VOICE TO SIGN LANGUAGE CONVERSION APPLICATION

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Abstract
A voice to sign translator is a technology that converts spoken language into sign language. It is designed to help people who are deaf or hard of hearing to communicate more easily with others who do not know sign language. The system uses speech recognition to convert spoken words into text, which is then translated into sign language animations.The output is displayed on a screen or device, allowing the user to communicate with others using sign language.This technology has the potential to improve communication and increase accessibility for people with hearing disabilities in a variety of settings, including schools, workplaces, and public spaces. Voice to sign translator is a technology that aims to facilitate communication between individuals who are deaf or hard of hearing and those who are not. The system works by using speech recognition to convert spoken language into text, which is then translated into sign language using computer vision and machine learning algorithms.The process begins with the user speaking into a microphone, which converts the speech into text using speech recognition software. The text is then processed by a natural language processing (NLP) algorithm, which identifies the meaning and intent behind the words.The NLP output is then processed by a computer vision system that recognizes and interprets sign language gestures. This is done using a combination
of cameras and machine learning algorithms that have been trained on a vast dataset of sign language gestures.The final output of the
system is a video of a virtual sign language interpreter who performs the sign language translation of the spoken words.

1. INTRODUCTION

A voice to sign translator is a tool or technology that is designed to assist communication between individuals who are deaf or hard of hearing and those who can hear. This technology takes spoken language input and converts it into sign language output, allowing for real-time communication between people who speak different languages.The voice to sign translator uses natural language processing and machine learning algorithms to analyze and interpret the spoken language input, and then generates corresponding sign language output in real time. This technology has the potential to break down communication barriers for deaf and hard of hearing individuals, allowing them to participate more fully in conversations, meetings, and other social interactions.Voice to sign translators can be used in a variety of settings, including schools, workplaces, and public spaces. They are an important tool for promoting inclusivity and accessibility, and can help to create a more inclusive society.Sign languages are developed primarily to aid deaf and dumb people. They use a concurrent and specific combination of hand movements, hand shapes and orientation in order to convey particular information. One such set of language is the Indian Sign Language (ISL) system which is predominantly used in south Asian countries. Certain aspect that distinguishes ISL from other sign languages is that ISL devoid of any temporal inflections in its finger spelling chart and also the usage of sign detection systemh the hands. With the advent of artificially intelligent algorithms coupled with the availability of big data and large computational resources has led to a huge growth in the field of

healthcare, rosign detection systemics, autonomous self-driving vehicles, Human Computer Interaction (HCI) etc.

NLP:

Natural-language processing (NLP) is an area of computer science and artificial intelligence concerned with the interactions between computers and human (natural) languages, in particular how to program computers to fruitfully process large amounts of natural language data.

Advantages

•No training.

•Relives burden of learning syntax.

2.RELATED WORKS

The system may be designed with accessibility and inclusivity in mind, complying with standards such as the Web Content Accessibility Guidelines (WCAG), and providing options for different sign language dialects, cultural variations, or user preferences.Continuous Improvement: The system may incorporate mechanisms for continuous learning and improvement, leveraging user feedback, and data-driven approaches to enhance the accuracy, fluency, and usability of the voice to sign translation system over time.Security and Privacy: The system may prioritize security and privacy, protecting the confidentiality and integrity of user data, and complying with relevant data protection regulations or guidelines. Overall, an advanced existing system for voice to sign translator would likely combine cutting-edge technologies, user-friendly interfaces, and a focus on accessibility and inclusivity to enable effective communication between speakers and sign language users.The system may provide real-time translation capabilities, allowing for instantaneous conversion of spoken language into sign language, enabling smooth and efficient communication between users.User-Friendly Interface: The system may have a user-friendly interface, such as a mobile app or a web-based platform, that is intuitive and easy to use for both the speaker and the sign language recipient, with options for customization and personalization.Multi-Modal Integration: The system may integrate with other technologies or modalities, such as wearable devices, cameras, or microphones, to capture and process spoken language input, and provide sign language translations in different settings or scenarios.Accessibility and Inclusivity.

