

Chapter 11

Digital Twins for Heart Classification Theory: Practices and Advancements Using Machine Learning

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ABSTRACT

The technique referred to as “digital twins” is becoming more widely used. This study uses keyword co-occurrence network (KCN) analysis to look at how digital twin research has evolved. The authors analyse data from 9639 peer-reviewed publications that were released in the years 2000–2023. Two distinct groups may be formed from the findings. In the first part, they look at how trends and the ways that terms are linked have changed over time. Concepts related to sense technology are linked to six different uses of the technology in the second part. This study shows that different kinds of research are quickly being done on digital twins. A lot of attention is also paid to tools that work with point clouds and real-time data. There is a change towards distributed processing, which puts data safety first, going hand in hand with the rise of joint learning and edge computing. According to the results of this study, digital twins have grown into more complicated systems that can make predictions by using better tracking technology.

1. INTRODUCTION

When something exists in the real world, a computer Twin, also called a DT, is a computer model of that thing or process. In a manner that is completely unique, it is a computer model that merges the actual world with the digital world (KamelBoulos et al., 2021). Due to the fact that the field of medicine has to transition from a “wait and respond” healing area to an interdisciplinary preventative science, there is a growing interest among individuals in the ways in which DT technology may be used in the medical sector. The ability to transfer human bodily characteristics to the digital realm, such as changes and illnesses that occur in the body, is made feasible by DTs. Because of this, DT technology also

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makes it feasible to practice personalized medicine by enabling each individual patient to get their own assessment, optimization route, health prediction, and treatment plan (Sabri et al., 2023). Therefore, Health Digital Twins (HDTs) are models of a specific organ that are constructed using high-resolution medical photographs and data about the organ's structure and function at a variety of scales (Venkatesh et al.,2024). With the use of this technology, individuals are able to devise novel approaches to administering medications, choose certain therapies, and organise clinical research. HDTs are an excellent component of the concept of Healthcare 4.0, which advocates for the establishment of a public system that is capable of delivering efficient individual healthcare (Tortorella et al., 2020).

DTs are made to function with the use of a number of technologies, one of which is called Extension Reality (XR). As a result, people who use head-mounted displays (HMDs) might feel three different degrees of immersion in the real environment (Duque et al., 2024) With the use of this technology, you can see intricate objects—like organs and the problems they create—in three dimensions more than you ever could before. You can even utilize screens that don't need your hands to operate (A. Logeswaran, et al., 2021). X-rays are being used more and more to plan surgeries and, more lately, even to help with surgery itself (Castile,et al.,2024), (Marrone,et al.,2023). Immersive solutions are also becoming more important in medical education (Pregowska, A, et al.,2022) especially for people who want to learn from home (Garlinska,et al., 2023). These days, Deep Neural Networks (DNNs) and other AI-based tools have changed how pictures are made (Hasan,et al.,2023). Some experts think that correctly putting tumours into groups could help with both diagnosis and choosing the best treatment. For instance, a way has been found to use artificial intelligence to tell the difference between skin cancers of different colours. Because of this, doctors can find illnesses earlier and keep patients from having to go through painful treatments (Hosny, et al.,2023, Young,et al.,2020). Because artificial intelligence is adaptable and can be scaled up or down based on the situation, it may potentially be used to detect cancer, particularly in its early stages (Page, et al., 2021, Rudnicka, et al., 2024). But when it comes to linking, different XR-based systems have different needs that make them special. Because of this, smart DTs along with AI-based tools and XR devices could completely change how medicine and public health are done.

RQ1:Is it possible for programmes that are based on AI to correctly differentiate between human components and medical data? What would they do with their hearts if such were the case?

RQ2:Using Health Digital Twin technology, how might algorithms that are founded on artificial intelligence help?

RQ3:Can you explain what Extended Reality is and how it interacts with solutions that are based on the Health Digital Twin?

RQ4:Should we be concerned about the repercussions of living in a world that is constructed using artificial intelligence and the metaverse? (Sabri, et al.,2023).

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