AI AND COMPUTER VISIONING **IMPROVE COVID DIAGNOSES**

Three Spanish hospitals work with a consortium including Capgemini, Vodafone Spain, Intel, Cisco, Microsoft, and Gilead Sciences Spain to develop a proof-of-concept federated diagnosis model to screen X-ray scans for COVID in symptomatic patients

DIAGNOSING COVID PATIENTS

The COVID-19 pandemic placed a tremendous strain on many aspects of life. Every industry felt its impact, though none quite so much as healthcare, where hospitals and their staffs struggled to keep up with the surge in patients requiring diagnosis and, all too often, intensive care. Caring for the large numbers of people looking for treatment as well as testing for the disease required an incredible commitment in time and effort from experienced professionals. However, as the numbers mounted and time constraints grew,

Client: Hospital Ramón y Cajal (Madrid), Hospital 12 de Octubre (Madrid), Hospital San Pablo (Barcelona)

Region: Spain

Industry: Healthcare

Client Challenge:

COVID placed a strain on hospital staff all over the world, prompting three Spanish hospitals to look for a way to utilize AI to provide support when it came to diagnosis of potential COVID patients

Solution:

A consortium that included Capgemini developed an AI-based proof-of-concept diagnosis model that drew upon common data to perform X-ray screenings of symptomatic patients while maintaining the utmost privacy with regard to patient information

Benefits:

- 24% increase in model performance relative to local models
- Maintenance of high-level privacy for patient data
- Ability to support hospitals with less expertise

the restriction of expertise required for proper patient diagnoses became an increasingly clear target for improvement.

"Microbiology tests are the most common way of diagnosing COVID in patients, but since respiratory symptoms represent the primary change connected with the disease, chest X-rays have been essential in diagnosing symptomatic patients," explains Fabiola Bermejo Sanz, Tessella Spain Director at Capgemini Engineering. "But reading the resulting output requires time and substantial medical expertise, both of which were in short supply considering the number of patients we had to admit."

The radiologists of three Spanish hospitals, Hospital Ramón y Cajal and Hospital 12 de Octubre in Madrid as well as Hospital San Pablo in Barcelona, decided to collaborate in pursuit of a solution to this challenge. They reached out to potential technology partners in order to combine their working medical and administrative expertise with the technical knowledge needed to realize such an ambitious vision. This brought Capgemini, Vodafone Spain, Intel, Cisco, Microsoft, and Gilead Sciences Spain into the fold to form a comprehensive coalition.

AI AND COMPUTER VISION PROVIDE A SOLUTION

"What we wanted was to show that automated diagnosis could form the basis for an aggregated clinical diagnosis experience," says Bermejo Sanz. "And one of the most important elements of that was guaranteeing the privacy of patient data while creating that experience. In the end, we wanted to develop a new tool to keep up with the ramping need for X-ray review without compromising our patients' private information."

Together, the consortium members set about creating a proof-of-concept that would use artificial intelligence and computer vision to screen X-rays and determine a symptomatic patient's COVID status. This included a federated learning platform, developed through a collaboration between the hospitals and Capgemini, that would enable experts to train computer vision models with scarce data sets. In addition, Cisco and Intel provided the computing infrastructure required for experimentation and testing of the platform. All the while, the utilized data was kept secure by third-generation Intel Xeon Scalable processors using Software Guard Extensions (SGX) for encrypted aggregation tasks.

"In the end, we made sure that patient data never lever left the hospitals," explains Bermejo Sanz. "So, we trained the AI that reviewed the X-rays using expertise from each of the three hospitals to develop an aggregate solution that drew upon our combined expertise. The result was a single diagnosis model that was more accurate than any of the local models that served as a starting point."

