|  |  |  |  |
| --- | --- | --- | --- |
| Title | 3D Gesture Recognition and Adaptation for Human–Robot Interaction | | |
| Author(s) Name | Jubayer Al Mahmud, Bandhan Chandra Das, Jungpil Shin, Khan Md Hasib, Rifat Sadik, MF Mridha | | |
| Contact Email(s) | firoz.mridha@aiub.edu | | |
| Published Journal Name | IEEE Access | | |
| Type of Publication | Journal | | |
| Volume | 10 | Issue |  |
| Publisher | IEEE | | |
| Publication Date | 2022/11/1 | | |
| ISSN | 2169-3536 | | |
| DOI | 10.1109/ACCESS.2022.3218679 | | |
| URL | https://ieeexplore.ieee.org/abstract/document/9933761 | | |
| Other Related Info. |  | | |
|  | | | |

|  |  |
| --- | --- |
| Abstract |  |
| Gesture-based human-robot interaction has been an important area of research in recent years. The primary aspect for the researchers has always been to create a gesture detection system that is insensitive to lighting and backdrop surroundings. This research proposes a 3D gesture recognition and adaption system based on Kinect for human-robot interaction. The framework comprises the following four modules: pointing gesture recognition, 3D dynamic gesture recognition, gesture adaptation, and robot navigation. The proposed dynamic gesture recognition module employs three distinct classifiers: HMM, Multiclass SVM, and CNN. The adaptation module can adapt to new and unrecognized gestures applying semi-supervised self-adaptation or user consent-based adaptation. A graphical user interface (GUI) is built for training and testing the proposed system on the fly. A simple simulator along with two different robot-navigation algorithms are developed to test robot navigation based on the recognized gestures. The framework is trained and tested through a five-fold cross-validation method with a total of 3,600 gesture instances of ten predefined gestures performed by 24 persons (three age categories: Young, Middle-aged, Adult; each with 1,200 gestures). The proposed system achieves a maximum accuracy score of 95.67% with HMM for the Middle-aged category, 92.59% with SVM for the Middle-aged category, and 89.58% with CNN for the Young category in dynamic gesture recognition. Considering all the three age categories, the system achieves average accuracies of 94.61%, 91.95%, and 88.97% in recognizing dynamic gestures with HMM, SVM, and CNN respectively. Moreover, the system recognizes pointing gestures in real-time. | |