FRONT END

The front end is designed using Python framework.

Front End (Python)

- Python can be used to create web applications ranging from personal websites to e-commerce applications and community web portals i.e. discussion forums, blogs etc. The main advantages of Python programming include the following:
- Open Source, Python is completely free.
- Python can be easily embedded directly into HTML.
- Platform independent can run on Windows Linux or Mac servers.
- Run faster on the internet and easily integrate AJAX, Callback etc.
- Interfaces very easily with Apache/PostgreSQL
- Lots of good products and on-line help.
- It's available with documentation in many languages.
- Easy to learn compared to many other scripting languages. It has a syntax that is easy to parse and is actually rather human-friendly.
- Lots of hosting services have it ready to use, no special configuration.
- Pretty easy to access other web-based tools through Python i.e. google maps, etc.

- Lots of good source code out there to use and/or learn from, as well as many useful libraries for working with PDFs, graphics, etc.

Machine Learning

Machine learning is a core sub-area of artificial intelligence; it enables computers to get into a mode of self-learning without being explicitly programmed. When exposed to new data, these computer programs are enabled to learn, grow, change, and develop by themselves.

Features

- Machine learning can easily consume unlimited amounts of data with timely analysis and assessment.
- Machine learning algorithms tend to operate at expedited levels.
- Applying machine learning to practical applications and scenarios is simply vital.

Advantages

- Sophisticated pattern recognition
- Intelligent decisions
- Self-modifying
- Multiple iterations
- Automation of tasks

NLP

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MACHINE LEARNING:

Introduction:

Machine Learning is a method of data analysis that automates analytical model building .It is an application of artificial intelligence that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. The primary aim is to allow the computers learn automatically without human intervention or assistance and adjust actions accordingly. Machine Learning enables analysis of massive quantities of data. It may also require additional time and resource to train it properly. Machine learning (ML) is a category of algorithm that allows software applications to become more accurate in predicting outcomes without being explicitly programmed.

The basic premise of machine learning is to build algorithms that can receive input data and use statistical analysis to predict an output while updating outputs as new data becomes available. The processes involved in machine learning are similar to that of data mining and predictive modelling. Sign detection systemh require searching through data to look for patterns and adjusting program actions accordingly

Machine Learning Types:
1. Supervised learning
2. Unsupervised learning
3. Reinforcement learning

Supervised learning:
It can apply what has been learned in the past to new data using labelled examples to predict future events. The system is able to provide targets for any new input after sufficient training. The learning algorithm can also compare its output with the correct, intended output and find errors in order to modify the model accordingly. Supervised learning systems are mostly associated with retrieval-based AI but they may also be capable of using a generative learning model. The Supervised learning which can be categorized based on the Regression and Classification. Algorithms which are widely used such as Naive Bayes, Support Vector Machine, Random Forests and Decision Tree, Logistic regression, K-nearest neighbour.

Unsupervised learning:
They are used when the information used to train is either classified or labelled. The system doesn't figure out the right output, but it explores the data and can draw inferences from datasets to describe hidden structures from unlabelled data. There are two types of problems which occurs are as Association and Clustering.
The algorithms used in unsupervised learning which are as follows are: K-Means, Fuzzy clustering, Hierarchical clustering. Unsupervised learning algorithms can perform more complex processing tasks than supervised learning systems. However, unsupervised learning can be more unpredictable than the alternate model.

Reinforcement learning:
It is a learning method that interacts with its environment by producing actions and discovers errors and rewards. Trial and error search are the relevant characteristic of reinforcement learning. This method allows machines and software agents to automatically determine the ideal behaviour within a specific context in order to maximize its performance. Reinforcement learning is an area of machine learning concerned with how software agents ought to take actions in an environment so as to maximize some notion of cumulative reward.

1) Gathering Data:
Collecting data allows you to capture a record of past events so that we can use data analysis to find recurring patterns. From those patterns, you build predictive models using machine learning algorithms that look for trends and predict future changes. Gathering data is the most important step in solving any supervised machine learning problem. This step is very crucial as the quality and quantity of data gathered will directly determine how good the predictive model will turn out to be. The data collected is then tabulated and called as Training Data.