A NOTABLE STEP FORWARD

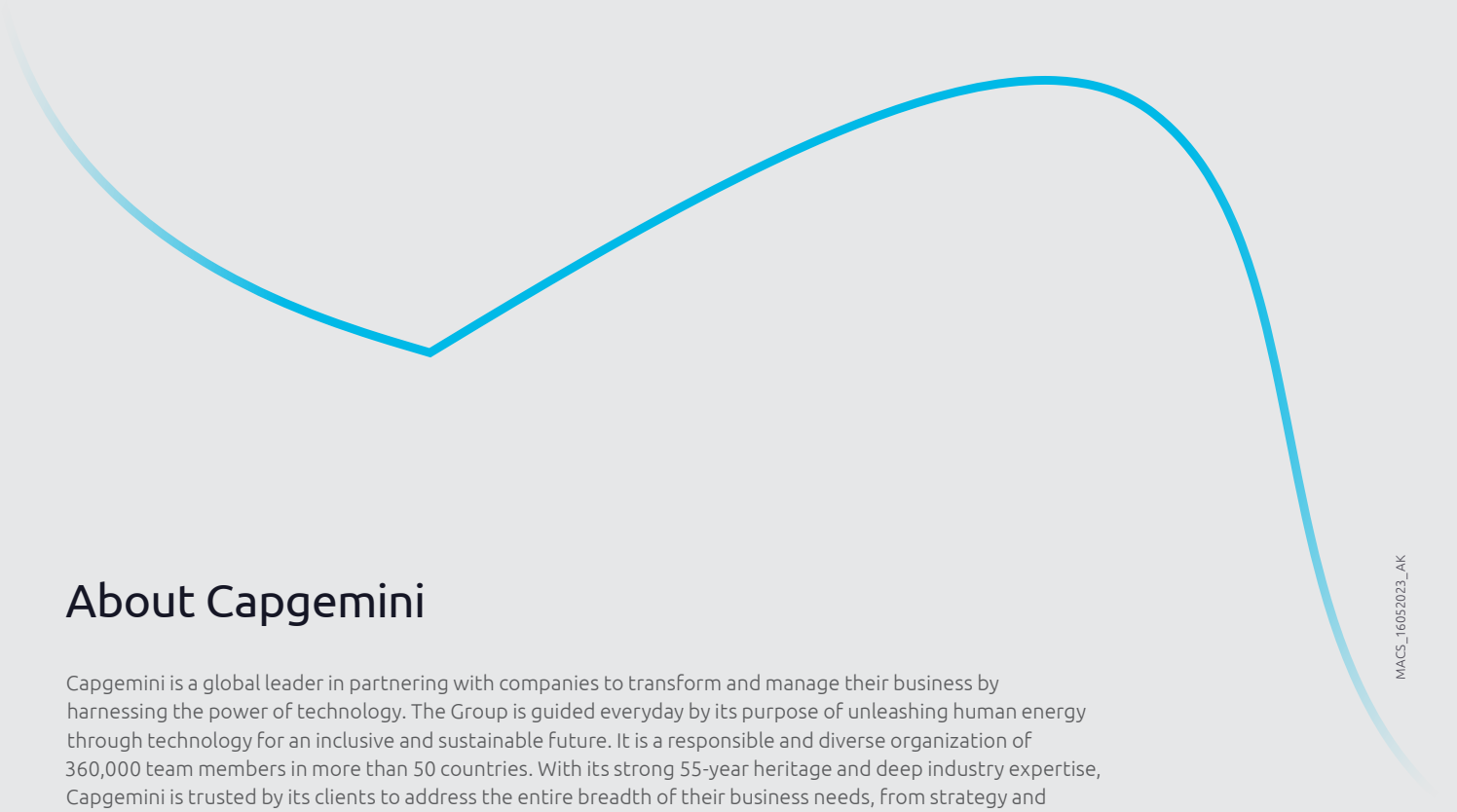
In the wake of the consortium's work, the proof-of-concept solution demonstrated the efficacy of automated diagnosis built upon a learning platform. Compared to the best available local models, the aggregate model achieved a 24% increase in diagnostic performance while leveraging common data. Most importantly, the partners accomplished this while maintaining the security of patient information throughout the process, thereby indicating that the solution could be developed and eventually implemented without risk to privacy.

While this is only the first step towards the introduction of artificial intelligence and computer vision into the diagnosis process, it is a significant illustration of the solution's potential impact. A future platform developed on the basis of this proof-of-concept will help medical staff manage the burden during periods of excessive patient traffic. In addition, a global diagnostic model will particularly benefit facilities that possess more limited experience with X-ray screening, both for COVID and beyond.

"We've shown that an AI-based diagnostic solution has the potential to make a great impact," says Bermejo Sanz. "And the biggest part of that is that it doesn't require anyone to share identifiable patient information to build the model or to perform a diagnosis.

"This means that we can help hospitals manage pandemic-level numbers of patients, regardless of their experience with a particular disease or diagnostic method. Ideally, future outbreaks will be less dangerous in terms of the stress they put on hospital staff as a result."

The success of the proof-of-concept has cleared the path forward for the consortium to continue development of a global diagnostic model that can be applied to a wider selection of hospitals and improve patient care on a larger scale.



About Capgemini

Capgemini is a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided everyday by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of 360,000 team members in more than 50 countries. With its strong 55-year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fueled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering and platforms. The Group reported in 2023 global revenues of €22 billion.

Get the Future You Want | www.capgemini.com

MACS_16052023_AK