

XR TECHNOLOGY AND ARTIFICIAL INTELLIGENCE



WHAT IS THE XR ASSOCIATION?

The [XR Association](http://www.xra.org) promotes the dynamic growth of the XR industry. We convene and educate policymakers, thought leaders, researchers, developers, civil society, and the public on XR's infinite potential and serve as the premiere resource for anyone interested in learning about the applications of immersive technologies. Our member companies are united in our mission to champion the responsible development and thoughtful advancement of XR solutions that foster positive societal outcomes. Let us help you explore the endless potential of XR.

WHAT IS XR TECHNOLOGY?

Extended reality, or "XR," encompasses spatial and immersive computing technologies including virtual (VR), augmented (AR), and mixed reality (MR). XR is changing the way we learn, work, create, and provide essential human services. By delivering efficiencies in manufacturing, accelerating learning and job training, improving vital healthcare, and supporting national security efforts, XR is already having a significant impact on sectors across the spectrum. What's more, XR will be an essential component of the next generation of computing technology, revolutionizing the way we engage the world around us.



Virtual Reality (VR) replaces a user's view of their physical space with a new virtual environment such as a work area like a factory floor, or something more fanciful like a replica of the solar system.



Augmented Reality (AR) layers digital content onto a user's view of their physical environment, thus providing a composite view. A familiar example might be the heads-up directions displayed for a driver on her vehicle's windshield.



Mixed Reality (MR) allows a user to experience simulated content within their physical space and to manipulate and interact with virtual elements in real time. For example, MR allows medical students to practice surgical procedures by interacting with holographic patient simulations.



WHAT IS ARTIFICIAL INTELLIGENCE?

Artificial intelligence, or “AI,” refers to computer systems that can perform tasks that typically require human intelligence. These tasks can include learning, reasoning, problem-solving, perception, language understanding, content generation, and decision-making.



Artificial Intelligence, generally speaking, is a technology that allows machines to analyze data, make decisions, and perform tasks. These systems utilize both inputs from the environment and direct human inputs.



Generative AI creates content including text, images, audio, and video when prompted by a user. These systems generate responses using algorithms that are trained on various data sources which may include open-source information, such as content from the internet.



Machine Learning is a component of AI that focuses on the use of data and algorithms to imitate the way humans learn. Through machine learning, an AI will improve performance on specific tasks over time - without being explicitly programmed - by recognizing patterns in data and making predictions or determinations based on that data.

BUILDING THE NEXT GENERATION OF TECHNOLOGY

XR and AI are complementary technologies that are joining forces to drive innovation and enhance people’s lives. The combination of XR and AI opens limitless possibilities for creating more immersive, intelligent, personalized, and interactive experiences across myriad sectors.

AI Creates More Natural and Frictionless XR Experiences

XR developers are using AI to create immersive experiences that foster a sense of presence and authenticity.

- AI-powered gesture recognition enables users to interact with virtual content through natural hand movements without the need for handheld controllers.
- AI helps to enable XR “passthrough” (a feature that allows you to step outside your view in VR to see a real-time view of your physical space) so users feel more comfortable and connected to their actual, physical surroundings while enjoying an immersive experience.
- AI assistants allow XR users to speak naturally when engaging their device, rather than being limited to specific voice commands. Generative AI also facilitates shorter and more useful answers.

AI Enables Tailored User Experiences in XR and Supports Individuals with Physical Limitations

AI helps XR to deliver customized experiences based on a user’s preferences and individual needs.

- AI can assist in tailoring XR experiences by adapting the virtual environment to a user’s learning style. This is particularly useful for educational or job training applications.
- AI algorithms can analyze user inputs including speech and eye movements and adapt XR interfaces accordingly. For instance, AI-powered gaze tracking can enable users to interact with virtual environments simply by looking at objects or controls, which is particularly beneficial for individuals with limited mobility.
- AI can add accessibility features to XR content including closed captions for the hearing impaired and enhanced color contrast for users with visual impairments.



AI Supports XR Developers and Makes Content Creation Easier

AI is giving more people the ability to become digital creators, leading to diverse immersive experiences.

- AI can assist in generating XR content such as 3D models, textures, animations, and even entire virtual environments. For instance, AI-powered tools can automate the process of creating realistic landscapes, characters, and objects, thereby speeding-up development workflows and reducing manual labor. This can significantly accelerate the creation process for designers and developers.
- AI-powered plug-ins and extensions for XR development platforms provide developers with pre-trained models and templates for common tasks such as object recognition, voice interaction, and scene generation.



