SIGN LANGUAGE RECOGNITION APP WITH PYTHON

PROJECT REPORT

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INTRODUCTION

- Goal is to bridge the communication gap between individuals with hearing abilities and those who are hard of hearing or deaf.
- Project aims to use computer vision for real-time and accurate Sign Language Detection(Action Recognition).
- Utilized Python modules: OpenCV, Mediapipe, Tensorflow, and Keras.
- OpenCV module crucial for processing live video frames captured by a camera.
- Video frames serve as input for sign detection system.
- Utilization of transfer learning in a neural network to facilitate custom sign detection.

PROBLEM STATEMENT

- **Effective communication is crucial for socialization and achieving goals in society.**
- **Individuals with hearing or speech disabilities face challenges in vocal communication.**
- **Sign language serves as an alternative communication method but requires extensive training and may not be universally understood.**
- **The system will recognize and interpret sign language gestures in real-time, reducing the need for intermediaries.**
- **The project aims to promote inclusivity and enhance communication for individuals with disabilities.**
- **The system will enable real-time translation of sign language, facilitating meaningful engagement in society.**

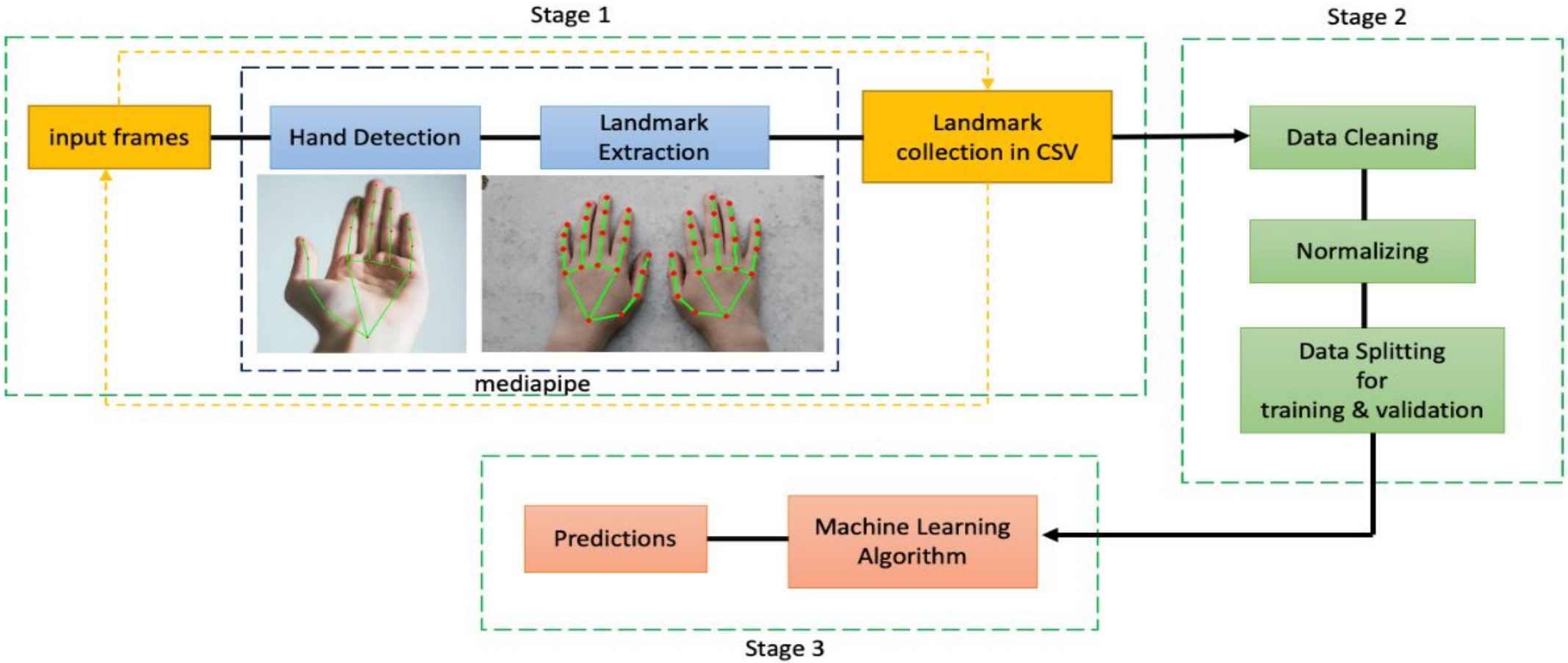
OBJECTIVES

- Sign language recognition project focuses on creating a sign detector for bespoke signs and expandability.
- OpenCV, Mediapipe, Tensorflow, and Keras Python modules used in the project.
- OpenCV processes live video frames from a camera to detect the actions of a person.
- Mediapipe Holistic used to extract key-points from hands, torso, and face in the video frames.
- Extracted key-points passed to the prediction algorithm for real-time hand sign prediction.
- The technology displays the expected sign based on the prediction.