2) Data Analysis:
To get the useful information from the data, data analysis is applied for describe and summaries irrespective of qualitative or quantitative data also identified the relationship/difference between the variables and comparison between the variables.

3) Cleaning and Integration:
In this stage, irrelevant and unnecessary data was removed from the huge dataset. A clean dataset can give accurate results. Data cleaning phase was conducted before integration in data pre-processing. In

data integration data from the multiple sources is combined in a common data source after performing data cleaning steps.

4) Building a Model:

The next step that follows in the workflow is building a model by finding the accuracy between all supervised learning algorithms and finding the best twoaccuracies to predict the better accuracy in identifying whether the patient is affected with lung cancer or not.

5) Training:

After the before steps are completed, you then move onto what is often considered the bulk of machine learning called training where the data is used to incrementally improve the model's ability to predict. The specific machine learning task will inform the selection of an appropriate algorithm. We then "feed" the data to the model during this phase and we will get a learner. A learner is a ML algorithm that has been trained on some data and adjusted to fit the data as best as possible.

6) Evaluation:

Once training is complete, it's time to see if the model is any good, using Evaluation. Because each learner results in a biased solution, it is important to evaluate how well the algorithm learned from its experience. Depending on the model used, we might be able to evaluate the accuracy of the learner using a test dataset.

7) Prediction:

We finally use the built model to predict the accuracy and to identify whether the result is true or false.
ALGORITHM SPECIFICATION

CLUSTERING ALGORITHM

Clustering is the grouping of specific objects based on their characteristics and their similarities. As for data mining, this methodology divides the data that are best suited to the desired analysis using a special join algorithm. This analysis allows an object not to be part or strictly part of a cluster, which is called the hard partitioning of this type. However, smooth partitions suggest that each object in the same degree belongs to a cluster. More specific divisions can be created like objects of multiple clusters, a single cluster can be forced to participate or even hierarchic trees can be constructed in group relations. This file system can be put into place in different ways based on various models. These Distinct Algorithms apply to each and every model, distinguishing their properties as well as their results. A good clustering algorithm is able to identify the cluster independent of cluster shape.

K-MEANS ALGORITHM

The k-means clustering algorithm is a simple unsupervised algorithm that is used to predict the classification from an unlabelled dataset. The prediction is based on the number of cluster center present (k) and the nearest mean value. Finally this algorithm aims at minimizing an objective function referred to as squared error function given by:
Where,
'$\|x_i - v_j\|$' is that the Euclidean distance between x_i and v_j.

'c_i' is that the number of knowledge points in i-th cluster.
'c' is the number of cluster center.
Let $X = \{x_1, x_2, x_3, \ldots, x_n\}$ be the set of data points and $V = \{v_1, v_2, \ldots, v_c\}$ be the set of centers.

1)   Randomly select 'c' cluster centers.
2)   Calculate the space between each datum and cluster centers.
3)   Assign the info point to the cluster center whose distance from the cluster center is minimum of all the cluster center.
4)   Recalculate the new cluster center using: where, 'ci' represents the amount of knowledge points in ith cluster.
5)   Recalculate the space between each datum and new obtained cluster centers.
6)   If no datum was reassigned then stop, otherwise repeat from step 3.

Pros and Cons of K-Means:
Pros:
☐   Simple: It is easy to implement k-means and identify unknown groups of datafrom complex data sets. The results are presented in an easy and simple manner.
☐   Flexible: K-means algorithm can easily adjust to the changes. If there are anyproblems, adjusting the cluster segment will allow changes to easily occur on the algorithm.
☐   Suitable in a large dataset: K-means is suitable for a large number of datasets and it's computed much faster than the smaller dataset. It can also produce higher clusters.
☐   Efficient: The algorithm used is good at segmenting the large data set. Itsefficiency depends on the shape of the clusters. K-means work well in hyper-spherical clusters.
☐   Time complexity: K-means segmentation is linear in the number of data objects thus increasing execution time. It doesn't take more time in classifying similar characteristics in data like hierarchical algorithms.

