guidelines indicate specific treatment protocols based on nodule characteristics such as diameter and composition.

Additionally, *ClearRead* CT improves the radiologist's reading efficiency. It takes the average radiologist two to three minutes to determine whether a nodule is present in a given CT image and longer to manually measure it, but Riverain's algorithm can locate and measure nodule characteristics, greatly reducing the burden on the radiologist. Although the algorithm does not currently assign a malignancy score to detected nodules, Worrell suggests that feature would be a logical next step. Additionally, *ClearRead* does not use patient health history to make determinations, so it falls to the radiologist to use the nodule data in the overall context of patient care case by case.

According to Worrell, around 30% of abnormalities in radiological readings are missed, partly due to radiologists' untenable workloads. Comorbidities like emphysema and technical factors such as movement artifacts also contribute to this figure, as does the subtlety of the nodules themselves, hidden amid vascular structures on the image. Failure to detect an anomalous feature in the lung can lead to an average delay in diagnosis of 250 days, during which time the disease can progress substantially and require more invasive therapies. As Worrel explains, "It can mean the difference between life and death, or, at a minimum, the difference between a treatment regimen with minimal side effects and one that is painful and expensive."

The *Clear Visual Intelligence* capability adds value to imaging data by suppressing bone and blood vessels, giving target features full visibility with no confounding elements in the way. The company's next offering, part of a comprehensive chest solution package in development, will be able to assess heart attack risk based on the presence of coronary calcium. Worrell says there are no hard plans to move into other anatomical regions with *ClearRead*. But the technology's potential and IP protection, covering the suppression techniques, data normalization, and artificial nodule creation, would ease the shift if it does happen in the future.

Riverain's customers include radiology groups, hospital systems, veterans' hospitals, and academic medical centers. Within those organizations, Worrell says, "typically, the cardiothoracic radiologist is the gatekeeper for us because they're the experts; they'll be the clinical champions." These specialists will advocate for the use of *ClearRead* to improve accuracy, reading efficiency, and patient outcomes. This is particularly true for less experienced radiologists and other specialists with less specialized training in the lungs.

ClearRead CT is now deployed in more than 200 sites and Worrell states Riverain has yet to lose a single customer. He chalks this high retention rate up to the strong image processing engine that delivers high specificity and sensitivity as well as the thoughtful interface that easily integrates into the clinical workflow. "As a rule, radiologists don't want to have to invoke another viewer," notes the CEO. Worrell believes considerable consolidation is likely to occur over the next couple of years with respect to AI vendors, and he believes that will open the door for Riverain to grow stronger in terms of talent, offerings, and market presence. Riverain was profitable in 2023, growing revenue by more than 400% and will likely not need to raise another round of capital.

Gesund.ai Puts Algorithms to the Test to Improve AI Equity

With a host of AI vendors coming into the market, newcomers and incumbents need a means of ensuring that the models function as intended in a broad range of scenarios and do so safely and reliably. Enter **Gesund.ai**, the world's first independent AI assurance lab designed to validate medical AI solutions in line with FDA requirements. Acting as a contract research organization (CRO), Gesund.ai sources case-specific data from health system partners, works with board-certified experts in various medical fields, and uses its unique technology platform to put AI models through a clinical trial to determine their accuracy. The company is HIPAA and SOC Type 2 compliant, preserving the privacy and integrity of medical data and algorithm intellectual property (IP). CEO Enes Hosgor, PhD, explains, "We never touch personal health information. Everything has been de-identified within the hospital firewall."

Despite the practicality and convenience of remote data access, the volume and quality of data has been too limited to be used for machine learning historically. Gesund.ai addresses this compromise by formatting data into a more readable iteration through a semi-automated curation process. A team of clinical experts creates cohorts with specific inclusion and exclusion criteria that FDA requires for validation, then tests AI predictions against ground truth data remotely and annotates the results using a panel of US board-certified readers, quantifying sensitivity and specificity metrics in accordance with FDA regulations. As Hosgor puts it, "Our technology allows AI developers to not only run validation studies, but also to stress test AI models in a custom-tailored environment that reveals blind spots in the algorithm to prepare them for a robust pre-submission process." Alternatively, those developers would have to use homegrown tools to prepare data, which can present bottlenecks and roadblocks when trying to perform the same rigors of validation. "We remove those uncertainties from the equation, allowing the customer to meet FDA requirements

in a more predictable fashion and help them stay compliant postdeployment," says the CEO.

