

BUILDING THE HEALTHCARE INTERNET OF THINGS WITH MACHINE LEARNING



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INTRODUCTION

Jeroen Tas became Philips' chief innovation and strategy officer in February 2017, after numerous roles at the company — most prominently as the leader of the Dutch giant's Connected Care and Informatics businesses. He was instrumental in the creation of HealthSuite, the company's visionary effort to bring a "healthcare Internet of Things" cloud platform to the industry.

HOW IMPORTANT IS MACHINE LEARNING TO YOUR BUSINESS — AND WHAT STAGE HAVE YOU REACHED IN DEPLOYING IT?

Artificial intelligence is something we're already building into many of our products — and ultimately we will put it into every one of our solutions. The actionable insights that we derive from AI and data-driven propositions add tremendous value and differentiation to what we're already doing today. And we're already seeing the first results in the market from the effect of the application of that technology. A couple of years from now, we won't have this discussion because the use of AI will be widely deployed in smart devices, adaptive workflow and new user experiences.

YOU'RE REDESIGNING YOUR BUSINESS MODEL AROUND DATA...

We were a product-oriented company. Now, our products are becoming building blocks for solutions that are configured to our customers' needs. Every year there are 275 million people hooked up to a Philips patient monitor — in intensive care units, in an ambulance, in a general ward or at home. From the combination of vital signs and medical information about patients, we can optimize care operations and ensure better patient outcomes.

Philips is leading in imaging, clinical information systems and image guided therapy solutions, for minimally invasive procedures. We are now integrating different data sources to create richer and more holistic information for more precise diagnostics and personalized patient treatment. While you may still need a CT scan, an MR or ultrasound, these modalities are becoming part of a larger solution, where information is fused to enable better clinical decision making.

We can sell hospitals patient monitors, or we can sell services that help to continuously optimize the performance of intensive care units. And we believe that by looking at the data, benchmarking and interpreting the data, we can help with operational improvements while supporting better health outcomes. You need a strong informatics core that helps you build more intelligence into these devices and to connect the data from multiple sources into solutions that can provide insights at the point of care.

WHAT ACTION DID YOU TAKE TOWARD THIS GOAL OF CONNECTED HEALTHCARE?

Three years ago we started with HealthSuite digital platform to securely connect medical devices, making them smart and creating a common view of data that enables teams to analyze and orchestrate care. If we stream information from different devices and combine it with a medical profile of a patient, feeding the profiles with real-time data, we can become much more accurate in predicting whether a patient is deteriorating and needs an intervention. Doctors can get a deeper view of the patient, which leads to

more precise and timely action. It can help them to apply the right therapy.

YOU'RE DESCRIBING AN IDEAL ENVIRONMENT FOR DEEP LEARNING. WHAT IS ITS ROLE IN THIS INFRASTRUCTURE?

Deep learning is applicable to our businesses for diagnosis and treatment, which are built around our imaging systems and the related information systems. We're looking at how we can better interpret what we see on radiology images and how we can create a better-quality image, even from a grainy ultrasound. For example, we can get a live-looking, real model of your heart. If you quantify what you see on that image, you can also start comparing it to previous studies and see how things have evolved. Artificial intelligence can help interpret that image in the context of what we know about that patient. The more we know about this person, the better we can understand what we are seeing and what we should be looking for. And that knowledge can guide our interaction with the device or system, which adapts to the physicians and may give real-time feedback as they perform the diagnosis on that patient. So that adaptive and interpreting environment is a very good application area for deep learning.

HOW DOES AI HELP IN DIAGNOSING SPECIFIC CASES, SUCH AS CANCER?

AI plays a key role in supporting a precise diagnosis and finding the right, personalized treatment. We can identify the cancer on an image and start asking questions like: What is the volume of the lesion? Has the cancer metastasized? How aggressive is the cancer? Are the cells dead or alive after applying therapy? Using AI we will quantify the growth over multiple imaging studies and assess how aggressive the cancer is. From there the tissue that is relevant for a biopsy can be identified. Using digital pathology we will apply deep learning to find biomarkers on the tissue that are relevant for the diagnosis. The pathologist can highlight key cancerous cells. The DNA of the cancer cells can then be read to find genetic markers. Given this very precise diagnosis, oncologists can now search for the best therapy for this specific cancer in this specific patient with these specific conditions.

HOW WOULD MACHINE LEARNING APPLY TO MEDICAL TREATMENT?

You can start using artificial intelligence to understand the healthcare needs of a population better and identify people who might be at increased risk. Targeted and precise screening results in early detection and early intervention. We see a future of integrated diagnostics and personalized screening programs, including genetic screening. Therapies will be tuned

to the specific needs of patients, understanding that not only medication adherence is important, but also the health behaviors that impact the course of a disease. AI will play a role in guiding the patients toward better control of chronic disease, guiding them in their daily lives.

We're also using AI to support therapy. We are applying AI in guiding catheters for non-invasive procedures. We are even working on virtual and augmented reality to give the surgeon full control of the procedure.

HOW IS MACHINE LEARNING HELPING YOU DRIVE EFFICIENCY AND CONTAIN COSTS?

It's about optimizing resources to make sure you have the right people at the right time, reducing variability in outcomes through better guidance and early warning systems. The care process can be improved through AI by ensuring dynamic and optimized allocation of key medical resources and expensive machines. You improve care and costs at the same time, because you will get better outcomes when you solve problems earlier. You have both better patient outcomes and operational efficiency.

WHAT ROLE DOES THE CLOUD PLAY IN OUTCOME AND EFFICIENCY?

You need computing power to interpret data. While we gather data at the source in the hospital, at home or in the lab, it comes together in the cloud. Using a complex cancer case, we may accumulate a terabyte per patient, because we have lab tests, digital pathology, genomics, images and other data from medical records. You need an environment where you can securely aggregate the data and do the large-scale computation on it, and then pass back the results to medical professionals at the point of care.

HOW DO YOU SEE YOUR AI STRATEGY PLAYING OUT AMID THE COMPLEXITY IN HEALTHCARE?

We're building and deploying the core infrastructure for the future. We're creating holistic, patient-centric solutions for cardiology, oncology, chronic disease management and the overall health of the population. It has to become a trusted ecosystem because it's not just Philips; it's a collection of companies, research organizations and care providers in an industry that needs to embrace an exchange and openness of data, very much like the financial services industry did 25 years ago in creating the secure payment network. Many illnesses can be prevented if we support patients in a more continuous, proactive way. Many of the leading providers will go in that direction over the coming years. And by better understanding their patients and the unique risks associated with each of them, they can deploy programs in the hospital and in the patient home to create better outcomes.