At the centre of a new reality

The leader of Samsung's artificial-intelligence research outlines the quest for convenient and natural interaction with machines. **By Leigh Dayton**

Sebastian Seung's new role at Samsung's R&D Campus in the South Korean capital of Seoul is a world away from his previous post at Princeton University in New Jersey. Appointed as the head of Samsung Research in June 2020, Seung is leading thousands of people in 15 research centres, who are investigating technologies such as computer vision, augmented reality, robotics and 5G communications networks. Seung also heads seven global artificial intelligence (AI) research centres in South Korea, the United States, the UK, Russia and Canada, overseeing research on future technology development and digital convergence, the way in which unrelated technologies become more closely integrated as they advance.

"That's a big leap beyond running a lab of students, postdocs and staff," says Seung, who maintains his role as professor at the Neuroscience Institute and Computer Science Department of Princeton University remotely. His lab at Princeton runs Eyewire, an international citizen-science project to map the brain.

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Having previously worked at the Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts, and AT&T (now Nokia) Bell Labs in New Jersey, Seung describes academia and industry as having "conceptual similarities". Both, he says, are highly competitive engines for innovation; scientists compete for funding, whereas companies compete for profits, with both sectors demanding creativity.

A self-described "intellectual jack-of-all-trades", Seung brings experience in computer science, neuroscience and physics. He was recruited by Samsung Electronics in 2018 to help develop its AI strategy, including academic collaborations and hiring researchers. Seung says the top priority for Samsung Research in AI is to make users' interactions with their devices "as convenient and natural as possible". That may mean turning on the air-conditioning unit with a voice command, running health checks through a smartwatch, or directing robot vacuum cleaners with simplified sign language.

"Multimodal interaction is core to what we do," says Seung. "It has become a buzzword driving AI research at Samsung." Multimodal interaction refers to devices that offer the user multiple modes of interaction, such as sight, speech and touch. Current AI systems use deep learning to achieve this, which is a form of machine learning enabled by artificial neural networks. Inspired by the structure and function of the human brain and nervous system, artificial neural networks simulate the way the brain analyses and processes information.

Deep learning

Seung's academic career has long straddled the border between artificial and biological neural networks. He was involved in the early development of neural chips, for instance, which pack powerful AI systems into computer chips small enough to be integrated into battery-powered smartphones or robots. "When I was at MIT 20 years ago, my lab published research on a neural chip and it was featured on the cover of *Nature*," says Seung. "Many of my colleagues dismissed neural chips as science fiction back then, so it's amazing that they are becoming everyday technology now."

Seung says this focus on 'on-device AI' technology at Samsung is about developing devices that are 'smart' on their own, offering more interactivity and control to the user, without having to communicate remotely with computers in a data centre. This also enables fast and reliable responses from the device, and helps to safeguard privacy, he says.

The smaller AI systems are, the more viable wearable devices become. Already, these devices are making an impact, says Seung, pointing to Samsung's HeartWise Galaxy watch and smartphone app, designed to encourage healthy behaviour after a heart attack.

As reported in the *New England Journal of Medicine Catalyst* in 2019 (go.nature.com/2jpnkjn), the app, a collaboration between Samsung and health-care provider and insurer, Kaiser Permanente, significantly improves the likelihood that patients will complete rehabilitation programmes. "The completion rate jumped to almost 90%, up from 50, and the rate of rehospitalization plummeted after HeartWise," says Seung. "This is a way to save lives and also help to reduce health-care costs."

Leigh Dayton is a writer in Sydney, Australia.

Sebastian Seung.

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