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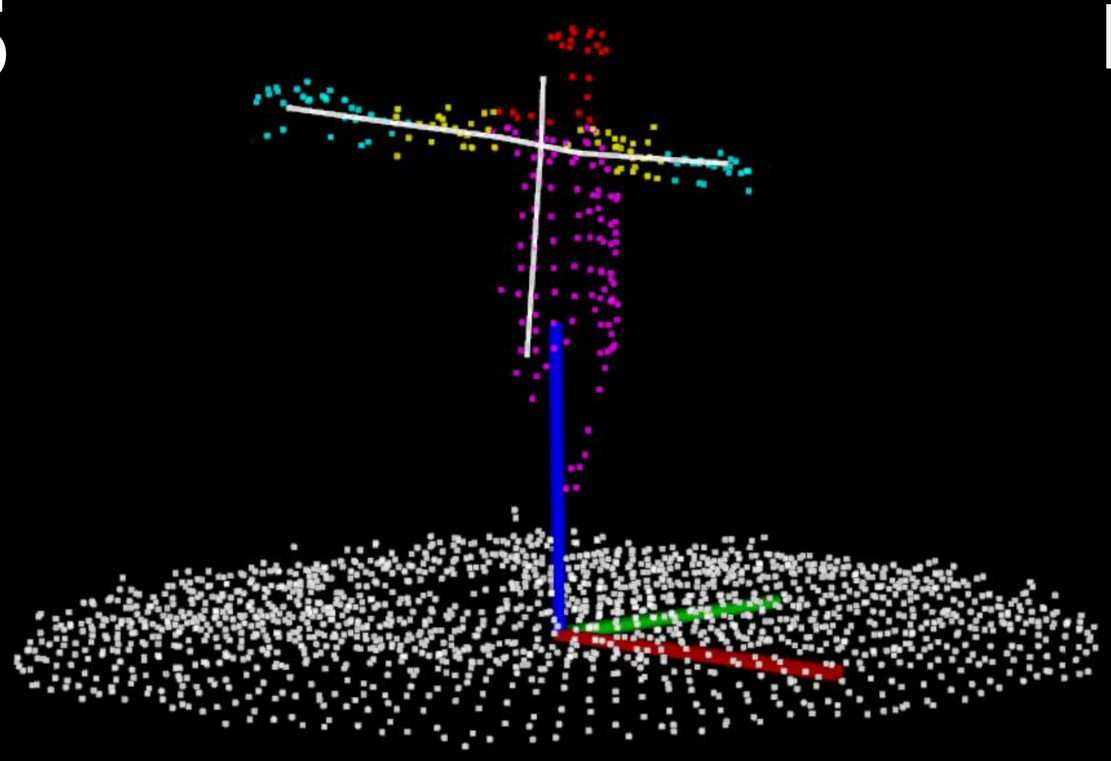

Human gesture recognition

using top view depth data obtained from Kinect sensor

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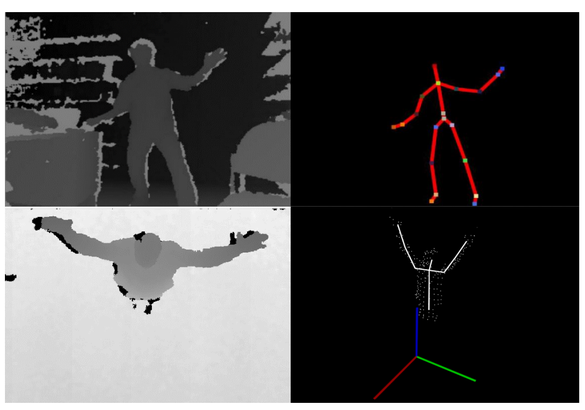
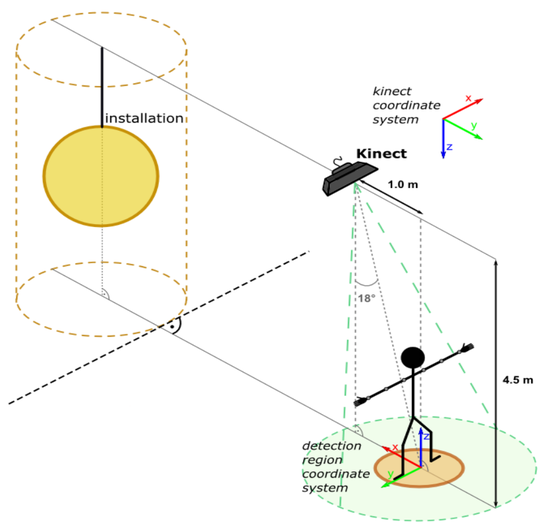


