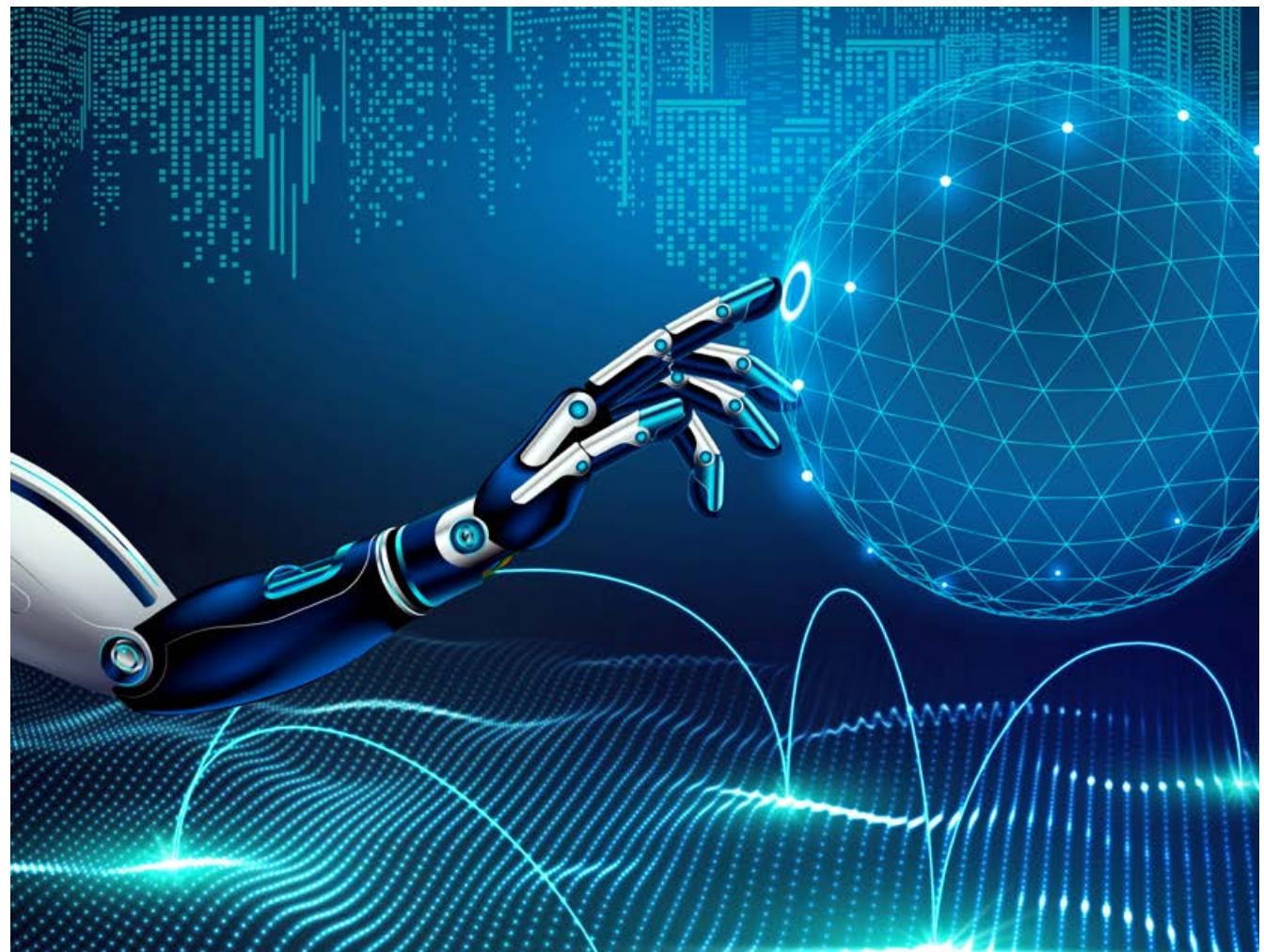


Wireless AI for networks that understand you

The annual Mobile World Congress (MWC) in Barcelona is a weather vane for the mobile and ICT industries. At the CTO Roundtable hosted by Huawei at MWC 2018, network automation was one of the hottest topics – no surprise given that the exploration and application of artificial intelligence (AI) in mobile networks has been picking up pace in recent years. It's likely that a sharp rise in network complexity in the 5G era will lead to stronger demand for network automation and AI in mobile networks.

By Ding Jiangbo



Network automation

In the 5G era, networks will be larger, contain more frequency bands and channels, and offer a greater variety of base station types and scenarios, features that will sharply increase network O&M complexity. Moreover, the complexity of network systems will lead to a continual fall in the utilization efficiency of wireless resources.

