CHAPTER

1

UNDERSTANDING NATURAL HAND GESTURES IN EXTENDED REALITY

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1.1 INTRODUCTION

Gesture recognition technology has revolutionised human-computer interaction in immersive realms such as extended reality (XR). Gesture recognition technology in XR has brought about a paradigm shift in human-computer interaction. Gesture recognition technology in XR has redefined human interaction in immersive realms by providing a more intuitive and natural way of interacting with virtual objects and environments. Gesture recognition technology in XR has transformed the way humans interact with computers and virtual environments, providing a more intuitive and natural method of interaction (Hao et al., 2020). Gesture recognition technology has revolutionised the way humans interact with computers, particularly in immersive realms such as XR. It has provided a more intuitive and natural way of interacting with virtual objects and environments, eliminating the need for complex external control devices. By simply using hand movements or body gestures, users can navigate through virtual spaces, select and interact with objects, and even communicate with virtual characters.

1.2   EXTENDED REALITY

Within the realm of XR, which encompasses virtual reality (VR), augmented reality (AR), and mixed reality (MR), gestures assume a pivotal role in interacting with the virtual or augmented environment. The choice of gestures depends on the specific context, user experience goals, and the hardware being used. Gesture recognition technology, with its ability to interpret and understand human gestures, has the potential to redefine human interaction in immersive realms such as XR technologies (Ahn et al., 2020).

In the context of XR, freehand gestures denote users' capacity to engage with virtual environments through organic hand movements, eliminating the necessity for physical controllers or devices. This type of interaction aims to create a more immersive and intuitive experience by directly translating users' hand gestures into virtual actions. In shared XR spaces, freehand gestures can enable users to communicate with others through virtual high-fives, handshakes, or other gestures that mimic real-world interactions.

Leveraging gesture recognition technology within XR can reshape the way users engage with immersive environments. By allowing users to use natural hand gestures as a direct input device, gesture recognition technology eliminates the need for intermediate media and enables direct control of virtual objects and environments. This not only enhances the user experience but also opens new possibilities for intuitive and seamless interactions in VR. From a technical standpoint, developing and improving gesture recognition accuracy have been crucial in enabling this redefinition of human interaction. With advancements in input data from multiple sensors, gesture recognition accuracy has steadily improved, ensuring that the virtual environment accurately interprets and responds to the user's gestures. Figure 1.1 shows the AR, MR, and XR immersive realms. It begins with information overlaid and ends with virtual immersion. In the final timeline, the three components are considered to have been understood as XR.
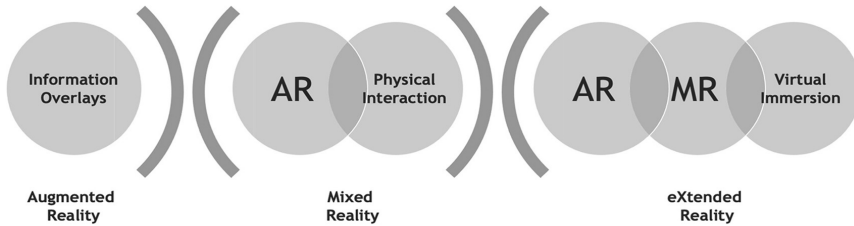
Figure 1.1 Augmented reality, mixed reality, and extended reality immersive realms

1.3   NATURAL HAND GESTURES IN EXTENDED REALITY

Real-hand gestures provide a more intuitive and immersive way for users to interact with virtual environments and objects in XR. By mimicking real-world hand movements and gestures, users can engage in activities such as grabbing, pushing, pulling, pointing, and gesturing, enhancing the sense of presence and agency within the virtual space. Users can use hand gestures to grab virtual objects, simulating the action of reaching out and picking up the objects as they would in the real world. This gesture allows for intuitive interaction with virtual objects, enhancing immersion and engagement. Hand gestures can be used to push or pull virtual objects, enabling users to move objects around within the XR space. This interaction is particularly useful for manipulating larger objects or rearranging elements within a scene, providing users with a greater sense of control and agency. Pointing gestures allow users to direct their attention towards specific objects or areas within the XR environment. By pointing with their fingers or hands, users can indicate targets, navigate menus, or interact with interface elements, facilitating communication and interaction within the virtual space. Gesturing involves using hand movements to convey meaning or commands within the XR environment. Common gestures such as thumbs-up, waving, or making a fist can be interpreted by the system to trigger specific actions or responses, adding expressiveness and interactivity to the user experience. Table 1.1 lists the types of gesture descriptions.