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STRATUS MEDICINE

Machine learning tackles the leading cause of breast cancer mortality

Machine learning algorithms flag likely breast cancer recurrence to support clinicians in deciding upon early intervention

Cancer is a complex set of many diseases, each distinctly manifesting within the body in locations characteristic to that particular ailment. Left unchecked, insidious cancers can metastasize which often leads to the patient's death. Relentless research, clinical experimentation, and treatments completed over many, many decades have parried against this biological foe with differing degrees of success, achieving greater rates of remission. But even with these successes, breast cancer remains among the leading causes of death for women.

Breast cancer is a complex disease in itself. As with most cancers, survival depends on early detection. Most often, the patient emerges from surgery, chemotherapy, or a combination of the two with no detectable cancer anywhere in her body, her chances of survival extremely good. But in a limited percentage of cases, the cancer comes back. If the cancer has recurred and metastasized, the patient's survival chances are significantly lower. Recurrence has, in fact, become the leading cause of death in breast cancer patients.

The median time for breast cancer recurrence in patients treated at the Foo Foundation Sun-Yat Sen Cancer Center of Taiwan is currently 30 months. "Early detection of a metastasis is really key to patient survival," says Dave Burdick, CEO of Status Medicine, a Google Cloud Partner that drives healthcare innovation. "You want to get that patient into a followup treatment regimen as soon as possible." But for a long time, it was very difficult to assess whose cancer was at risk of recurrence and whose wasn't.

About Stratus Medicine:

Stratus Medicine, based in Seattle Washington, assists healthcare systems, startups and payers to fast track their innovative projects. Their core effort uses FHIR, imaging, and machine learning.

About Koo Foundation Sun-Yat Sen Cancer Center:

The Koo Foundation Sun-Yat Sen Cancer Center, located in Taipei, Taiwan, opened in 1990. Now a 325 bed hospital, its mission is to prevent and cure cancer by providing expert and compassionate care, to deepen understanding of cancers to which patients are especially vulnerable, and to train the next generation of oncologic and healthcare professionals

Due to individual physician discretion, there is variability in the use of advanced and invasive imaging, such as whole-body bone CT scans, during followup. Establishing a more consistent process for stratifying the risk of breast cancer recurrence became imperative to accelerate the timing of recurrence treatment which in turn reduces patient mortality and cost.

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Automating early detection of breast cancer recurrence

The partnership between Stratus Medicine and The Koo Foundation Sun-Yat Sen Cancer Center led to a real-time machine learning algorithm that helps clinicians more accurately stratify the risk of recurrence in breast cancer patients. The team built their solution on Google Cloud Platform because of the speed and agility that the leveraging fully managed services such as the Cloud Healthcare API created. "To create this system, we extracted the relevant data from the center's health system and put it into a structured FHIR and DICOM format, trained the model using these data, and then deployed the model to provide insights in real time to the physician seeing the patient," explains Burdick.

To train the system, the team established an automated process for collecting information from Electronic Health Records (EHRs) and mammograms, including radiology reports describing the severity of each original malignant lesion, who the radiologist was, and which patient was involved. Three sets of images were collected for each patient in the study: images with benign lesions that later turned malignant; follow-on images showing the lesions after they turned malignant; and low Breast Imaging-Reporting and Data System (BI RADS) score images of lesions that stayed benign.

Radiology experts examined each selected image in the DICOM store to label them with a BIRADS score to indicate malignant or non-malignant. Drawing from this data, the team built a transfer learning model that used Auto ML Vision to classify unlabeled images. Google Auto ML Vision processed hundreds of thousands of images to build a model that could classify lesions that turned malignant and those that did not. Technicians then fine-tuned the model to the desired level of performance. The model now automatically screens patient images to indicate higher or lower
risk of a cancer recurrence, given the patient's other pathology and demographic data. The system updates itself with each new patient, retrieving additional historical images and related data to strengthen the model.

David Burdick, CEO, Stratus Medicine

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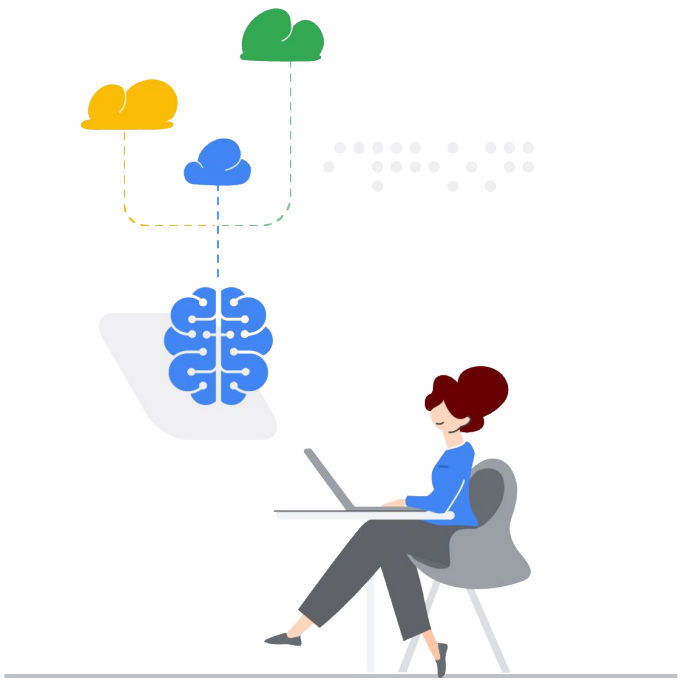

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An innovation-ready platform

By using ready-made services like the Cloud Healthcare API to manage FHIR and DICOM data, as well as Cloud Function and Cloud SQL, Stratus Medicine could move quickly. “We didn’t have to provision or manage any of the hardware, or even think about virtual machines or containers,” says Burdick. “The Auto ML Vision and AutoML tables allowed us to create models that were really good, both in terms of speed and the investment we put into making them. And the fact that they integrate so well with the other managed services meant we could move a lot faster than a traditional research project.”

Although this system was designed for a specific project, it can scale to support all the data science research projects at The Koo Foundation Sun-Yat Sen Cancer Center. As Burdick describes it, “Everyone can now leverage these FHIR and DICOM registered resources to do both innovative research and clinical delivery projects and quality improvement projects at a speed unheard of with the earlier on-premises deployment, where you would be building and managing everything yourself.”

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To learn more about Stratus Medicine contact:
david.burdick@stratusmedicine.com