At the service level, there's been a dramatic increase and diversification in the types of services carried by the same physical mobile networks, from traditional MBB services, such as voice and data, to mobile IoT services that enable industry digitalization. Safeguarding service experience has become a prerequisite for service development. At the same time, the use of network slicing has made real-time resource orchestration involving multiple services more difficult.

With future networks set to be 100 times more complex than current mobile networks, how will the industry deal with the challenges arising from complex network O&M, wireless resource management, and service experience assurance? Traditional methods and tools won't be able to meet the service development needs of the new 5G era, and so adopting AI to accelerate network automation is the only answer.

Wireless AI

At the Global Mobile Broadband Forum in London in November 2017, the President of Huawei Wireless Solutions, Edward Deng,

made the first announcement of Wireless AI, which is set to become a core element of future networks, lighting the spark for the democratization of AI in the wireless domain.

Huawei debuted its Wireless AI solution at MWC 2018, positioning it as the way to solve three major challenges in the 5G era: O&M complexity, declining resource utilization efficiency, and service experience assurance. There are three major benefits of AI in the wireless domain: simplifying O&M, breaking through performance limitations, and enabling new business.

Deng showed how introducing Wireless AI in three scenarios – Massive MIMO, multi-band/multi-system, and wireless fingerprint positioning – could increase O&M efficiency by up to ten times, improve experience by 20 percent, and increase positioning accuracy by between three and ten times.

Massive MIMO 5G base stations provide high-capacity coverage and greatly improve spectral efficiency. With current 4.5G, there are nearly 300 broadcast beam combinations for improved cell coverage, but with 5G, there will be over 10,000. It will be impossible to flexibly adapt to particular scenarios and traffic models using traditional manual methods. However, enhanced learning-based automated optimization will automatically adapt to specific scenarios. The resulting dynamic traffic models will make it possible to automatically batch fast-lock optimal patterns and double O&M efficiency, which will improve overall cell performance. A joint innovation test that Huawei conducted with an operator in Japan revealed a potential

20 percent increase in cell throughput and number of connected users.

Moreover, with the rise of mobile IoT and in particular the proliferation of NB-IoT applications, demand will increase for positioning capabilities that meet the needs of massive numbers of IoT terminals, for example, bike-sharing services. GPS-based positioning solutions offer meter-level positioning capabilities, but problems include high chip costs and high energy consumption. NB-IoT-based positioning accuracy is currently inadequate to meet the needs of applications. Using Wireless AI, multi-dimensional structured data can be entered to form a network fingerprint, enabling a positioning accuracy of approximately 30 meters. This meets the positioning requirements of bike-sharing services. In the future, sub-meter level positioning is hoped for, alongside the expansion of network fingerprint dimensions and more innovative applications.

Creating the DreamWorks of Wireless AI applications

The development of Wireless AI isn't something that can be achieved overnight. Capabilities must be built in data, intelligent algorithms, and architecture.

Increasing mobile big data to make it more valuable: Mobile networks generate huge quantities of data every day, but much real-time data is "read and burn", and structured storage is lacking. Wireless AI in the mobile domain will lead to three data expansions and transformations: real-

time to historical, single-dimension to multi-dimensional, and fragmented to structured. Over the longer term, mobile base stations will become mobile big data awareness systems, including the data generated within the mobile communication system and sensing data from mobile stations' external environments. It will be possible to analyze the characteristics of big data and accurately profile cells, grids, and users, creating a digital twin mobile network.

Building a dedicated automated machine learning (AutoML) platform for the mobile domain: Wireless network systems have their own unique characteristics. Huawei has built a library of AI/ML algorithms for wireless networks based on its experience in mobile communications. The algorithm library integrates various industry- and Huawei-developed AI algorithms that generate various data models that match mobile network application scenarios, with 90 percent of mobile scenarios covered. At the same time, Huawei is also partnering with universities on AI research and exploring new algorithm models. Huawei has developed the industry's first AutoML for mobile communications and reduced the data modeling cycle from months to days, accelerating the incubation of Wireless AI applications.

We're at the very start of integrating mobile networks and AI. As we prepare to enter the 5G era, we believe that continual interaction, understanding, and integration between Wireless AI and mobile networks will lead to mobile networks that understand you, networks that are dedicated to you, and networks that work for you. **H**

In the future, sub-meter level positioning is hoped for, alongside the expansion of network fingerprint dimensions and more innovative applications.