Digital Twin Technology: Revolutionary to improve personalized healthcare

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Abstract:-

Personalized medicine uses fine grained information on individual persons, to pinpoint deviations from the normal. 'Digital Twins' in engineering provide a conceptual framework to analyze these emerging data-driven health care practices, as well as their conceptual and ethical implications for therapy, preventative care and human enhancement. Digital Twins stand for a specific engineering paradigm, where individual physical artifacts are paired with digital models that dynamically reflects the status of those artifacts. Moral distinctions namely may be based on patterns found in these data and the meanings that are grafted on these patterns. Ethical and societal implications of Digital Twins are explored. Digital Twins imply a data-driven approach to health care. This approach has the potential to deliver significant societal benefits, and can function as a social equalizer, by allowing for effective equalizing enhancement interventions

Keywords: Digital Twin, Helathcare, Social Implication.

Introduction:-

Can you estimate the number of Alzheimer's patients whose drug is ineffective? What about arthritis patients? And heart arrhythmia? In reality, you don't have to wonder that the US Food and Drug Administration (FDA) has the answers: 70%, 50% and 40% respectively. The number of patients with inadequate treatments varies from 38-75 percent with different illnesses from depression and osteoporosis. The key cause is any individual's very genetic structure. The above is so distinctive and their relationship so special that "average patient" treatments can not be suited to the "actual patient." Ultimately, same-diagnosed patients will respond differently to the same treatment¹.

The natural issue that arises is: is there no way of turning the care mechanism to rely on the individual patient? Yeah, that'll be customized medication. The theory of rotating healthcare from diagnosis to recovery. Now consider extending this idea to medicine: a synthetic model of the human body and its organs to research medication results. This sounds like what to do in silico experiments and organs-on-a-chip².

But consider a simulated representation of persons on which any recognized medication can be tried for that person's disease. This would allow maximum medication deduction. It can also track and warn virtual "being" until a situation occurs. Thus the actual individual should take protective action. This is what the interactive twin healthcare paradigm hopes, and delves into customized medicine³. Twin is the pioneer of precision health platform, powered by Artificial Intelligence, Internet-of-Things and Digital Twin technologies, used by doctors to safely reverse type 2 diabetes and chronic diseases. Twin platform monitors and restores impaired metabolism, the root

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cause of diabetes, through: Precise diet, Customized instructions, Continuous Mobile System Tracking. Twin's revolutionary technology lets physicians reliably recognize the body's metabolic malfunction. Every day the Twin precision software framework compares through the 1500+ health markers obtained across five non-invasive, healthy and FDA-approved sensors, combining historical and ongoing data on patient health, including detailed blood test markers performed through blood samples⁴. Through this detailed definition of metabolic disorder, the Twin platform helps doctors to build precise, customized care for your body wellbeing that suits your lifestyle and desires.

Evolution to Revolution

Several organizations created human organs digital twin versions. Hewlett Packard Enterprise collaborated with the Ecole Polytechnique Fédérale de Lausannes (EPFL) on its Blue Brain Initiative to develop automated brain models for scientific purposes. Siemens Healthineers has a Digital Twin model and Philips' own interactive heart edition. At a glance, these models look like the normal progression of radiological imaging and diagnosis—detailed representations of patient organs—but they really snowballed a revolution.

A.I. helps design in digital twins to integrate the physiological data of the organs to generate a 3D image. The above may be modeled by their basic parameters to a specific patient. Siemens Healthineers trains its algorithms with over 250 million annotated images, papers, and operating data on a vast database. This helps them to develop digital heart models based on patient data with the same patient parameters (size, ejection fraction, muscle contraction). The operator will then evaluate treatments on the platform and analyze the result. Eventually, with this particular patient, one should choose the right treatment. Simply stated, a digital twin is a simulated replica of a physical object (e.g. car engines or people) or an intangible structure (e.g. industrial procedures or marketing systems) that can be evaluated independently of its real-world equivalent for educated decisions. NASA's idea was identical. It had actual replicas of the spacecrafts on Earth when they were in outer space. This proved critical in the Apollo 13 project, where Earth's engineers must assess the problem and pursue a remedy using the same assets as the astronauts. Such undertakings gradually gave way to full-digital simulations in diverse fields.

Siemens, the German tech company, used such a twin for its Amberg plant, making commercial computer-control devices. "This digital twin is similar in all ways and is used to plan, test and simulate control units and program development devices. Once everything is funny, the digital twin hands off to the physical factory to start making stuff true," writes The Economist. Dorin Comaniciu, Vice President of Artificial Intelligence at Siemens Healthineers, said they used this approach in cardiovascular risk management ventures with European hospitals. The organization also designs templates for other organs including lungs and liver⁵.

However the idea is still emerging, with only organ twins seen. Although organizations like the Swedish Digital Twin Consortium are pressing for the concept, we are also far from being fully digitized. However, we could even have automated copies of our organs that may act as models for potential personalized treatment⁶.

"Imagine we have a patient with all their organ functions, all their cellular functions in the future, and we can simulate this complexity," explained Benjamin Meder, a cardiologist at Heidelberg University Hospital in Germany who is testing automated heart software from Siemens Healthineers. "They may foresee weeks or months in advance which patients would get sick, how a patient will respond to a certain treatment, which patients will profit more. That would revolutionize medicine."

Slippery slope problems

Obviously, several considerations would come into play with such a definition. This varies from financial capital to decide the healthcare center or indeed which patient can afford the equipment, to the very technical advancements needed to create sensors that people can carry without disturbing their everyday routine. It may even be daunting to perform models of the human body or also organs. For the Blue Brain Initiative, individual neuron simulation contributes to some 20,000 ordinary differential equations. For whole brain domains, we're staring at 100 billion equations that need to be solved simultaneously⁷.

The next move in personalized medicine is to relate these observations to your organs' 3D-models. Wearable sensors, as small as the BioSticker, feed real-time data to a central server holding your digital twin. You and your GP will get daily reminders on relevant tests/procedures to be conducted as protective steps⁸.

Seeing the future

As follows, robotic twins operate in the production sector. Like a generator, the actual entity requiring a digital twin is fitted with sensors that transmit real-time status details. These sensors' data and parameters then feed the digital twin mapping program. It can therefore gain insight into its efficiency and predict when the entity (engine) requires maintenance. As such, operators don't need daily check-ups of this specific engine, but only when the digital twin shows.

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