Multi Sensor Performance Driven Data Fusion for Sign Language Synthesis

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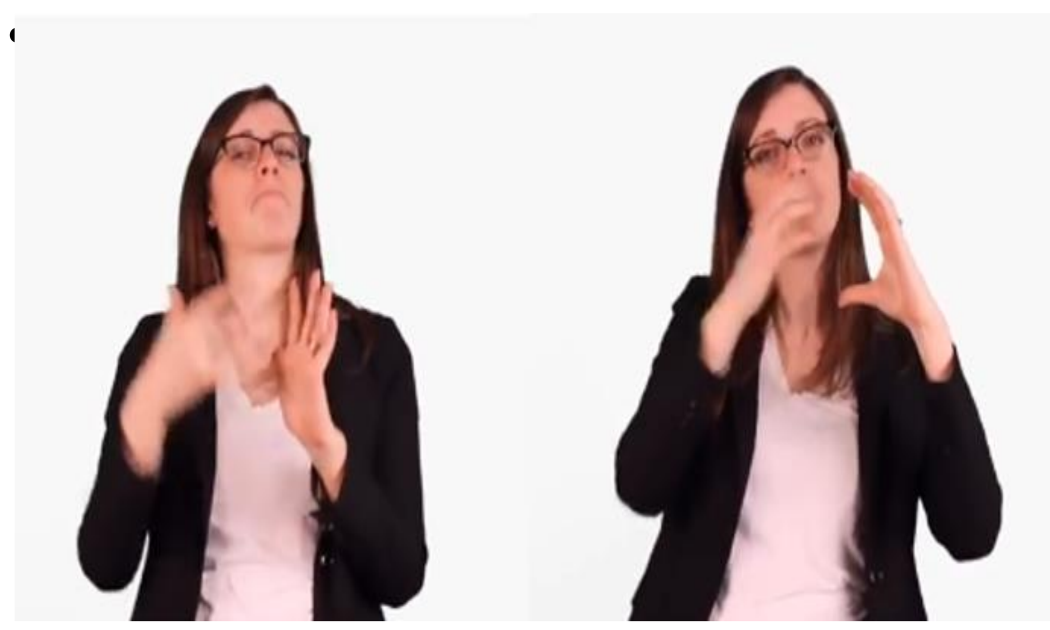
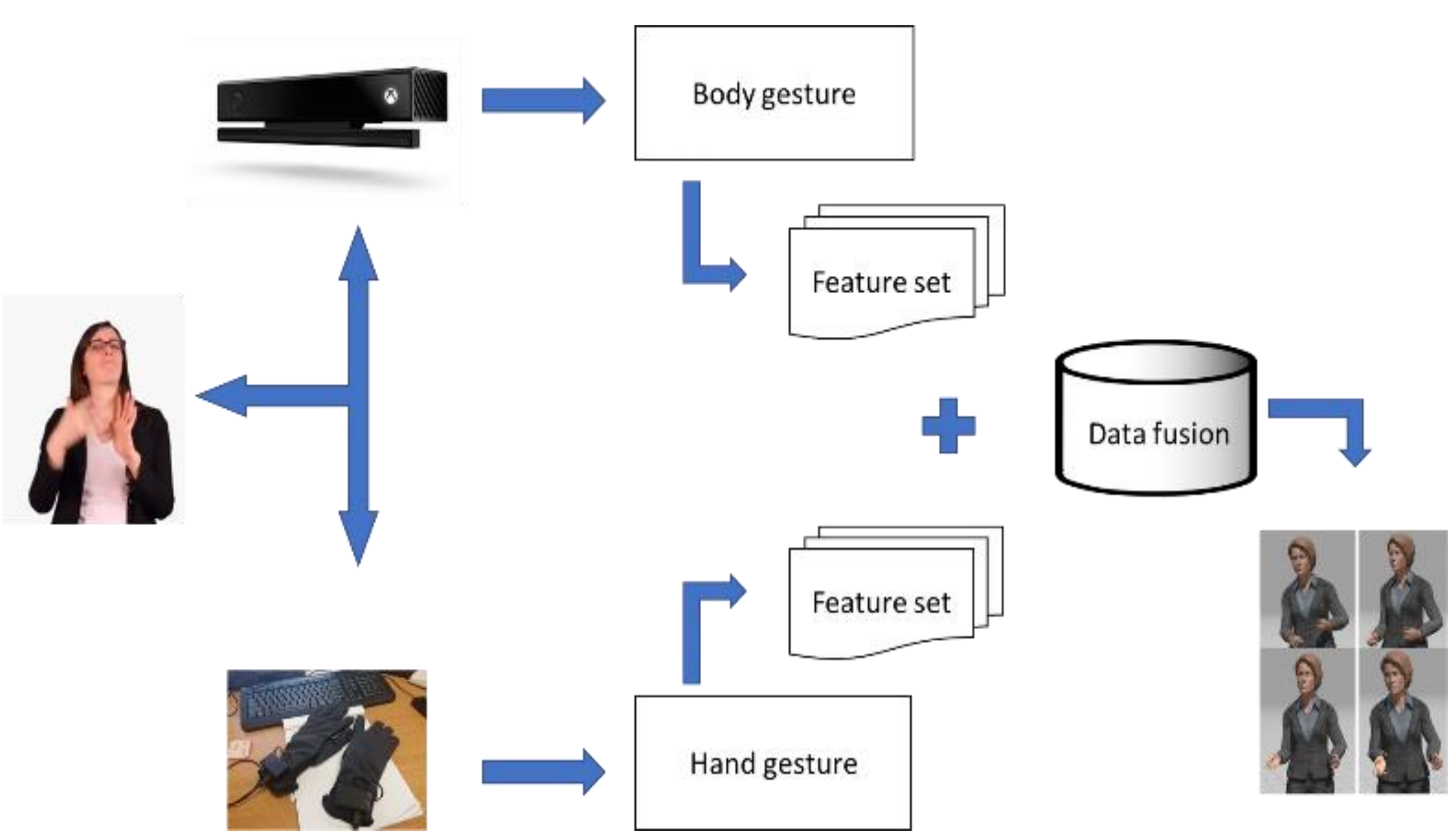
Introduction

