

FORBES INSIGHTS

3 ANALYTICS STARTUPS TRANSFORMING HEALTHCARE

1. X-RAYS THAT AUTO-DIAGNOSE: **ZEBRA MEDICAL VISION**

A decade ago, Eyal Gura, an Israeli tech executive, was traveling in a remote beach town when he had a scuba diving accident. A technician took X-rays of Gura's chest but couldn't make heads or tails of the resulting images. "We had to wait a few days for the radiologist to come from the big city to diagnose what I had," delaying his treatment, Gura says. "I asked: How come we don't have a centralized reference database of all the X-rays for people like me so that I can just run a computer vision comparison against it and get my own sense of what's going on in my body? That was the seed of the idea."

The idea became Zebra Medical Vision, which transforms vast amounts of medical imaging data into actionable insights, allowing doctors to better detect diseases, tumors and fractures while giving patients more information about their health. The technology interprets patient scans using algorithms trained on millions of past medical scans. Relying

on machine learning, it can identify, with a great deal of accuracy, say, whether a patient has a hairline fracture in her limb or a suspicious lump in her chest. And just as important, it can do it for as little as one dollar per scan.

Though Zebra is already used in hospitals around the world, encouraging wider adoption is the next great challenge. "When we started the company [in 2014], many clinicians were afraid of AI," says Gura. "In the last year and a half, there's been a complete mind shift. Now the statement in all the radiology conferences is that radiologists will not be replaced by AI — but they will be replaced by radiologists that are using AI."

This distinction is key to understanding healthcare's digital transformation. Machine learning, artificial intelligence, advanced imaging, genomics — these technologies are pushing medicine to new frontiers, but they are often doing it by augmenting, rather than supplanting, the doctor's expertise. The question now is how both parties can work together — which innovators like Gura and the founders profiled below are answering.





“Sometimes algorithms can find something that the human eye cannot see, like bone density,” says Gura. “This is something that is easier for a machine to do, to count and quantify pixels, but it’s hard for the human eye to see beneath a certain threshold.” The machine can also work far faster, diagnosing in a fraction of a second what may take several minutes for a human to determine. That can make a big difference for a doctor charged with treating dozens of patients a day. And with its ability to spot issues like osteoporosis early, Zebra’s technology is about prevention as much as diagnosis.

It took three years of cold-calling hospitals to assemble the requisite data set to train Zebra Medical Vision’s system, and in 2018 Gura’s company received its first FDA clearance, for an algorithm that detects coronary blockage. Since then, it has racked up approvals to detect brain bleeds, assess chest X-rays and more.

For many of us, our next X-ray might be read by both a human and a machine, but the decision making will remain, as it always has, firmly in human hands.

2. PERSONALIZING FERTILITY:

CELMATIX

As a graduate student in biology, Dr. Piraye Beim noticed a trend in contemporary oncology: the use of patients’ genetic profiles to design individualized cancer treatments. The soon-to-be embryologist wondered whether genetics could bring similar precision to the world of reproductive health, where treatments are often based on general information — sometimes even age alone.

In 2009, she founded Celmatix, which applies artificial intelligence and genomics to the frequently complicated, uncertain and expensive process of fertility treatment. Its patient- and doctor-facing software, Polaris — which has helped the company become a leader in the burgeoning

field of personalized reproductive health — works by comparing patient biomedical data and detailed histories to thousands of past anonymized fertility cases in order to generate a woman's individual probability of conceiving. Celmatix also developed a proprietary genetic panel test, Fertilome, which screens for 46 genetic variants linked to reproductive conditions that can complicate pregnancy. "We've discovered non-obvious things in genes you wouldn't normally associate with these processes," says Beim, like previously overlooked biomarkers that can indicate increased risk of endometriosis or early menopause.