Cons
Lacks consistency: K-means clustering gives varying results on differentruns of an algorithm. A random choice of cluster patterns yields different clustering results resulting in inconsistency.
☐   Uniform effect: It produces cluster with uniform size even when the inputdata has different sizes.
☐   Order of values: The way in which data is ordered in building the algorithmaffects the final results of the data set.
☐   Prediction issues: It is difficult to predict the k-values or the number ofclusters. It is also difficult to compare the quality of the produced clusters.

ALGORITHM
Regression analysis is the data mining process is used to identify and analyse the relationship between variables because of the presence of the other factor. It is used to define the probability of the specific variable. Regression, primarily a form of planning and modelling. For example, we might use it to project certain costs, depending on other factors such as availability, consumer demand, and competition.

Primarily it gives the exact relationship between two or more variables in the given data set.

SUPPORT VECTOR REGRESSION
Support Vector Machine can also be used as a regression method. SVR uses the same principle as SVM for classification, with only few minor differences. The Support Vector Machine is a discriminative classifier formally defined by a separating hyper plane. When the output is a real number it becomes very difficult to predict the information, which has infinite possibilities. In the case of regression, a margin of tolerance (epsilon) is set in the approximation to the SVM which would

have already requested from the given problem. The main idea of this algorithm is to minimize the error, individualize the hyper plane which maximizes the margin and to tolerate the error occurred.

Following are the steps needed in the working of SVR:
☐ Collection of the training set
☐ Selection of Kernel along with its parameters and any regularization if required.
☐ Creation of correlation matrix
☐ Train machine to get the contraction coefficients $\alpha = \alpha_i$
☐ Create an estimator using the coefficients.

Pros and Cons of SVR:
Pros:
☐ SVM works relatively well when there is clear margin of separation between classes.
☐ SVM is more effective in high dimensional spaces.
☐ SVM is effective in cases where number of dimensions is greater than the number of samples.
☐ SVM is relatively memory efficient

Cons:
☐ SVM algorithm is not suitable for large data sets.
☐ SVM does not perform very well, when the data set has more noise i.e. target classes are overlapping.
☐ In cases where number of features for each data point exceeds the number of training data sample, the SVM will underperform.
☐ As the support vector classifier works by putting data points, above and below the classifying hyper plane there is no probabilistic explanation for the classification.

3.PROPOSED SOLUTION:
　　　Initially, the system take audio as input on a Personal Digital Assistant (PDA) by utilizing the python PyAudio module. Next, the system convert the audio to text using the Google Speech API. Presently utilizing NLP i.e Natural language processing the system breakdown the text into smaller, simpler and understandable text. The system has a reliance parser for analyzing the grammatical structure of the sentence and building up the connection between words.
By utilizing some AI the system can prepare a model and now the system have data sets of predefined sign language and ISL Generator can input sentences using ISL grammar rules. By using AI the system can display the converted audio into the sign. Finally, the system converts audio into Sign language. In addition to sign language recognition, audio to sign language conversion is done with India specific sign language. The "Indian Sign Language" or ISL utilizes manual communication and non-manual communication to convey thoughts, emotions or feelings. ISL signs can be commonly grouped into three classes:
- One-handed
- Two-handed
- Non-manual signs

One-handed signs and two-handed signs are additionally called manual signs where the signer uses his/her hands to make the signs for passing on the data whereas Non-Manual signs are produced by changing the body stance, outward appearances, and facial expressions.

FEASIBILITY STUDY
　　　An analysis and evaluation of a proposed project to determine if it is technically feasible, is feasible within the estimated cost, and will be profitable. Feasibility studies are almost always

conducted where large sums are at stake. A feasibility study aims to objectively and rationally uncover the strengths and weaknesses of an existing banking applications and threats present in the environment, the resources required to carry through, and ultimately the prospects for success in the sign language detection

Tests of Feasibility
Feasibility study is conducted once the problem clearly understood. Feasibility study is necessary to determine that the proposed system in sign language detection is feasible by considering the technical, operational, and economical factors. By having a detailed feasibility study the management in the will have a clear-cut view of the proposed system of the sign language detection. Feasibility study encompasses the following things:
•   Technical Feasibility
•   Economical Feasibility
•   Operational feasibility

