[Date]

SIGN LANGUAGE RECOGNITION

-APURVA SATAM

FEYNN LABS
30.07.2023

PROBLEM STATEMENT:

A major issue with this convenient form of Sign Language communication is the lack of knowledge of the language for the vast majority of the global population. Just as any other language, learning Sign Language takes much time and effort, discouraging to from being learned by the larger population. However, an evident solution to this issue is present in the world of Machine Learning and Image Detection.

MARKET / CUSTOMER / BUSINESS NEED ASSESMENT:

Sign Language is a form of communication used primarily by people hard of hearing or deaf & dumb. This type of gesture-based language allows people to convey ideas and thoughts easily overcoming the barriers caused by difficulties from hearing issues.

TARGET SPECIFICATION AND CHARACTERIZATION:

There have been several advancements in technology and a lot of research has been done to help the people who are deaf and dumb. Aiding the cause, Deep learning, and computer vision can be used too to make an impact on this cause. This can be very helpful for the deaf and dumb people in communicating with others as knowing sign language is not something that is common to all, moreover, this can be extended to creating automatic editors, where the person can easily write by just their hand gestures.

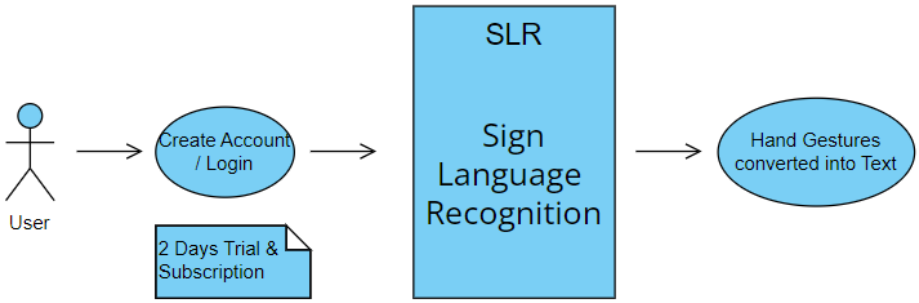
EXTERNAL SEARCH:

https://towardsdatascience.com/sign-language-recognition-with-advanced-computer-vision-7b74f20f3442

https://www.sciencedirect.com/science/article/pii/S2667305321000454
https://data-flair.training/blogs/sign-language-recognition-python-ml-opencv/

FINAL PRODUCT PROTOTYPE WITH SCHEMATIC DIAGRAM:

Sign language is an essential tool to bridge the communication gap between normal and hearing-impaired people. However, the diversity of over 7000 present-day sign languages with variability in motion position, hand shape, and position of body parts making automatic sign language recognition (ASLR) a complex system. In order to overcome such complexity, researchers are investigating better ways of developing ASLR systems to seek intelligent solutions and have demonstrated remarkable success.



Review of vision-based sign language recognition

The stages involved in vision-based sign language recognition (SLR) can be categorised into five stages: image acquisition, image pre-processing, segmentation, feature extraction, and classification, as shown in the below figure.

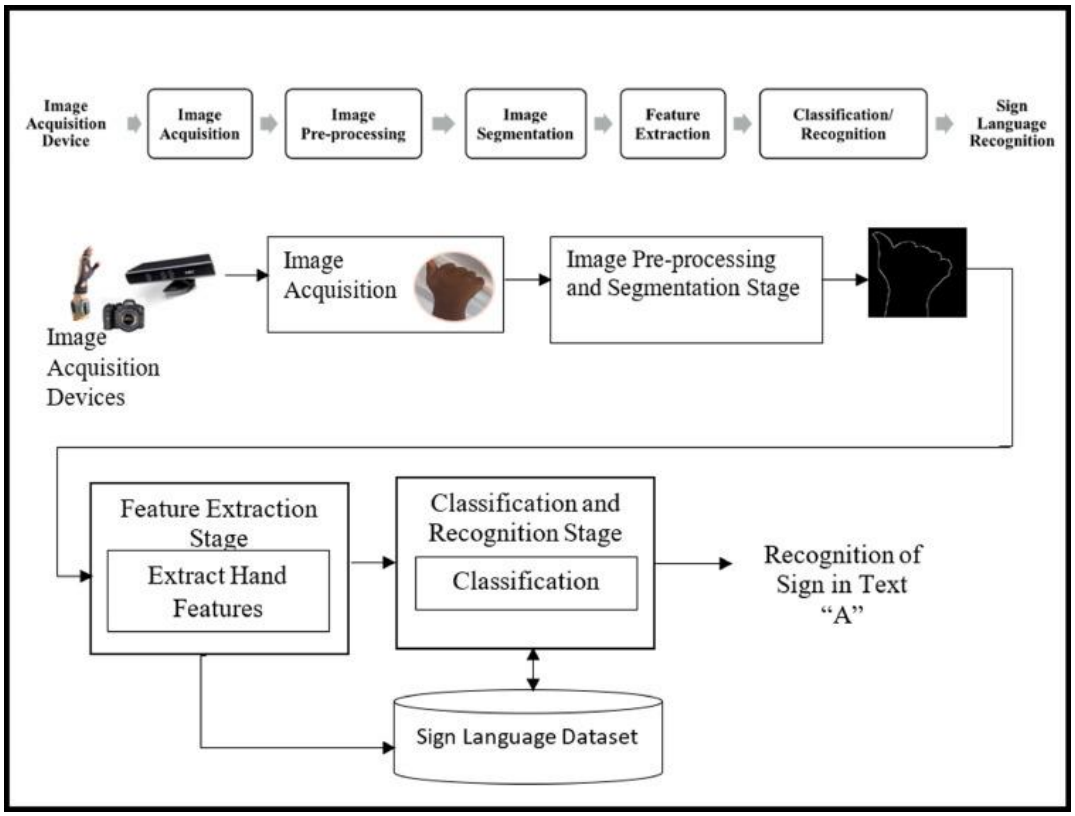
Image acquisition is the first stage in sign language recognition that can be acquired through self-created or available public datasets.