These AI-driven insights can't make diagnoses on their own, but they can help personalize treatments and provide a "real-time second opinion" that may reinforce a doctor's judgment or steer them in another direction. After one woman's panel indicated that an irregular response to hormones might be causing her inhospitable uterus, for example, her physician prescribed a course of estrogen-reducing drugs that helped her get pregnant. In other cases, simply knowing the probability that IVF will be successful may influence a doctor's advice — or help a patient make an independent assessment about the financial investment. The goal, says Beim, is to empower patients and their doctors to make educated, proactive decisions. Celmatix now counts as customers a dozen major fertility clinics, serving thousands of patients.

The biggest challenge to fully individualized medicine in any field, says Beim, is one of information — how to gather it, how to organize it and how to draw actionable insights from it, which is why Celmatix spent its early years compiling a massive data set of clinical trial outcomes and anonymized information about female genetic health and fertility. Beim's team approached clinics around the U.S., telling them, "We need a reference data set that is really representative of the typical thousand people who walk in the door of a fertility clinic." Since then, it has assembled "the largest structured data set for real-world evidence on the clinical side," says Beim. "It is over half a million individuals and almost a million treatment cycles that we pulled from electronic medical record databases."

The company's scientists are now branching out from its original vision, researching endometriosis treatments, new

forms of female contraception that don't rely on hormones and how to help women control their age of menopause. Reproductive health, Beim says, is a highly personal matter; reproductive healthcare should be too.

3. USING TECH TO BREAK ADDICTION: LUMME LABS

Despite all the innovation in healthcare tech, little of it focuses on tackling the long-standing addiction problem, says Akshaya Shanmugam, the cofounder and CEO of Lumme Labs, a startup in Massachusetts. Lumme, whose name is an exclamation of surprise in British English, is developing "a continuous health-monitoring platform that induces patient behavior change." Its first goal? Helping smokers quit. Combining machine learning, data analytics, gesture monitoring and principles from cognitive behavioral therapy, Lumme's software, installed on a wearable smartwatch, determines when a patient is most likely to engage in addictive behavior and offers targeted interventions in the form of text messages.

The software essentially collects gesture data, monitoring how one's hands move and tracking variances in behavior. "We train the algorithm to understand what smoking gestures look like and what eating gestures look like based on data we've collected from a huge pool of subjects," says Shanmugam. A person smoking, for instance, will be mostly keeping one hand up near her mouth, whereas the hands of someone eating move back and forth from plate to mouth.

“ We were able to demonstrate that we can detect smoking gestures within

95%

and a false positive rate of

0.005% ”

AKSHAYA SHANMUGAM,
COFOUNDER AND CEO,
LUMME LABS

It takes two weeks for Lumme’s software to learn a smoker’s habits, such as when and where she’s likely to smoke. And once the system has a handle on what’s likely to trigger a smoking episode (such as social context or certain hand gestures), Lumme can predict when, down to a span of six minutes, a person is likely to smoke. The system then sends text messages that anticipate — and warn against — smoking, steering the patient in a healthier direction.

Relying on machine learning algorithms, Lumme is “not only able to figure out when [users] need help,” says Shanmugam. “We’re also able to figure out what would be the right kind of help that we could offer to them in order to help them handle their upcoming craving or trigger.” Some people react best to positive messages, while others will react to stern reminders, she says. Shanmugam compares it to a therapist standing next to you, ready to warn you off that next cigarette. The Lumme app also automatically tracks data like how many cigarettes a user has smoked, the location where he smoked them and time between cigarettes, without the need for manual logging.

To prove the platform’s efficacy, Lumme conducted a national clinical trial to encourage smoking cessation. “The results were truly phenomenal,” says Shanmugam. Of the

system’s users, 49.2% were able to quit smoking, well above competitors’ cessation rates.

Lumme is charting unfamiliar territory, says Shanmugam. The next step is closing an equity financing round and partnering with companies to help their employees quit smoking and reduce healthcare costs. But Lumme also has a broader vision for apps and devices that constantly monitor our health and both track and anticipate a range of diseases and unhealthy habits, like food-related disorders and opioid addiction. “The bold future that we have, that we’re trying to develop, is a continuous health-monitoring platform that looks at everything a patient does on a daily basis and gives them insights and actionable outcomes from their data,” says Shanmugam. “There’s so much we can do with technology today.” ■

