

ELECTIVE IN ROBOTICS 2010/11

Two short projects in Module “Locomotion and Haptic Interfaces”

Human Hand Tracking using Kinect

The Kinect depth sensor is having a lot of success in the robotics research community, with many possible uses and applications. One reason is that it is cheap and easy to use. The other is that it embeds an efficient human body motion tracker based on the machine learning algorithms developed by A. Blake and his group in the UK (see [1, 2]). The paper [3], its supplementary material [4], and the video [5] present their latest results. As a further development, people have started using Kinect for tracking the human hands (e.g., using then this input for commanding robot motion). There are several computer vision approaches implemented, depending on the objectives and the level of detail needed (see the videos [5-13] downloaded from YouTube). Some Italian groups have started using Kinect together with a kinematic model of the human/robot hand for studies on grasps and haptic interfaces, see [14] (and the references therein) and [15] (and the web site <http://handsdvi.dii.unisi.it>).

In these two short projects, the ultimate goal is to develop a kinematic skeleton-type algorithm for tracking finger motions of a human hand by Kinect. The human wrist is assumed to stay (almost) fixed. No gesture interpretation is needed. Partial results and/or a more limited scope and applicability conditions are indeed acceptable. The two student groups may work in parallel (on two different ideas) or in sequence (the second group taking the results of the first one as starting point), according to their agreement.

[1] Kinect Body Tracking Reaps Renown - Microsoft Research

<http://research.microsoft.com/en-us/news/features/kinectskeletal-092711.aspx>

[2] The Motion Tech Behind Kinect - The Institute

<http://theinstitute.ieee.org/technology-focus/technology-topic/the-motion-tech-behind-kinect779>

[3] J. Shotton, A. Fitzgibbon, M. Cook, T. Sharp, M. Finocchio, R. Moore, A. Kipman, and A. Blake, “Real-Time Human Pose Recognition in Parts from Single Depth Images,” *24th IEEE Computer Vision and Pattern Recognition Conf. (CVPR 2011)*, 2011

[4] Supplementary material.

[5] Accompanying video: CVPR_2011_MRC_Video.mp4

[6] kinect - fingertip detection.mp4

[7] kinect - hand segmentation.mp4

[8] Real Time Hand Posture_Gesture Recognition with OpenCV.mp4

[9] Real-time Hand Motion_Gesture Detection for HCI - Demo 1.flv

[10] Gesture feature extraction using openCV.mp4

[11] Palm position tracking (can be tracked with whole arm).mp4

[12] gesture and fingers recognition.mp4

[13] Introducing_the_Kinect_augmented_org.flv

[14] V. Frati, D. Prattichizzo, “Using Kinect for hand tracking and rendering in wearable haptics,” *IEEE World Haptics Conf.*, 2011

[15] Hands_DVI_SIDRA2011_Poster.pdf

ADL, November 21, 2011