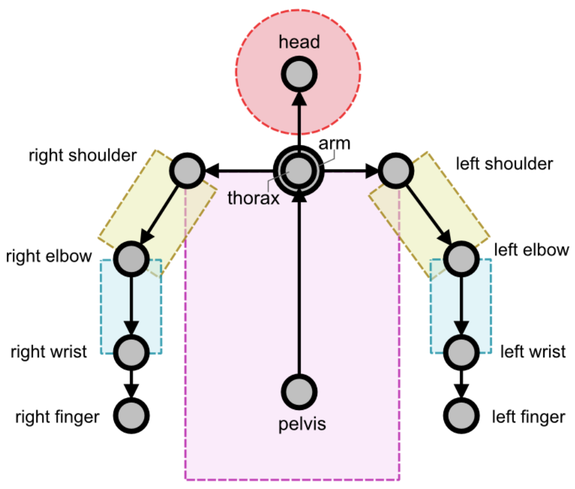
System overview

Proposed system is suitable for real-time human tracking and predefined human gestures detection using depth data acquired from Kinect sensor installed right above the detection region. Such an installation is needed in case the sensor must be placed outside of the detection region (e.g. security surveillance systems, human computer interaction, etc.). Well established existing solutions like Microsoft Kinect SDK does not work under these conditions so the system had do be designed and built from scratch.



Human Tracking

The human tracking consists of two phases. First, the presence of a human in the detection region is detected. A subject must perform the initial gesture (straight posture, arms spread out) which enables the system to estimate the human height and derive other body parts proportions. Then a bootstrap particle filter based tracker is started. Each particle corresponds to a different human pose represented by the articulated human model. In each frame, 640 particles with 16 parameters are iteratively processed.

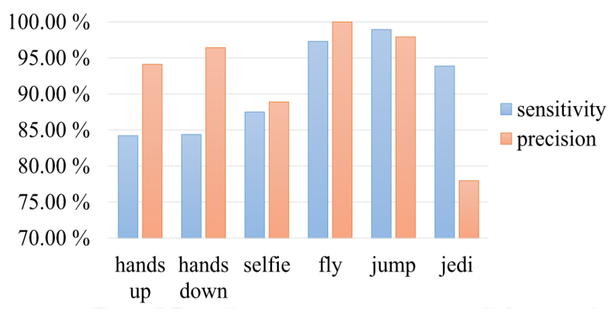


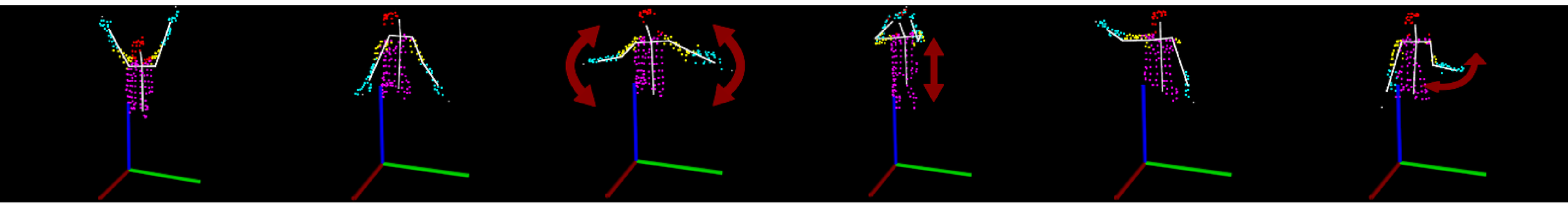
Gestures

The gesture recognition part utilizes the timed automaton conforming to the human body poses and regarding tolerances of the joints positions and time constraints. Each gesture consists of ordered sequence of separate poses defined as configuration of the articulated human model. A tolerance is assigned to each pose so that the variance in gesture performance would be allowed.

Results

The system was tested against the manually annotated 61-minutes-long recording of ten different people. The 92.38\% sensitivity was reached as well as the real-time performance exceeding 30 FPS. No a priori knowledge about the tracked person is required which makes the system suitable for seamless human-computer interaction solutions, security applications or entertainment industry. The system was accepted for one of such applications – the entertainment solution enabling a user to control a glass kinetic installation which was exhibited at Euroluce 2015 in Milan, Italy, by Czech company Lasvit.





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