LITERATURE REVIEW

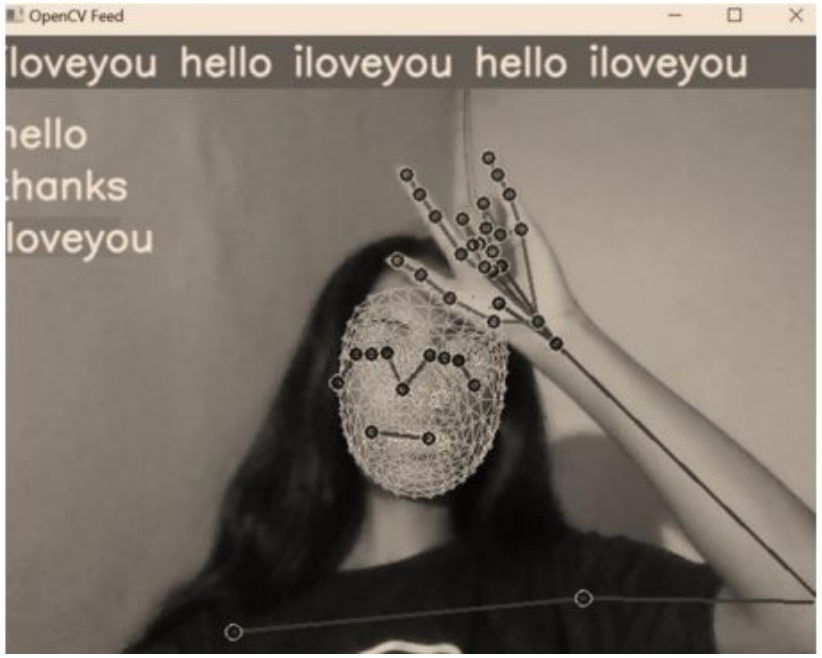
- Advancements in sign language recognition hold promise for communication, accessibility, and inclusion.
- Deep learning pipeline for automatic sign language recognition [1] utilized SSD, 2DCNN, 3DCNN, LSTM, and introduced novel hand skeleton features.
- Deep CNN architecture [2] detects and classifies sign languages, incorporating static and dynamic gestures in training.
- Comparative analysis [3] compared machine learning and deep learning models for classifying American sign language, ensuring robustness with user-independent k-fold cross-validation and testing.
- Real-time sign language recognition [4] proposed a model combining single shot detector, 2D CNN, SVD, and LSTM.
- Human action recognition [5] used motion tracking and feature extraction with Recurrent Neural Network model with Gated Recurrent Unit.

METHODOLOGY



RESULTS & INTERPRETATION

- Results showed promising potential for practical applications.
- The developed system achieved high accuracy, with the Mediapipe LSTM model performing exceptionally well.
- The system reached 100% accuracy on test sets.
- It effectively recognizes and interprets hand gestures in real-time.
- Provides coordinated outputs for sign language translation.



H/W & S/W REQUIREMENTS

- **H/W Requirements : Dell Inspiron 15 Laptop (11th Gen Intel Core i3), 8GB RAM, 256GB SSD**

- **S/W Requirements : Windows 10 operating system, Python (3.10.8), IDE (Jupyter), Mediapipe (version 0.10.1) , Numpy (version 1.23.5) , cv2 (openCV) (version 4.7.0.72) , Keras (version 2.12.0), Tensorflow (version 2.12.0)**

FUTURE SCOPE & CONCLUSION

- Future directions include developing a mobile application that classifies complete word symbols by incorporating facial emotions and hand movements.
- Expanding the sign language dataset with common words and enhancing model accuracy through additional hyperparameters are also planned.
- The research aimed to create a real-time sign language detection and translation system.
- The developed system achieved high accuracy, effectively recognizing and interpreting hand gestures in real time.
- The results show promising potential for practical applications.

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