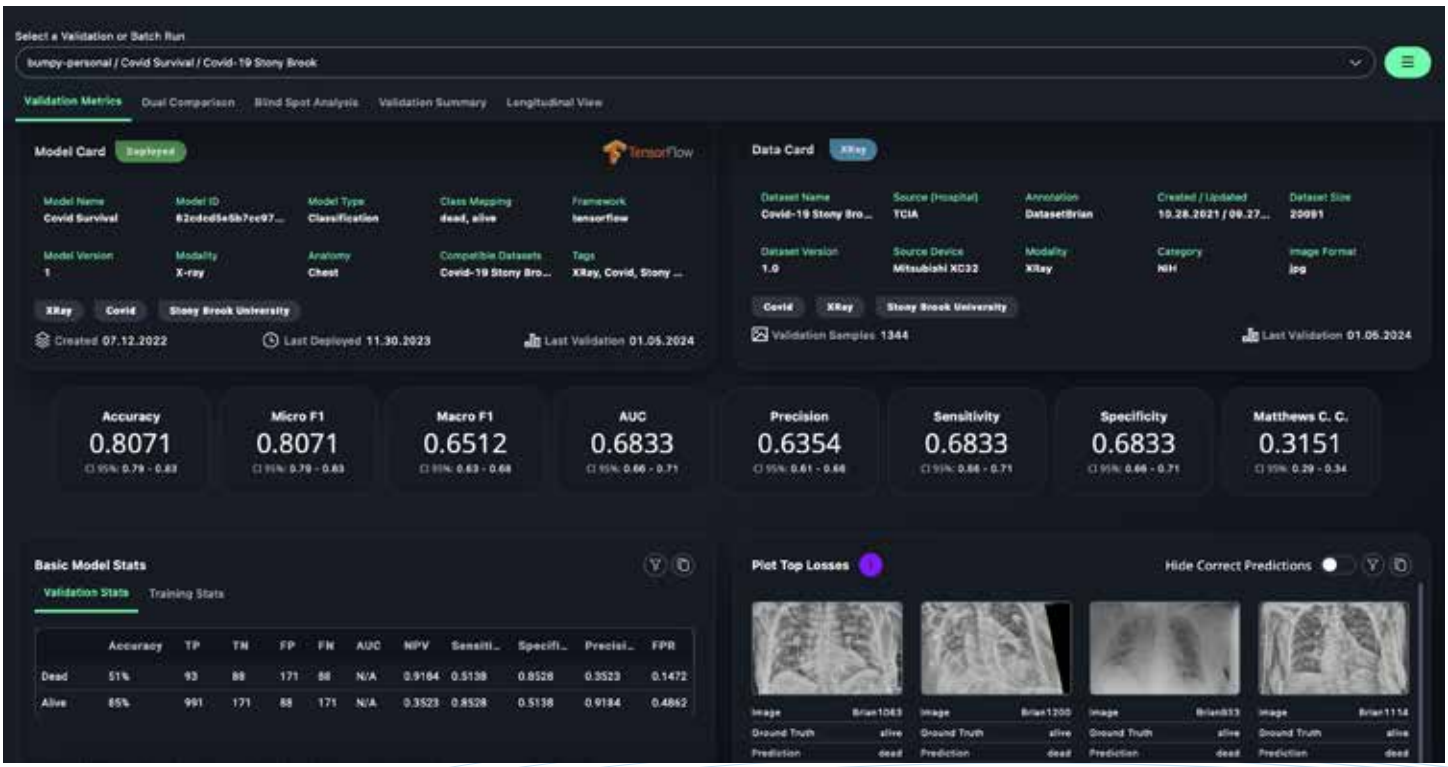
Gesund.ai's technology platform, *AI Factory*, is also currently being used by developers from the medtech and pharma worlds to build models from scratch (see *Figure 3*). The intuitive interface is suited for coders and non-coders alike, so parties with any amount of experience—such as subject matter experts or quality assurance professionals—can be involved in R&D from the start, as opposed to relying on data scientists operating in a silo. Users can drag and drop elements on the screen to build models in the Python programming language and physician annotators can draw measurements, segmentation polygons, and bounding boxes in-platform to adjust algorithm performance. "We have to build that infrastructure that connects data custodians and stakeholders for the entirety of the AI lifecycle," Hosgor says.