Technical Feasibility
A large part of determining resources has to do with assessing technical feasibility. It considers the technical requirements of the proposed project of sign language detection. The technical requirements are then compared to the technical capability of the banking system. The systems project is considered technically feasible if the internal technical capability is sufficient to support the banking system's requirements. The analyst must find out whether current technical resources can be upgraded or added to in a manner that fulfils the request under consideration.
The essential questions that help in testing the operational feasibility of a system include the following:
•   Is the project feasible within the limits of current technology?
•   Does the technology exist at all?
•   Is it available within given resource constraints?
•   Is it a practical proposition?
•   Manpower- programmers, testers & debuggers
•   Software and hardware
•   Are the current technical resources sufficient for the new system?
•   Can they be upgraded to provide to provide the level of technology necessary for the new system?

Operational Feasibility
        Operational feasibility is dependent on human resources available for the project and involves projecting whether the system will be used if it is developed and implemented. Operational feasibility is a measure of how well a proposed system in sign language detection solves the problems, and takes advantage of the opportunities identified during scope definition and how it satisfies the requirements identified in the requirements analysis phase of sign language detection development.
The essential questions that help in testing the operational feasibility of a system include the following:
•   Does current mode of operation provide adequate throughput and response time?
•   Does current mode provide end users and managers with timely, pertinent, accurate and useful formatted information?
•   Does current mode of operation provide cost-effective information services to the business?
•   Could there be a reduction in cost and or an increase in benefits?

Economical Feasibility
        Economic analysis could also be referred to as cost/benefit analysis. It is the most frequently used method for evaluating the effectiveness of a new system of the sign language detection. In economic analysis the procedure is to determine the benefits and savings that are expected from a

candidate system and compare them with costs. If benefits outweigh costs, then the decision is made to design and implement the sign language detection. An entrepreneur must accurately weigh the cost versus benefits before taking an action.

Possible questions raised in economic analysis are:
•   Is the system cost effective?
•   Do benefits outweigh costs and system study?
•   Sign is detected and displayed.

result and analytics

MODULEDESCRIPTION
- AUDIO RECOGNITION
- IMAGE PREPROCESSING
- SEGMENTATION
- FEATURE EXTRACTION
- CLASSIFICATION & SIGN DISPLAY

AUDIO RECOGNITION

Initially, the system take audio as input on a Personal Digital Assistant (PDA) by utilizing the python PyAudio module. Next, the system convert the audio to text using the Google Speech API. Presently utilizing NLP i.e Natural language processing the system breakdown the text into smaller, simpler and understandable text. The system has a reliance parser for analyzing the grammatical structure of the sentence and building up the connection between words. By utilizing some AI the system can prepare a model and now the system have data sets of predefined sign language and ISL Generator can input sentences using ISL grammar rules.

IMAGE PREPROCESSING

The image acquired is preprocessed. The preprocessing starts by converting the RGB image to L*a*b* color space. The L*a*b* color space consists of Luminosity layer L*, chromacity layer a* and b*. All of the color information is stored in the layers a* and b*. It requires to make color form so that the RGB colored image is converted to L*a*b* space. The function is makecform(), later the format is applied to the image that was acquired

SEGMENTATION

There are several algorithms used for segmentation but one of the best methods used for detection of disease is k- means clustering. k-means clustering is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. k-means clustering aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. This results in a partitioning of the data space into Voronoicells.k-means clustering tends to find clusters of comparable spatial extent, while the expectation-maximization mechanism allows clusters to have different shapes.

