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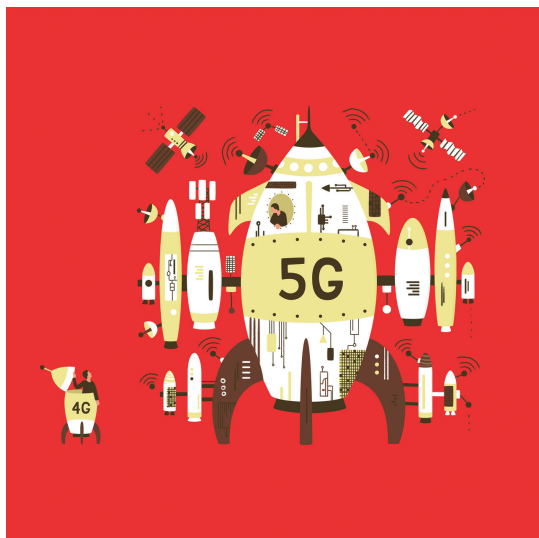
BUSINESS | JOURNAL REPORTS: TECHNOLOGY

The Power of Combining 5G and AI

Putting the two technologies together will change everything from drug making to brewing beer

Among other advantages, 5G networks let internet-connected devices transmit much more information much more quickly.
PHOTO: FRANCESCO CICCOLELL

By James Rundle and Angus Loten

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The convergence of artificial intelligence with internet-connected machines and superfast 5G wireless networks is opening possibilities across the planet—and even in outer space.

These advancements are allowing farmers to pick the optimal way to grow crops, pharmaceutical companies to shorten the development times of new drugs, researchers to track pandemics, and cities to manage their resources in a manner that was pure science fiction at the turn of the millennium.

Taken alone, these technologies have enormous potential in their own right, but combined, experts say, they have the power to transform industrial technology on a scale not seen since the advent of steam power.

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The key ingredient, the experts say, is 5G. It gives developers the ability to scale up projects more easily because there's no need to build extensive fiber-optic networks to keep data flowing. What's more, 5G networks let internet-connected devices transmit much more information much more quickly—which in turn is spurring developers to come up with more advanced machines that can take maximum advantage of the capability.

"5G in the field, in real-world deployments, enhances the value of all these other technologies," says Bill Menezes, a senior principal analyst at information-technology research and advisory firm Gartner Inc.

Here's a look at early examples of what is possible when these technologies are yoked together:

In food and drinks

In the food industry, AI is already being used to track supply chains and ingredient quality, sort produce and even create taste profiles to target specific demographics. And the technology is poised to take on ever more complex tasks as it links up with 5G and networks of online-capable devices known as the Internet of Things.

Even the beer in our refrigerators may be partly designed by computer systems in the years to come—with sensors to collect massive amounts of data on ingredients, AI to crunch the numbers and 5G networks shuttling the information between them.

Carlsberg AS is exploring how this kind of approach can be used to develop new lagers at its research lab in Denmark.

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work focuses on yeast selection for the fermentation process needed to produce beer. Currently, the operation is costly in both time and resources: Thousands of yeast variants are tested over several weeks or months to determine whether they can function correctly on the mass-production scales required by Carlsberg. The tests also determine whether the process can produce enough alcohol.

Almost all of the variants end up being discarded. Even if they can meet the necessary standards, there's no way of reasonably determining how they will taste until the fermentation process is far along enough for human testing—meaning months of development could be wasted. One or two variants might make the final cut out of around 2,000 tested.

This, says

Carlsberg is exploring the use of advanced technologies in developing new lagers. **PHOTO:** DANISH SIDDIQUI/REUTERS

Jochen Förster, director and professor of yeast and fermentation at Carlsberg Research Lab, is where fast networks that can handle AI and lots of data play a role.

The project, part of a collaboration with Aarhus University, the Technical University of Denmark and Microsoft Corp. , is developing sensors that can determine the ultimate flavor of yeast variants before the fermentation process starts. Machine learning powers analysis of the wildly varied data that these sensors deliver and assembles it into a readable form.

The program, known as the Beer Fingerprinting Project, has another year to run and hasn't yet developed any new flavors, but the team is beginning to file patents for technology developed during its research, Dr. Förster says. As for future applications, he believes that the sensors they have developed could have applications for the pharmaceutical and medical industries, such as detecting microbial contaminations.

"We are generating a lot of knowledge on how to design these types of sensors, and we can clearly translate the technology to other applications in foods, diagnostics or in environmental [areas]," he says.

In hospitals

The world of medicine is immersed in emerging technologies. The possibility of remote surgery becomes far more achievable, for instance, as 5G gives doctors more reliable and robust connection speeds to control machines from afar. Pharmaceutical companies have released smart pills containing miniaturized computer chips to track patient health, with the data transmitted back to doctors by 5G.

Meanwhile, all of these new technologies could make a big impact on the process of drug development itself.

