CAROUSEL+

ARTIFICIAL INTELLIGENCE FOR EXPANDED SOCIAL INTERACTION IN A VIRTUAL WORLD
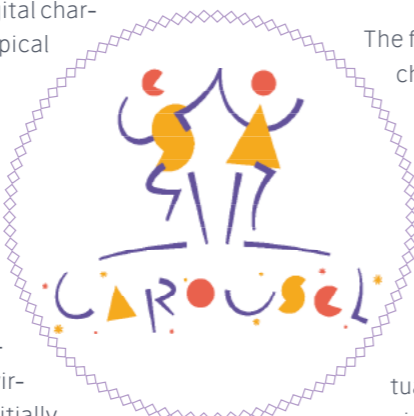
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The technologies of Virtual Reality and Augmented Reality are well established in the entertainment industry, but are also used in industrial applications. AR glasses are used during assembly tasks to show situation-related information in the operator's field of vision, while VR environments are employed in remote maintenance scenarios. Project Carousel+ is funded by the European Union and is tasked with investigating the potential of the virtual world for social interaction.

The aim of the project is to create a new scientific and technological basis for real-world, collaborative, and integrative AI scenarios (Real World Social and Physical AI) to improve the quality of human interaction with digital characters. Dancing was chosen as a prototypical application scenario.

Dancing together can be conveyed as a shared experience, not just an auditory and visual experience, but also a sensory one in a new virtual immersive environment now being developed.

Equipped with a VR headset and a sensor-actuator suit, people meet in the virtual world to dance with each other – initially as visualized by avatars, for example, a teddy bear figure. The sensor suit transmits the dancers' movements to a digital representation and, conversely, receives sensor signals generated when the avatar is touched. The immersive dancer can also meet an AI-controlled virtual character on the dance floor instead of the digital representation of a real-life dance partner. These characters can generate new movements on their own that are both creative and demonstrate "self-serving" behavior (autotelic) simply through curiosity and intrinsic motivation. Scenarios are even conceivable in which human-controlled avatars and the AI-controlled virtual characters meet on the dance floor. One particular challenge is created by the complex interdependence between motion, music, tactile contact, and the dancers' emotions.

The first prototype to be developed is a virtual character that can perform simple rhythmic motions like swaying, a la-ola wave (as seen in sports stadiums), or free-form dance with an individual partner. This capability will then be expanded to more complex couple dances like the tango or waltz, and to modern jazz, ballet, hip-hop, as well as acrobatic dances like breakdancing and pole dancing. Eventually, it will even extend to group dance dynamics with multi-agent simulations and many participants. Implementation will be achieved with the help of various learning methods, for example, reinforcement learning and motion models.

This implies understanding the movements and synthesizing them so as to appear natural and interactive. This requires the use of multi-modal input parameters, such as touch via pressure sensors, and also recognizing many different attributes like emotions, fatigue, and perceptions of the environment, the group, and the individuals.

The Agents and Simulated Reality research department, led by Prof. Philipp Slusallek, develops smart simulation technologies for the control of physically plausible virtual characters. To generate high-quality animated content, signals from multiple individuals are interpreted in real-time to achieve a seamless and engaging visual experience during the dance. The integration of sensor data in a game engine enables visualizations of the user avatars. A character-controller is generated from a user analysis and the current scene to animate the virtual character. Special machine learning models are used to train the different types of movements found in the different dances. The realism is increased when the characters can work intrinsically and learn from their own experience. In the special case of a training scenario, visual and haptic feedback is integrated with an agent-controller.

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CAROUSEL+ is part of a new branch of research called "Real-World Social and Physical AI" that investigates application scenarios in the areas of social, entertainment, health care, education, autonomous driving, and safety and disaster management.