FEATURE EXTRACTION

The features of the selected cluster are extracted. The selected image is converted to grayscale since the image is in RGB format. At the next step the Gray Level Cooccurance Matrices (GLCM). The required statistics are derived from Gray level cooccurance Matrices (GLCM). The following 13 features that is extracted and evaluated:
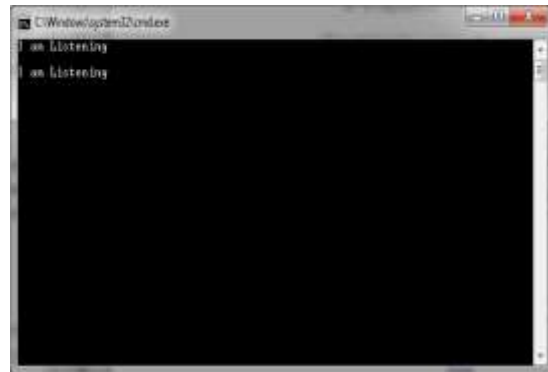
Contrast, Corelation, Energy, Homogenity, Mean, Standard Deviation, Entopy, RMS. Variance, Smoothness, Kurtosis, Skewness. The thirteen features are stored in an array.
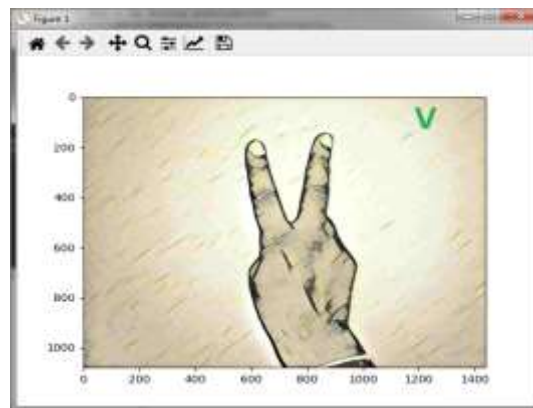
4.RESULT/DISCUSSION:

Welcome page:

Audio recognition

Recognizing kovil

5.CONCLUSION :

The software is completely menu driven and extremely user friendly since it is developed in an efficient front end tool. This Model is 97% accurate in detecting signs through speech input. The system is used to detect audio as well as to use the detection frame for sign display. The system prepare a model for sign detection and now the system have data sets of predefined sign language and ISL Generator can input sentences using ISL grammar rules. By using AI the system can display the converted audio into the sign. Finally, the system converts audio into Sign language with India specific sign language.The voice to sign language conversion app is an innovative way to bridge the communication gap between people who speak different languages. This app is easy to use and can be used in a variety of settings, from formal meetings to casual conversations. It can help bridge cultural divides and create a more inclusive environment. With its ability to accurately interpret spoken language and convert it into sign language, this app could open up a world of possibilities for those who use sign language and those who don't.The Voice to Sign Language Conversion App is an incredibly powerful tool that has the potential to revolutionize the way the deaf and hard of hearing community communicates with the hearing world. It can bridge the gap between hearing and deaf people, allowing deaf and hard of hearing people to communicate more effectively with those who can hear. This app can also be used to provide a platform for deaf and hard of hearing people to be more included in society, as it will enable them to better communicate with those who are not fluent in sign language. Overall, this app has the potential to be a game-changer for the deaf and hard of hearing community, and could potentially be the first step towards a more inclusive world.

SCOPE FOR FUTURE ENHANCEMENT

The system can be altered in accordance with the future requirements and advancements. System performance evaluation must be monitored not only to determine whether or not they perform as plan but also to determine if they should have to meet changes in the information needed for sign recognition. The performance of the system will be evaluated to determine whether system achieves the results that are expected and whether the predicted benefits of the system are realized. There are also possibilities for enhancing and further developing the project with sign recognition for sentences, pages etc.

- Incorporating AI and Machine Learning technologies to enable more accurate and faster translations.
- Connecting with various databases to provide a more comprehensive range of sign language translations.
- Adding facial recognition technology to identify the user's facial expressions and gestures while signing.
- Enhancing the user interface to be more user-friendly and intuitive.
- Integrating the app with virtual reality technology to simulate real-life signing scenarios.
- Supporting multiple languages to enable cross-language communication.
- Adding a feature to allow users to save translations for future reference.
- Developing a mobile version of the app for on-the-go access.
- Providing an option to customize the font, font size, and color of the text for greater user accessibility.
- Introducing features to enable users to share their translations with others

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