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A SURVEY ON SIGN LANGUAGE TANSLATOR

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ABSTRACT

People who are hard of hearing or deaf use sign language (SL), a visual-gestural language, to communicate. Unlike spoken language, sign language makes use of visual faculties I.e., Meanings are communicated through three-dimensional spaces created by hand and body movements. When communicating with those who do not understand sign language, these people typically have a very tough time. The existing solution for this problem focuses on converting only the Static signs into text speech, other methods include the usage of Hardware and External tools, which is very inconvenient for the users. Hence a translator which can be used remotely on their smartphones and provides efficient translation is required. A language translator of Tamil sentences / phrases for impaired people which enables these specially-abled people to communicate easily and normally. This is an accessible language translator for Tamil sentences and phrases, which combines signing, finger spelling, and specific body language.

I. INTRODUCTION

Our project intends to bridge the communication gap between typically abled individuals and people with speech and hearing impairments. This SLT uses automated digital image processing and classification techniques and is a simple, effective, and accurate technology.

The basic idea of this project is to build a communication interface using which deaf and dumb people can significantly communicate with all other people easily using Sign Language.

In our project, relevant features (key points) and neural network architecture are extracted using computer vision and deep learning approaches. Accurate image recognition is performed using advanced tools (open CV) & techniques (Convolution Neural Networks).

This works by interpreting three dimensional spaces in movements between hands and other parts of the body. Hence providing an efficient interface for communication between the disabled and others.

II. RESEARCH METHODS

2.1 Data source

1. Capture Images of various Tamil signs
2. Preprocessing into re-sized and grey scaled images
3. Storing the images in labelled files

2.2 Search Terms

1. Tamil Sign Language (TSL)
2. Sign Language Tools
3. Sign Language to Speech
4. Image / Video recognition
5. Convolution Neural Networks

III. COMPARATIVE ANALYSIS AND DISCUSSION

3.1 Existing Solutions

3.1.1 We Capable Tools: An Open Source ASL tool which converts text into signs. This tool takes text as input and produces the respective sign images.

3.2.2 Hand Talk Translator: A mobile app which recognizes hand signs and converts them into text.

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3.3.3 AI Translator: The GnoSys software recognizes a sign language speaker in videos using neural networks and computer vision, and then employs sophisticated algorithms to convert that recognition into speech.

3.2 Literature Survey

3.2.1 Alphabets

Paper Title	Authors	Inference
Research of a sign language translation system based on deep learning	Siming He	• Rapid R-CNN with embedded RPN • Feature extraction module using 3D CNN LSTM-based sign language recognition system with 91.7% accuracy
Sign Language Recognition: State of the Art	Ashok Kumar Sahoo, Kiran Kumar Ravulakollu & Gouri Sankar Mishra	• Convert sign language into speech or text • processing digital images on a computer • Various classification techniques are used • Understand how the alphabet flows Words and phrases in sign language are translated.
Sign language Recognition System Using Machine Learning Algorithm	Atreya Bain, Shiwam Birajdar, Prof. Manonmani S.	• Identifying alphabets and numbers Focuses on using lower cost & easy to use camera hardware. • A python-based application • Process the data and create models.

3.2.2 Words

Paper Title	Authors	Inference
Hierarchical LSTM for Sign Language Translation	Dan Guo, Wengang Zhou, Houqiang Li, Meng Wang	• High level visual semantic embedding model for sign language translation using hierarchical LSTM framework. • gestures made with the help of internet key clip mining. • a few issues with the model
Sign language recognition system based on prediction in Human-Computer Interaction	Maher Jebali, Patrice Dalle, and Mohamed Jemni	• An integrated framework for tracking the head and hands in videos • When used in prediction-based sign language identification, different motions are recognised based on the detection of various components.
Improving Sign Language Translation with Monolingual Data by Sign Back Translation	Hao Zhou, Wengang Zhou, Weizhen Qi, Junfu Pu1, Houqiang Li	• Utilize monolingual data to enhance translation quality. • Translation of words into source sign sequences via the sign BT pipeline • The artificial pairs as extra training data • Reduce the lack of parallel training data.
Deep sign: A deep-learning architecture for Sign Language Recognition	Jai Shah	• Deep Sign, for spatio-temporal learning • Recognize discrete Sign Language • Extracting important & unique features for classification. • Comparable results with limited training data

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3.2.3 Indian Sign Language

Paper Title	Authors	Inference
Tamil Alphabets Sign Language Translator	P Jayanthi, K. K. Thyagarajan	• No gloves are worn • Color-space Hand Segmentation in the Lab (HSL) • Background with a single, non-reflective colour • Utilizing the Generalized Hough Transform method for feature extraction • Recognition of 31 Tamil Language Alphabets
Dynamic Tamil Sign Language Recognition System	S Sudha & S Jothilakshmi	• vision-based strategy • Compression of images using two-dimensional DST • MATLAB simulation of the SOM or SOFM neural network for pattern recognition • 91% precision.
Indian Sign Language Recognition System	Yogeshwar I. Rokade, Prashant M. Jadav	• ANN and vector machines. • Central moments and HU moments for feature extraction • Artificial Neural Network for sign classification • Average accuracy of 94%
Conversion of sign language into text	Mahesh Kumar N B	• Recognize Indian sign language with MATLAB • Alphabet recognition • Linear Discriminant Analysis for high accuracy • Noise and dimensionality reduction