The second stage is pre-processing to eliminate unwanted noise and enhanced the quality of the image.

Next, after pre-processing step is to segment and extract the region of interest from the entire image.

The fourth stage is featuring extraction, which transforms the input image region into feature vectors for recognition.

The last stage in vision-based SLR is classification, which involves matching the features of the new sign image with the stored features in the database for recognition of the given sign.



STEP 1: PROTOTYPE SELECTION

A) Feasibility

This project can be developed and deployed within a few years as SaaS (Software as a Service) for anyone to use.

B) Viability

As there would be deaf & dumb people in every generation and at any point of time, hence there will always be need for this product in the market. So, it is viable to survive in the long-term future as well but improvements are necessary as new technologies emerge.

C) Monetization

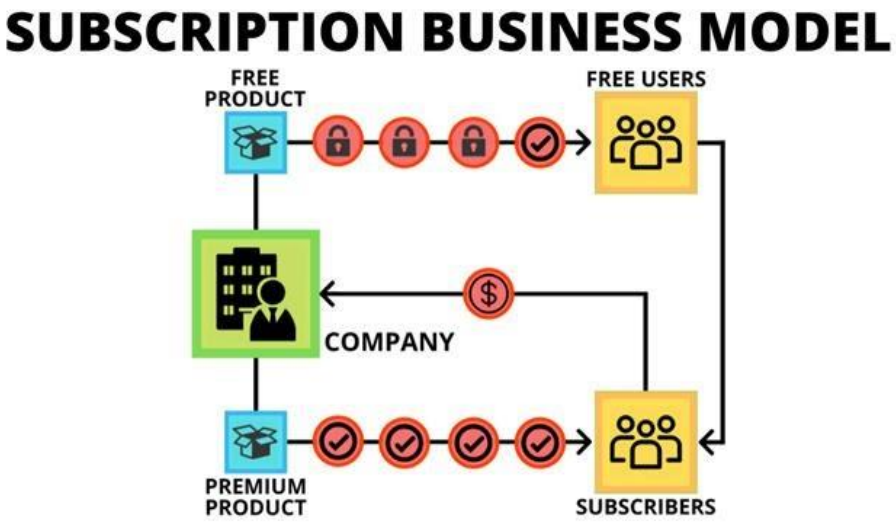
This service is directly monetizable as it can be directly released as a service on completion which can be used by businesses.

STEP 2: PROTOTYPE DEVELOPMENT

[Sign Language Recognition with Advanced Computer Vision | by Mihir Garimella | Towards Data Science]

STEP 3: BUSINESS MODELLING

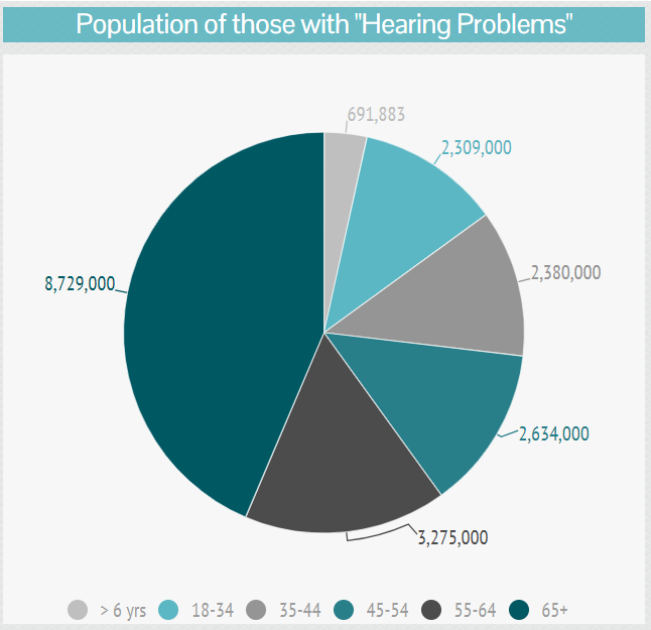
For this service, it is beneficial to use a Subscription Based Model, where initially some features will be provided for free to engage customer retention and increase our customer count. Later it will be charged a subscription fee to use the service further for their business. In the subscription business model, customers pay a fixed amount of money on fixed time intervals to get access to the product or service provided by the company. The major problem is user conversion; how to convert the users into paid users.



