HPC-based Hand Gesture Dataset Generation for Detection & Tracking

Organizations

Youbiquo is an Innovative SME founded in 2013, specialized in Artificial Intelligence, Computer Vision, and Machine Learning applied to Augmented Reality wearable electronic devices.

Bi-rex is one of the 8 Italian Competence Centers funded by the Italian Ministry of the Economic Development within the Industry 4.0 National Plan.

Cineca is the largest Italian supercomputing centre with an HPC environment equipped with cutting-edge technology and highly qualified personnel which cooperates with academia and industrial partners.

End User

YOUBIQUO

Domain Expert

bi-rex
Big Data Innovation & Research Excellence

HPC Provider

CINECA

The partners Bi-rex and Cineca are part of the Italian NCC.

ITALY
HPC Competence Center

The Challenge

Hand tracking and gesture recognition are critical components of Augmented Reality technology as they allow users to interact with virtual objects in a natural and intuitive way. To make hand tracking and gesture recognition truly seamless, two main challenges need to be addressed: latency reduction and the accuracy and robustness of detecting hand gestures in different scenarios in the shortest time. Most similar solutions are hardware-dependant and standard products are calibrated towards the detection of one hand at a time. Currently on the market are either predefined numbers of recognized gestures or expensive and time-consuming custom solutions for training non-defined gestures upon request.

The Solution

The solution developed in the experiment, called "HandyTrack", improves the performance of hand gesture detection and tracking algorithms by using HPC to train deep learning. The use of HPC allows our solution to reduce the time required for training algorithms and generating larger, more diverse datasets. This leads to improved accuracy and robustness of hand gesture detection and tracking algorithms and provides unlimited dynamic gesture recognition that is calibrated to the detection of both hands at the same time.

The Impact

This experiment will have a strong business impact on the profitability of a software library for hand gesture recognition and tracking based on dataset and training produced with HPC. It offers a higher level of accuracy in hand gesture detection in less time, which is an improvement on the state of the art represented by the main competitors. The overall result will be embedded both in a standalone software library bundled in wearable electronic devices and in a high-performance cloud-based application.

Moreover, reducing the time required for training and generating more realistic and diverse datasets gives HandyTrack the potential to significantly advance the field of touchless interaction and make hand gesture-based interfaces a reality. The designed solution has a human-centered vision and consequent social impact increasing inclusivity and diversity. For example, the generation of unlimited customized hand gesture datasets can be used to support people with disabilities in their interactions with non-disabled persons and machines as in the case of people who are deaf mute.

Benefits

· Improved training time: Up to 80% reduction of training time for neural networks.
· Reduced costs: Reduced cost of generating custom hand gestures by 99.6%.
· Natural user experience: Ability to switch from a static to a dynamic hand gesture model.
· Enhanced capability: Creation of an unlimited hand gesture dataset.
· New opportunities: Address previously untapped domains and market segments.