Data Science Project Proposal

1. Principal Investigator

Akhil Reddy Buchala – **buchalaa1@newpaltz.edu**

Rohan Reddy Yeruva – **yeruvar1@newpaltz.edu**

Chandra Sekhar Pokuri – **pokuric1@newpaltz.edu**

2. Title of Project

Hand Gesture Recognition using Hadoop.

3. Mentoring

Professor Min Chen, Department of Computer Science, SUNY-New Paltz

chenm@newpaltz.edu

4. Objective of Project

Conversing with people having a hearing disability is a major challenge. Deaf and Mute people use hand gesture sign language to communicate, hence normal people face problems in recognizing their language by signs made. Hence there is a need for systems that recognize the different signs and conveys the information to normal people. This project aims to implement fingerspelling and world-level sign language. We will use Inception -V3 Model for classification.

5. Background/History of the Study

Identification of sign gesture is mainly performed by the following methods:

1. **Glove-based method** in which the signer has to wear a hardware glove, while the hand movements are getting captured.

2. **Vision-based method**, further classified into static and dynamic recognition. Statics deals with the detection of static gestures(2d-images) while dynamic is a real-time live capture of the gestures. This involves the use of the camera for capturing movements.

The Glove-based method seems a bit uncomfortable for practical use, despite having an accuracy of over 90%.

WHAT IS SIGN LANGUAGE?

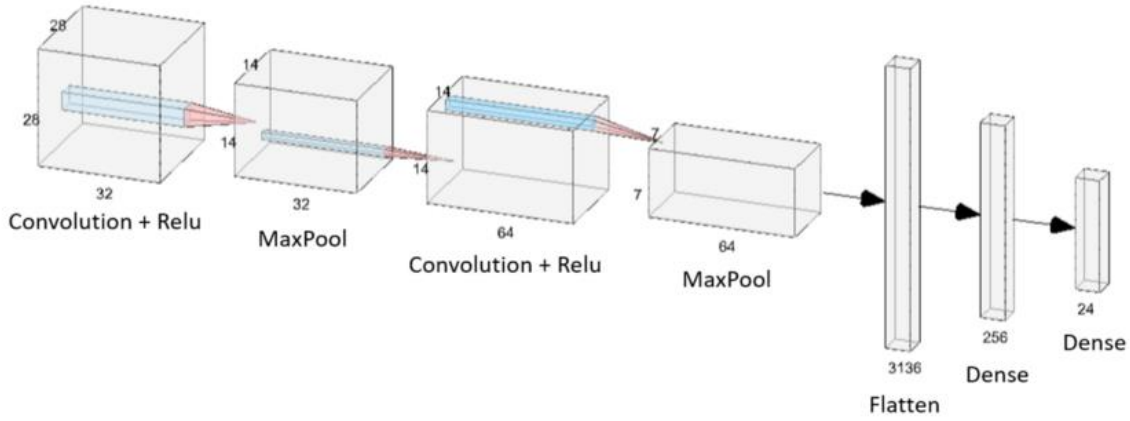
Sign language is a visual language. It mainly consists of 3 major components:

1. Fingerspelling: Spell out words character by character, and word level association which involves hand gestures that convey the word meaning. The static Image Dataset is used for this purpose.
2. World-level sign vocabulary: The entire gesture of words or alphabets is recognized through video classification. (Dynamic Input / Video Classification)
3. Non-manual features: Facial expressions, tongue, mouth, body positions

1. Learning/Modelling:

We will use Convolutional Neural Network, or CNN, model to classify the static images in our first dataset.

- CNN's are very effective in reducing the number of parameters without losing on the quality of models. Images have high dimensionality (as each pixel is considered as a feature) which suits the above-described abilities of CNNs.
- CNN retains the 2D spatial form of images.
- All the layers of a CNN have multiple convolutional filters working and scanning the complete feature matrix and carry out the dimensionality reduction. This enables CNN to be a very apt and fit network for image classifications and processing.



More object classes make a distinction between classes harder. Additionally, a neural network can only hold a limited amount of information, meaning if the number of classes becomes large there might just not be enough weights to cope with all classes. This justifies the reduction in model accuracy after adding more classes and training data to the dataset.

6. Approach to the Study

We use CNN's based methods for model training which are very effective in reducing the number of parameters without losing on the quality of models. Images have high dimensionality (as each pixel is considered as a feature) which suits the above-described abilities of CNNs. CNN retains the 2D spatial form of images. All the layers of a CNN have multiple convolutional filters working and scanning the complete feature matrix and carry out the dimensionality reduction. This enables CNN to be a very apt and fit network for image

classifications and processing. For better accuracy results we will implement Transfer Learning.

Storing: For Storing we use Amazon S3.

Processing: For Processing we use EMR(Elastic Map Reduce).

Initial timeline for implementation

1 Week	Literature review
2 Weeks	Data Collection and uploading to cloud storage
2 Week	Architecture setup and data Pre-processing
3 Weeks	Transfer learning and fine-tuning
1 Week	Model evaluation using testing images
2 Weeks	User interface creation
3 Weeks	Model deployment on webserver running on ec2

8. References

1. A survey paper on hand gesture recognition|Bhumika Nandwana; Satyanarayan Tazi; Sheifalee Trivedi; Dinesh Kumar; Santosh Kumar Vipparthi

2. Hand Gesture Recognition Based on Computer Vision: A Review of Techniques**(**J. Imaging | Free Full-Text | Hand Gesture Recognition Based on Computer Vision: A Review of Techniques (mdpi.com)**)**

3. Real-Time Hand Gesture Recognition Using Finger Segmentation (hindawi.com)

4. Hand Gesture Recognition using Image Processing and Feature Extraction Techniques - ScienceDirect

5. Gesture Recognition for Beginners with CNN | by That Data Bloke | Towards Data Science

6. Human Emotion and Gesture Detector Using Deep Learning: Part-1 | by Bharath K | Towards Data Science

7. What is Amazon EMR (Amazon Elastic MapReduce)? (techtarget.com)