STEP 4: FINANCIAL MODELING (EQUATION) WITH MACHINE LEARNING AND DATA ANALYSIS

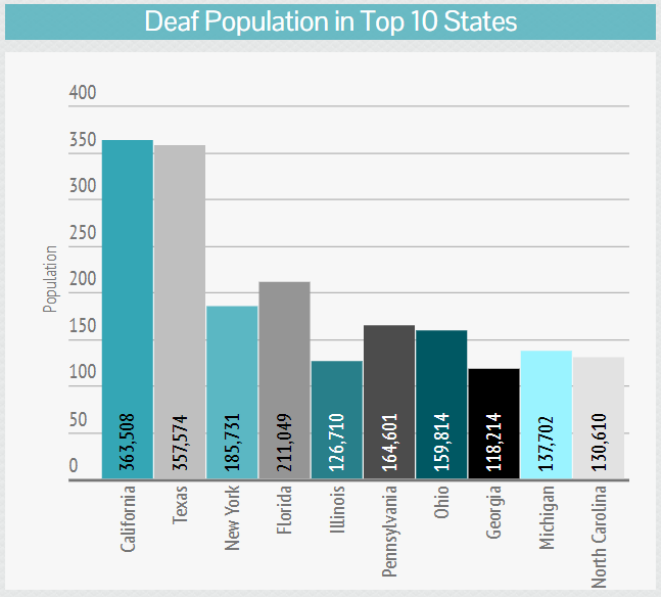
A. Identify which Market your product/service will be launched into:
UNHEARD DEAF POPULATION
"Deaf Culture is the heart of the Deaf community everywhere in the world; language and culture are inseparable, intertwined and passed down through generations of Deaf people."

B. Collect some data /statistics regarding that Market Online.:

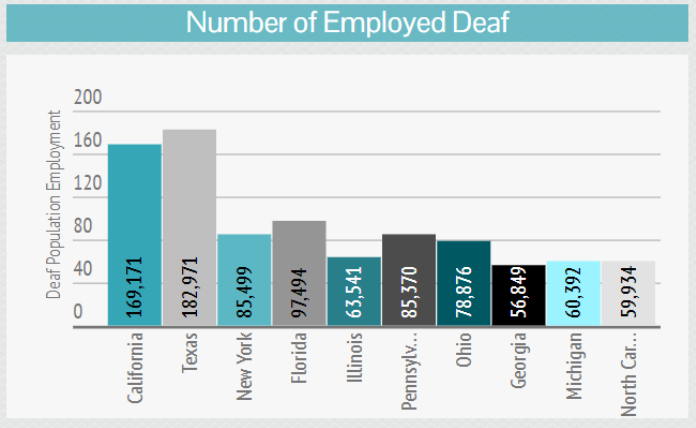


60% - the rate at which deaf children acquire English vocabulary that hearing children do.
15%-35% - Sign language comprehension among hearing teachers of the deaf

C. Perform forecasts/predictions on that Market using regression models or time series forecasting (alternately collect existing Statistics if you are unable to find appropriate data or perform time series):

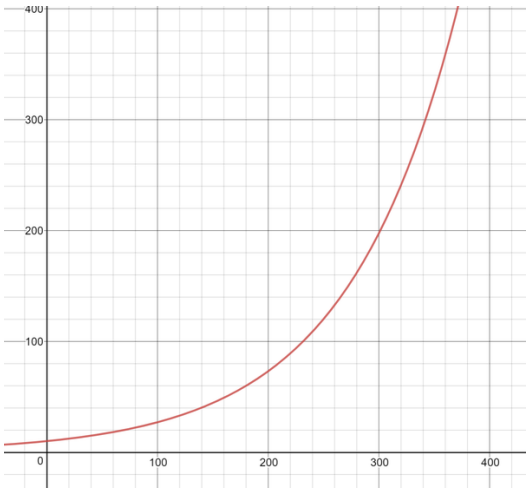


60% - Percentage of deaf high school graduates who are considered ill-prepared for college



50,000 - Approximate number of deaf people who collect some form of social security disability benefits

D. Design Financial Equation corresponding to that Market Trend.:



Let,
Total profit = y,
Price of the product = m,
Total sale as a function of time = x(t),
Total production & maintenance cost = c
Therefore, the financial equation is

$$\mathbf{Y = m\ x(t) - c}$$

If, m = Rs 500,
C = Rs 1,00,000

Hence,

$$\mathbf{Y = 500\ x(t) - 1{,}00{,}000}$$