In characterizing his potential customer base, the CEO estimates that 80% of all FDA-cleared AI products are radiology applications, with the rest mainly falling into cardiology and neurology. Industry dynamics show that, with new digital scanners coming online, pathology is expected to experience a surge, driving adoption and value creation by supporting AI innovation. Moreover, ophthalmology, hematology, and molecular imaging also show promise based on the number of issued patents for those specialties. From Hosgor's perspective, an AI boom is just around the corner. As Eric Topol, MD, pointed out in his article published in the September 2023 issue of the journal *Science*, "as AI goes multimodal, medical applications multiply."

The ongoing validation service offered by Gesund.ai empowers AI vendors with dynamic trustworthiness, which is vital to remaining compliant on the market long term. "Most of these AI models are still viewed as a black box. If they don't inspire confidence in clinicians, they will sit on the shelf," Hosgor says. Worse yet, not complying with new rules and regulations will result in products being delisted from the market and facing substantial penalties. Differences in patient profiles, scanners, and policies may contribute to this discrepancy when training parameters are not represented in the environment of deployment. If an algorithm is only trained in a university hospital, for example, it may not work in a community hospital because the training data doesn't sufficiently mimic the real-world data. To address these performance gaps, Gesund.ai runs predictability scenarios at the population level, cohort level, patient level, and even as granular as the image slice level.

AI models' functionality must be closely monitored, particularly given the recent push from California Attorney General Rob Bonta to generate evidence that algorithms are not subject to

Figure 3
***AI Factory* UX**



Source: Gesund.ai

bias against certain patient groups. Gesund.ai can help AI developers pinpoint the groups for which algorithms perform better and worse with specific predictability scores for each, as demonstrated in a study presentedat the 25th annual International Conference on Medical Image Computing and Computer Assisted Intervention in 2022. In this study, authored by Hosgor along with Brian Ayers, MD, Ray Funahashi, MD, and Veysel Kocaman, PhD, the model assessed was found to be 86% accurate for ICU patients, but only 60% accurate for current smokers, with other distinguishing factors including age, liver and kidney damage, and ventilator use.

The FDA does not regulate Gesund.ai's platform as a medical device *per se*, though the company and agency work in harmony to evaluate AI products. According to Hosgor, some traditional CROs have imaging backgrounds, but none possess a machine learning operations (MLOps) expertise or platform comparable to Gesund.ai. "Evolution of AI models is occurring at breakneck speed, and I can categorically say that the bar for compliance and trustworthiness is rising," he says. "FDA and ONC [Office of the National Coordinator] are requiring much more rigor and transparency from AI evidence than they have in the past." Hosgor also believes that multi-site validation is ostensibly the way of the future, as greater sampling diversity will yield broader representation in the data.

In October 2023, US President Joe Biden issued an Executive Order establishing expectations and plans for ascertaining the safety and security of AI technologies at large. The order outlines "the most sweeping actions ever taken to protect Americans from the potential risks of AI systems" (per the White House), including requirements that developers disclose safety test results, protect patient privacy, advance equity, and support workers' rights. In response to the government's statement, Hosgor published an essay January 3 on LinkedIn, writing, "The best way to ensure that AI is safe, fair, and equitable is to have a central agency supported by a hub-and-spoke network that serves as a critical watchdog layer." The CEO suggests establishing an AI Validation Agency with regional and sector-specific AI Validation Platform Entities that report to it, and in addition leveraging support from existing agencies such as the Department of Health and Human Services' Agency for Healthcare Research and Quality. Weeks prior to the announcement of the Executive Order, Gesund.ai joined the federal Cancer Moonshot initiative for its inaugural project, CancerX, providing its services to analytic tools used in oncology.

Quality In, Quality Out?

Overall, the greatest benefits that AI can offer a practice are time savings, burnout reduction, and improved clinical outcomes. However, these results depend on the quality of the algorithm that powers any given solution, which in turn depends on the data it is fed to recognize patterns, but opinions vary on the weight that data holds. For example, while Hosgor says an algorithm hinges on its training data sets "100%," Cicero's point of view is more holistic. As the 16 Bit CEO says, "It depends highly on the application. Data is important, but it reaches a threshold at some point where more data is likely not going to change the course of a product's success." At that point, he believes data takes a back seat to adoption, regulatory process, and reimbursement. With government officials and healthcare payor organizations watching the space closely, not to mention ancillary service providers guiding AI developers through the ever-changing slalom of requirements, it would seem that the emergence of novel AI technologies, even in great numbers, will be more of a controlled stream and less of a tidal wave. MTS

Posted on MyStrategist.com Jan. 24, 2024