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G. Anantha Rao ✉; K. Syama; K. Suribabu



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Statistical Features Based Selfie Sign Language Recognition System (SSLRS) with ANN Classifier

G. Anantha Rao^{1,a)}, K.Syama^{2,b)}, K.Suribabu^{2,c)}

¹ GMR Institute of Technology, Rajam, India

²Avanathi institute of Engg. &Tech, Cherukupally,India

^a Corresponding Author: anantharao.g@gmrit.edu.in, ^bsyamala.kanchimani@gmail.com,

^cSuribabu465@gmail.com

Abstract. This work is to bring mobile based sign language recognition system into real time. Selfie sign videos are captured with smart phone front camera. Morphological gradients along with Sobel edge operators are used to extract hand contour from each sign video frame. Discrete Cosine Transform (DCT) of hand contour is optimized by principle Component Analysis (PCA) to reduce the execution time. The four statistical features such as mean, skewness, standard deviation and kurtosis are calculated for the optimized hand contour DCT. The feature vector formed with these four statistical features is used for sign classification using Artificial Neural Networks (ANN) classifier. The performance of SSLRS is evaluated with the Word Matching Score (WMS).

1.INTRODUCTION

The international health organizations have figured that 5% of the total world population are hearing impaired. The hearing impaired can't communicate with others using acoustic words. The hearing impaired can use sign language to communicate with others. The signs are formed with hand moments and facial expressions. The signs are either dynamic or static. The static signs can perform with single moment of hand and the dynamic sign can perform with more than one moment of the hands [1].

In our previous papers, we proposed SSLRS with hand contour DCT optimized by PCA as feature vector and different sign classifiers such as distance classifiers, adaboost classifier and ANN. In this paper, the SSLR proposed with statistical features and ANN classifier. The hand contours of the signer in each frame of sign videos are obtained and it is represented with an energy compact representation using DCT. The hand contour DCT is treated with PCA. The four statistical features of PCA treated DCT are generated. The statistical feature vector (4X1) is used for sign classification using ANN.

This paper presents latest literature relevant to SLR in section-2, Mathematical models to extract feature vector and sign classification with ANN in section-3, results and performance of proposed SSLRS in section-4 and the proposed work is concluded in section-5.

2.LITERATURE REVIEW

Video segmentation methods using wavelets are proposed to detect hand and head shape and positions [2]. Tanibata et.al [3] proposed gesture features with orientation, area, flatness of hand portion. Parul et.al [4] presented features with height, centroid of hand portion and distance of centroid from origin of the frame. G.Anantha rao et.al proposed SSLR with compact energy features and ANN classifiers [5]. And also tested the performance of SSLR with shape energy features [6]. The better classification rates achieved with compact energy features for Indian sign language (ISL). Tharwat *et al.* [7] proposed Scale Invariant Feature Transform (SIFT) treated with Linear Discriminant Analysis (LDA) for American Sign Language. The optimized features using LDA was used for sign classification using KNN and SVM. The static signs and finger spells were categorized into manual and face expressions were classified as non-manual category [8]. Lee *et al.* [9] proposed techniques for capturing the hand features using kinetic device sensors. SVM is used for training and classification of signs based on hand direction, position and shape. The achieved results were reasonably good in statistics. Holden *et al.* [10] presented Hidden Markov Model (HMM) and SIFT features along with signs speed. Words and sentences were classified with accuracy 99% and 97% respectively. Body and the hand position were used for the language recognition with independent signer [11]. Successive frames with no overlap are smallest are chosen to avoid overlapping of signs. HMM is used for sign classification. The