XR Helps AI to Learn More Effectively

XR is essentially serving as a sandbox for AI by creating virtual worlds. Looking to the evolution of human cognition, researchers use XR to expose AI to ever-changing conditions as well as large numbers of human users with whom they must interact. The adaptability required to function in not only fluid environments such as virtual worlds, but also in the real world, is necessary for the highest levels of AI development.

XR AND AI IN ACTION

When integrated, XR and AI create a powerful synergy that transforms the way we interact with the digital and physical worlds, providing benefits to people in a variety of important ways.



Accessibility: Together, XR and AI offer transformative solutions for people living with disabilities, enhancing their daily experiences and facilitating greater inclusivity. Envision, for example, brought assistive technology to smart glasses. Envision's software uses AI to extract information from images and then relay that information orally, so users with visual impairments can experience an enhanced understanding of their environment.



Healthcare: XR and AI are combining to foster a more interactive healthcare environment and facilitate delivery of patient services. For example, XRHealth is introducing an AI-powered clinician on their XR software platform that can offer mental, physical, and occupational health treatment. This helps to provide much-needed patient support amid clinician shortages, and enables virtual consultations and remote patient monitoring - expanding access to care for individuals in rural and underserved areas.





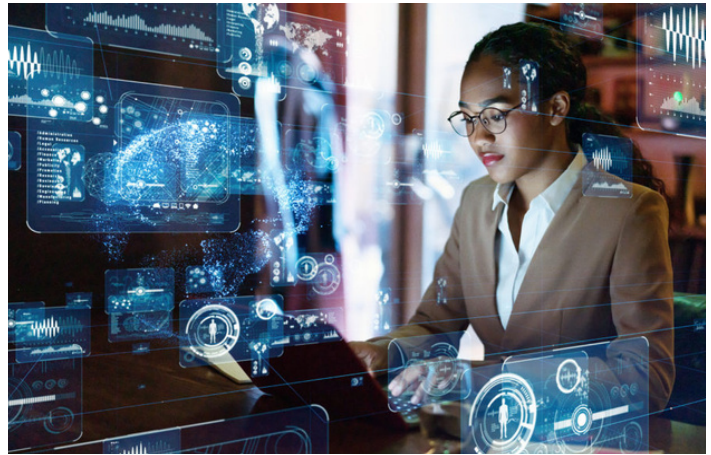
Education: In the classroom, AI and XR are revolutionizing education by creating personalized immersive learning experiences. For example, students can explore historical sites in virtual reality, conduct virtual science experiments, or practice surgical procedures in augmented reality, enhancing comprehension and information retention. AI algorithms analyze students' learning preferences, performance data, and feedback to generate personalized learning paths within XR environments. By adapting content and difficulty levels based on individual needs, AI enhances engagement and facilitates mastery of complex concepts.



Skills Training: Combining XR's immersive environments and AI's ability to personalize experiences, companies are creating engaging, efficient, and scalable training programs. For example, Boeing utilizes VR and AI for aircraft maintenance training. Virtual simulations of complex procedures are enhanced by AI algorithms that provide real-time guidance and feedback to trainees, improving their skills and efficiency.



National Security: AI and XR are supporting national security in a variety of ways. AI algorithms can analyze vast amounts of data from various sources - including satellite imagery, sensor networks, and media feeds - to provide real-time intelligence and situational awareness to decision-makers. XR technologies then enable visualization of this data in immersive environments, allowing analysts to identify patterns, assess risks, and plan missions more effectively.



Emergency Response: AI-powered simulations within XR environments provide realistic training scenarios for law enforcement officers and emergency responders, enabling trainees to practice decision-making, teamwork, and crisis management skills in a safe and controlled environment. AI and XR technologies also support disaster response and emergency management efforts by providing real-time situational awareness, coordinating response efforts, and facilitating communication. XR interfaces enable visualization of disaster scenarios, evacuation routes, and resource allocation plans, enhancing coordination and decision-making in high-pressure situations.



Manufacturing: AI and XR are working together to create Intelligent Digital Twins (IDTs) - bringing us closer to a future of sustainable manufacturing environments. Using massive amounts of data generated by an XR model of a physical counterpart such as a machine, AI continuously observes, learns, analyzes, and provides updates on the real-life machine's health. With a potential end state of predictive analysis, IDTs will serve as critical enablers for digitizing factories.