- Sign Language is a visual language that is used by hearing impaired peoples for communication. Sign language is composed of three features, namely manual signs, non-manual signs, and finger-spelling. Manual signs are the gestures that are represented by hand shapes, motions, and positions, whereas non-manual signs contain facial expression or body postures. They add syntactical information to the gestures that can be the part of a sign or modify the meaning of a manual sign. In finger-spelling gestures, different words are spelt out in local verbal language using fingers during communication Hence, Sign Language Recognition (SLR) systems aim to provide a robust and reliable interface capable of handling the complex requirement of the language and through which one can get feedback while interacting with a signer.
- Sign language recognition systems have been developed by various research groups, but most existing systems focus on just animating the hand thereby losing a lot of information from non-manuals in the process. It has been observed that, during gestural communication, the signer starts using finger-spelling to convey meaning in verbal language along with mouthing words, making facial expressions, and often moving in certain ways to further convey the message. The first image is representative of all aspects of sign language communication. In this research work, we propose a multi-sensor system that uses the Data glove and Kinect to record manual and non-manual information



Video capture of ASL signer from ASL-LEX dataset (image courtesy of ASL-LEX).

System Framework



Hardware

- **VMG30 Data glove**
- VMG30, as seen in second image, is a multi-sensor haptic glove that records hand and joint position through its different sensors. As per the specifications from the producers of the glove, the measuring sensor is located at a joint and can directly measure the joint rotation. To account for thumb joint motion beyond the metacarpophalangeal and interphalangeal joint, the VMG 30 glove has a thumb crossover sensor. In total, the VMG30 data glove system provides up to 30 high accuracy joint-angle measurements

