Summary 2:

A Natural User Interface for Realistic Tactile Perception of Object Surface Texture

Accurate haptic feedback can improve the perception of immersion in VR environment. There are previous haptic devices to generate tactile feedback but those are generally not wearable and would be less natural in the interaction sense. The system proposed contains a recording device to record surface textures, a processor to process that data, and a simulation device to render the tactile sensation. The recording device has an accelerometer, force sensor, and a control board. This can be worn on a finger and moved across a surface to record that texture. The processor used the data recorded to train a neutral network to find the vibration accelerations for that particular texture. The approximate transfer function from the neural network is programmed on to the simulation device to provide the voltage feedback with respect to the force and acceleration applied to simulated the texture. Users were tested with a focus on texture distinguish, intensity, and realism with no help from visual feedback. Users were able to distinguish the simulated texture with at least 70% correctness. The different intensities of the feedback are better for different textures.

BibTeX:

@INPROCEEDINGS{8048178,
author={Z. H. Lin and S. Smith},
booktitle={2017 9th International Conference on Intelligent Human-Machine Systems and Cybernetics (IHMSC)},
title={A Natural User Interface for Realistic Tactile Perception of Object Surface Texture},
year={2017},
volume={2},
number={},
pages={370-373},
abstract={Haptic feedback can increase the realism when interacting with virtual objects in a virtual environment. In this study, a natural user interface for providing realistic tactile feedback for object surface textures was developed. Users can wear the interface device in a virtual environment and naturally interact with virtual objects as they interact with physical objects in the physical environment to perceive object surface texture. A recording device composed of an accelerometer and a force sensor was designed to record the surface texture of an object. A simulation device composed of an accelerometer, a force sensor, and a piezo actuator was designed to reproduce the tactile feedback. A neural network was used to train an approximate function to transform the recorded data to simulation data. User test shows that users can perceive the simulated surface texture with at least 70% of correct rate.},
keywords={force sensors;haptic interfaces;surface texture;tactile sensors;virtual reality;haptic feedback;interface device;natural user interface;neural network;object surface texture;realistic tactile feedback;realistic tactile perception;simulated surface texture;virtual environment;virtual

objects;Acceleration;Haptic interfaces;Piezoelectric transducers;Surface texture;Thumb;Vibrations;haptic feedback;natural user interface;neural network;surface texture},
doi={10.1109/IHMSC.2017.194},
ISSN={},
month={Aug},}