IET International Travel Award 2024

IEEE Haptics Symposium 2024, Long Beach, USA

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I was very fortunate to be able to travel to Long Beach in California last month to present several of my research projects at the 2024 IEEE Haptics Symposium. This is the largest Haptics conference of the 2024 calendar and was an amazing opportunity to network and present my work to some of the foremost experts in this exciting and rapidly growing field. Haptics, broadly defined as the study and manipulation of the sense of touch, is an extremely diverse field which encompasses serious mechanical and electrical engineering, human-computer interaction, the biology of the human sensory system and various aspects of the psychology and cognition of physical sensations. Whilst they feature the usual assortment of paper presentations, posters, workshops and keynotes, haptics conferences differ slightly from regular conferences as they have a strong emphasis on getting attendees hands on with the research being presented, through hands-on-demonstrations. In addition to my paper presentation, I also presented two hands on demonstrations of my work in the main conference, and was invited to present a third in a workshop session.

The main project I presented as a full paper and demonstration looked at the design and construction of hardness-changing haptic interfaces. The feel of hard and soft objects is important in a range of areas from virtual reality, where the player in a virtual game may wish to touch clothes and furniture, to medicine where a student needs to learn to examine and characterise lumps and perform surgery on soft organs. This work looked at using a concept known as particle jamming to create haptic devices that can become physically harder or softer in a person's hand. Particle jamming is an emergent technology borrowed from the world of soft robotics and works on the idea that a particle fluid (seeds, sand, glass beads, etc.) will become stiffer and more viscous when the individual particles are jammed together. Whilst this has been demonstrated several times using a vacuum to compress particles in an airtight container, my paper and demonstration proposed several mechanical designs that can produce the same effect at a fraction of the size, cost and weight. Having the opportunity to present this work to an international audience, including the Stanford Professor whose research in soft haptics inspired me many years ago, was incredibly rewarding and I was surprised but extremely pleased to see the work receive an Honourable Mention for the conference's Best Paper Award. I am currently working on a number of medical simulations that will use this technology to simulate the soft tissues that doctors need to examine when assessing a patient.

The second project that I presented was an interactive demonstration of a simulated neurological examination, delivered in virtual reality and augmented with haptic feedback from a robot. Neurological examinations are inherently physical and require

doctors to examine a patient's muscle tone and motor control by physically pressing against their limbs and feeling for signs of weakness, asymmetry or loss of control. This is impossible to demonstrate to medical students through textbooks and videos, so part of my recent research has looked at ways of simulating the physical presentations of conditions such as Parkinson's and Stroke so that students can feel the motor response from their virtual patient. This demonstration sparked several interesting conversations with other attendees at the conference, including a researcher from the a medical school in Illinois who would like to collaborate with me on other projects applying haptics to medicine and healthcare.

Beyond presenting my own work, I had a fantastic time meeting and learning from other researchers who are doing fascinating work in other areas of haptics. Among them were PhD students and PostDocs from Canada, America, Mexico, Germany and Italy who are working on applying aspects of haptics to brain-machine interfaces, physical rehabilitation and driver assistance. I also had opportunities to meet and interact with very senior researchers from the Max Planck Institute, Korea Tech, the Technical University of Delft and the University of California, Santa Barbra who I may not have any imminent opportunities to work with, but who shared some fascinating comments and ideas about my work and other directions I could pursue in the future. I was also able to spend one of the lunch breaks with a senior scientist from MIT who shares my longer-term ambition to study the combination of haptic effects (like vibration, softness and temperature) and who invited me to visit her lab later this year to work on building temperature changing medical models to train doctors and surgeons to examine the vascular system.

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