3.2.4 External Tools

Gesture Control Algorithm for Personal Computers	Sahib Singh & Vijay Kumar Banga	• Tracks users finger movements • Gesture recognition with red color markers(increase accuracy) • Limited to minimal gestures to control • Red markers may inconvenience the user.
Sign language recognition system using CNN and Computer Vision	Mehreen Hurroo, Mohammad Elham Walizad	• CNN based model for classifying ASL alphabets • HSV color algorithm for detecting gestures. • Involves usage of gloves • Self-created dataset with 80:20 split • Accuracy > 90%
Multi-Modality American Sign Language Recognition	Chenyang Zhang, YingliTian, Matt Huenerfauth	• Learns through labelled ASL videos • Uses Kinect depth sensor and predicts ASL components • Already fed data as videos • Combined accuracy is 36.07% (insufficient).

3.3 Comparative Analysis

The Existing solutions available in the paper are for Static Signs which do not involve any hand and body movements. Hence, they can be used only for translation of words only.

The Proposed solutions contain mechanisms for conversion of Dynamic Signs but not Real time. Hence, it cannot be used for communication.

Continuous sentences or conversations need to be translated into speech or text. Our solution aims to translate wholesome sentences and conversations into text and speech.

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This Sign Language Translator involves a conversion mechanism which recognizes the three-dimensional spaces between the hands, face and body (Dynamic / video). Also, the translation is done in real time enabling the especially abled people to have a conversation effortlessly.

IV. DATASET GENERATION AND PRE-PROCESSING

4.1 Image Pre-processing

Images come in a variety of sizes and shapes. They also originate from many sources. We must pre-process any image data in order to account for all these changes.

Although RGB is the most widely used encoding type and the most "natural image format," a machine cannot learn very effectively from an RGB image. Making the photos the same size is also one of the initial steps in data pre-processing. To lessen the workload on the machine, we used auto scaling in this case to convert all the photographs in the dataset into the same resolution and turned them into grey scale (a black and white image).

4.2 Feature Extraction

When fewer resources are needed for processing without losing crucial or pertinent data, feature extraction is a beneficial technique.

The amount of duplicated data for a particular investigation can be decreased through feature extraction. Additionally, the machine's efforts to generate variable combinations (features) and the reduction of the data speed up the learning and generalization stages of the machine learning process.

4.3 Image Labeling

We independently labelled each topic (picture) twice. On a picture archiving communication system (PACS), labelling was first assessed using the original images. Thereafter, the resized images utilised for the real learning data were employed. The temporal dataset was utilised to evaluate the test, and datasets were defined as the internal dataset and temporal dataset. The internal dataset was divided into subgroups for testing (15%), validating (15%), and training (70%).

V. DEEP LEARNING TECHNIQUES

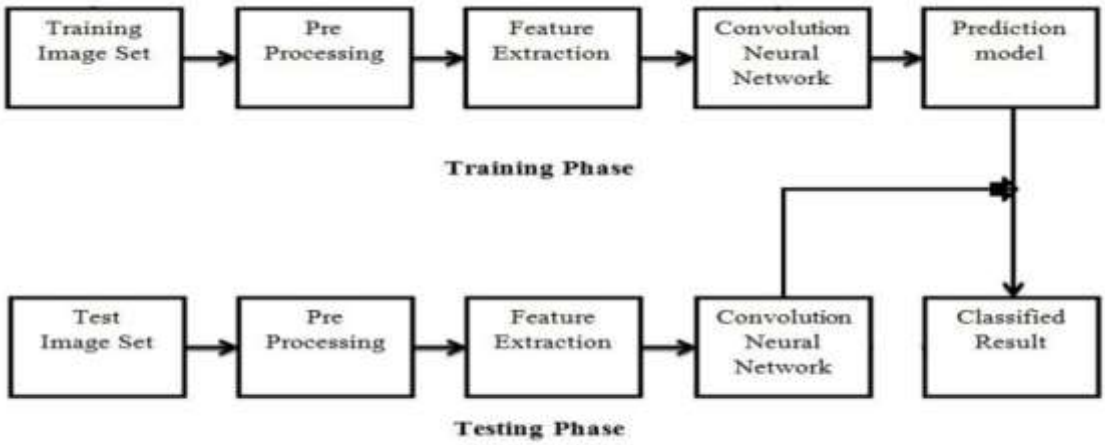
5.1 Convolutional Neural Networks

Convolutional neural networks (CNNs) are a subset of deep neural networks used in deep learning, and they work with a set of data to extract knowledge from it. In order to extract data, CNN may employ images, sounds, movies, etc.

In CNN, three things are predominant. Local receptive field comes first, followed by shared weight and bias, and finally the activation and pooling. To enable CNN to extract the feature of an input, neural networks are first trained using a large amount of data.

When an input is received, it undergoes picture preprocessing, feature extraction based on a set of stored data, data categorization, and output is given.

Only those inputs for which the neural network has been trained and saved data can be handled by CNN.



VI. CONCLUSION

This Sign Language Translator involves a conversion mechanism which recognizes the three-dimensional spaces between the hands, face and body (Dynamic / video).

Using this advanced mechanism conversion of Tamil phrases and sentences in Sign Language into text or speech is possible.

Also, the translation is done in real time enabling the specially-abled people to have a conversation effortlessly.

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