- **Microsoft Kinect V2**
- Microsoft Kinect is an input device capable of producing 3D color images. It is a high-resolution low-cost RGB sensor that produces images with synchronized color and depth. It was originally intended for use for the X-box gaming console, but researchers in the computer vision field realized that it could be used in applications other than gaming and was readily available and at a more cost-effective rate to your regular 3D cameras. Since its creation, there have been a number of works on using Microsoft Kinect in the field of computer vision.
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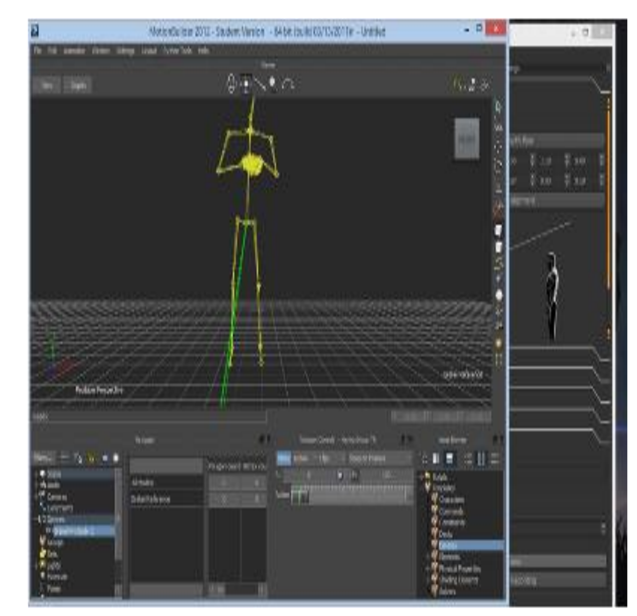
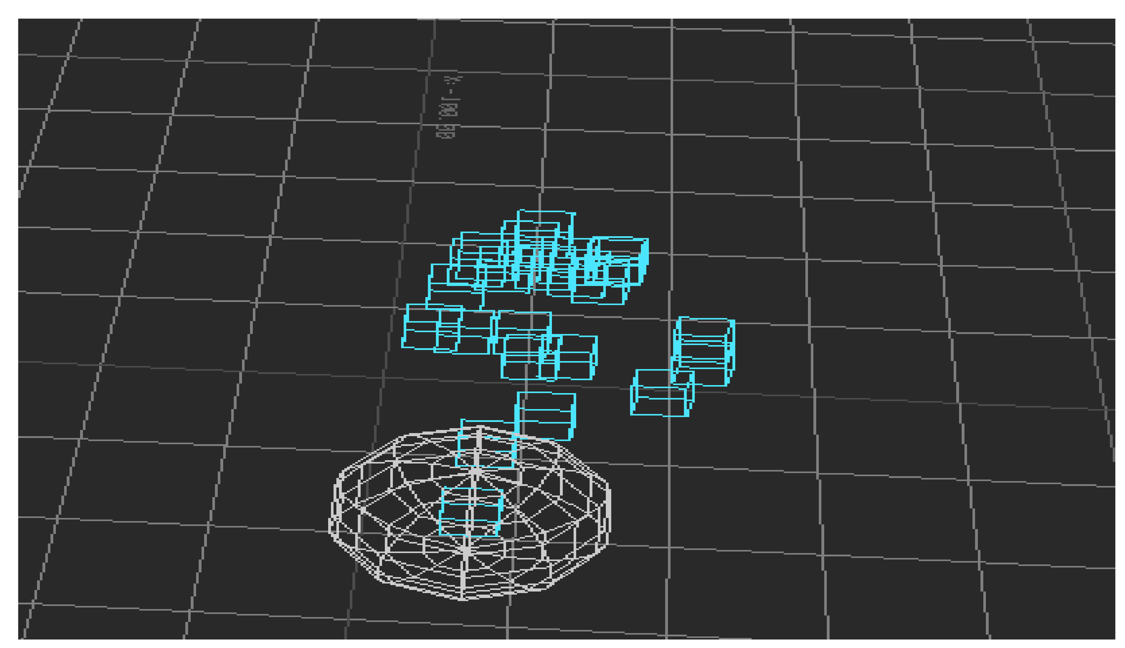
Data Collection\ Initial result





Conclusion

In conclusion, this system would aid in the recognition of isolated signs in the American Sign Language (ASL) using low cost and easily available devices such as the data glove, and Microsoft Kinect. It also shows the improved accuracy in animation as a result of employing multi-sensor frameworks, and the use of boosting algorithms to supplementing the possible reduction in performance arising from the lower cost devices. This work focuses on the use of gesture recognition in the area of sign language learning and education, by seamlessly mapping the hand gesture onto the hand model in near real-time, but as a future extension of this study, a system can be developed to teach and aid in the learning of sign language. While this paper covers the recognition and synthesis of hand gestures, the system to teach sign language is beyond the scope of this work. .

Lab

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