Artificial Intelligence for Business  
Decisions and Transformation

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**Introduction**

We focus on two AI-driven projects: Real-time Sign Language Detection System and Location-Based Restaurant Recommendation System. Both projects leverage advanced machine learning algorithms to tackle significant challenges—communication for the hearing-impaired community and personalized restaurant recommendations based on user location.

**1. Real-time Sign Language Detection System**

The **Real-time Sign Language Detection System** aims to recognize and interpret sign language gestures in real-time, making communication more accessible for the deaf and hard-of-hearing community. This system relies on a variety of AI tools and libraries to achieve this goal.

**Key Development Tools and Libraries**

* **TensorFlow**: This deep learning library is the backbone of the system. It enables the training of the LSTM (Long Short-Term Memory) model, which is particularly useful for recognizing sequential gestures over time. TensorFlow’s scalability also makes it ideal for both mobile and web platforms.
* **OpenCV**: A computer vision library that captures live video feeds, processes frames in real-time, and forwards them to the AI model for gesture detection.
* **MediaPipe**: A tool developed by Google for detecting human landmarks such as hand, face, and body poses. MediaPipe simplifies the process of identifying key landmarks necessary for gesture recognition.
* **Numpy**: Used for handling numerical data, specifically for processing landmark data extracted from MediaPipe before feeding it into the model.

**Comparison with Google’s Sign Language AI**

Google’s Sign Language AI also uses TensorFlow and OpenCV, but it primarily utilizes CNNs (Convolutional Neural Networks) for image-based gesture recognition. In contrast, our project uses LSTM, which is more effective in recognizing continuous sequences of gestures. Another key difference is that Google’s system is limited to pre-trained gestures, primarily American Sign Language (ASL). Our project allows for custom gesture training, making it adaptable to different sign languages or even user-specific gestures. This flexibility is crucial in extending the system’s usability across different regions and languages.

**2. Location-Based Restaurant Recommendation System**

The Location-Based Restaurant Recommendation System recommends restaurants based on a user’s geographic location by clustering restaurants using the KMeans algorithm and analyzing data from the Yelp dataset.

**Key Development Tools and Libraries**

* **Pandas**: A powerful data manipulation library used to filter and organize restaurant data such as reviews, ratings, and locations from the Yelp dataset.
* **GeoPandas**: A geospatial analysis tool that helps in mapping the restaurant locations and visualizing them in clusters.
* **Scikit-learn**: Provides the KMeans clustering algorithm to group restaurants based on their geographic coordinates (latitude and longitude). This allows the system to identify and recommend restaurants located near the user.
* **Plotly and Folium**: Libraries used to create interactive maps and visualizations. These tools help in displaying restaurant clusters, making the system more intuitive and user-friendly.

**Comparison with Uber Eats**

Uber Eats’ recommendation system primarily uses collaborative filtering, which recommends restaurants based on user preferences and previous orders. Our project focuses more on location-based clustering, grouping nearby restaurants to make recommendations based on proximity. While Uber Eats provides a basic map view, our system uses Plotly and Folium to offer interactive, detailed visualizations of restaurant clusters, enhancing the user experience. Additionally, our system can be scaled to new geographic regions by using available data, making it more flexible and adaptable.

**Decision and Future Pursuit**

After analyzing both projects, we have decided to pursue the Real-time Sign Language Detection System. This project offers more potential for social impact by enhancing communication accessibility for the deaf and hard-of-hearing community. The system’s adaptability to multiple sign languages, combined with its customizable gesture training, makes it a versatile solution for global use. Additionally, the use of LSTM for continuous gesture recognition provides a unique advantage over existing systems, such as Google’s Sign Language AI.

**Conclusion**

The Sign Language Detection System stands out for its potential to drive social change and innovation. By integrating tools such as TensorFlow, LSTM, OpenCV, and MediaPipe, this project holds the promise of creating a scalable and impactful solution for improving communication accessibility across different communities.