Creating drugs to treat mental-health disorders can take up to seven years, says Naheed Kurji, chief executive of Toronto-based biotechnology firm Cyclica Inc. Molecules in drugs can interact with the body's proteins in any number of ways, which can, in turn, cause different reactions further on. Now artificial intelligence can handle the level of computation required to model all those interactions.

Cyclica is teaming up with Berlin-based biotechnology company ATAI Life Sciences AG on a joint venture, Entheogenix Biosciences Inc., to create an AI-powered laboratory that will seek to develop treatments for mental-health disorders that are derived from psychoactive substances, including psilocybin, commonly known as magic mushrooms.

The company is making "the whole process of developing drugs that cost $1.5 billion, and take 10 to 12 years, shorter and less costly. That's the ambition," says Florian Brand, ATAI's chief executive.

On store shelves

Trevor Sumner, CEO of Perch Interactive, says 5G and connected devices are bringing retailers such as Neiman Marcus a new level of customer intelligence—and changing the way shoppers browse the aisles.

New York-based Perch develops connected retail-marketing platforms, with sensors installed on store shelves that detect when customers pick up a product for a closer look, and then relay that information back to store managers.

"We can say, this product was picked up a hundred times, but people decided to put it back," Mr. Sumner says. "Let's go find out what's wrong."

Combined with AI-enabled software and other advanced analytics, that data can help retailers reset prices or improve product displays, among other strategies. For instance, Mr. Sumner says, store managers may arrange their fragrance lines by brand—but, after tracking customers, the stores may realize that shoppers actually browse for products by category, such as perfume, cologne or eau de toilette.

From the customer's perspective, the Perch technology triggers a video screen, embedded in the shelf, that provides more information on products as they browse. Mr. Sumner says retailers using the tools report an average 60% increase in sales. Current users include Sunglass Hut, Sephora, Kate Spade and Pernod Ricard.

And 5G, he says, is set to supercharge the platform, which currently operates over 4G networks, by cutting down latency speeds. Ramped-up speed will enable the tools to target customers

with more-specific marketing messages—using facial recognition to target a customer's demographics—or a range of product-related videos, he says.

He adds that the technology collects no personally identifiable information and runs on its own secure cellular network that is independent of the retailer.

Within the next few years, Mr. Sumner foresees bricks-and-mortar stores back on a more competitive footing with online retailers such as Amazon.com Inc. that can tweak their products based on clicks and other online behavior. "We can start doing that at physical retail outlets and drive greater customer engagement," he says.

In factories

The manufacturing process is perhaps one of the ripest for transformation by the combination of rapidly evolving technologies. For instance, advanced sensors will pick up new levels of performance data about the heavy machinery running inside plants—which will be transmitted at superfast speeds between those machines and central control systems.

In the area of maintenance, for example, plant managers could get an early warning of problems by taking performance data from the machines and coupling it with external information, such as data about what makes similar machines break down, says Rajeev Gollarahalli, chief business officer at 42Q, a part of computer-chip manufacturer Sanmina Corp.

> "I can tell you why it is going to fail because I know the kind of products that it's run in the past, and I can look at what sort of wear and tear that may manifest from this product and the effect it may have on the machine," he says.

The combination of information will also have a huge impact on product quality, Mr. Gollarahalli says, as companies can use ever more detailed data to refine the production process.

The new technologies will also assist plant owners in being able to quickly establish physical facilities in new locations, he says, as 5G can eliminate the need to set up expensive on-site infrastructure such as fiber-optic cabling.

"In today's world, especially with all the trade wars and tariffs and the political situation, you have to be able to very quickly respond to changes in customer demand or even regulations to move your factories from one place to another. And 5G is going to be perfect for that," he says.

In towns, cities and skies

The potential for these emerging technologies doesn't stop with companies. Many believe that combining them with satellites and other space technologies could provide windows onto our planet and ways of understanding our society that were impossible before.

Some of this has already manifested in various partnerships between the European Space Agency, companies and public-sector bodies. For instance, Rita Rinaldo, head of the agency's institutional-projects section, says the agency is exploring how a combination of space-based technologies and AI can track the spread of pandemics by collecting data about infection rates and analyzing it at the source, while combining that information with satellite images transmitted by 5G.

The agency is also using those types of technologies to implement projects across a wide variety of industries—for instance, energy management in rural or remote areas that may not

have regular access to electricity.

Analyzing data about where villages are located and what types of buildings they have "can provide insight to planners and to governments about where to deploy microgrids to provide electricity in these areas," she says.

Other projects have included partnerships with Telefónica SA's O2 telecom business to assist with the implementation of autonomous vehicles by managing traffic and other things, and projects in agriculture that can correlate sensor data with satellite imagery to assess the health and status of crops.

Messrs. Rundle and Loten are reporters for The Wall Street Journal in New York. They can be reached at james.rundle@wsj.com and angus.loten@wsj.com.

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