Literature Review

for

SIGN LANGUAGE RECOGNITION WITH MACHINE LEARNING (SLRWML)

Version 1.1

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Abstract

After the 2010s, technological developments focused on artificial intelligence and machine learning. Despite this, technologies that help people with disabilities have not improved as much as other technologies. They should have the same opportunity as other people. This project aims to bring deaf people closer to other people. Sign language is very important for communication. According to the project, Deaf people use that application to translate what they want to say to Turkish. In addition to that, people who need to communicate with deaf people also want that translation. The other usage of that technology is easy writing like what voice assistants do. Using sign language, users can easily send messages. In order to help programmers, videos explaining how the project works, open-source code, and libraries used are shared in the literature. This article aims to summarize the literature and research of previous projects that were the subject of this project. We also examine machine learning and artificial intelligence science literature to evaluate how to work in this field.

Keywords: Sign language, deaf people, machine learning, artificial intelligence

Öz

2010'lu yıllardan sonra teknolojik gelişmeler yapay zeka ve makina öğrenmesi alanlarında yoğunlaştı. Buna rağmen engelli insanlar için yapılan gelişmeler diğer gelişmelerin yanında eksik kaldı. Engelli insanlar da diğer insanlarla aynı fırsatlara eşit olmalıdır. Bu proje duyma engelli insanlarla diğer insanları daha çok yakınlaştırmayı amaçlar. Bu iletişim için de işaret dili büyük önem arz etmektedir. Bu projeye göre duyma engelli insanlar, uygulamayı kullanarak anlatmak istedikleri şeyleri işaret dilinden Türkçe'ye çevirebilirler. Buna ek olarak duyma engelli birisiyle iletişim kurmak istediğinde diğer insanlar da bu uygulamayı kullanarak onlara işaret dili tercümesini gösterebilirler. Bu uygulamanın diğer bir kullanım alanı da sesli asistanlar gibi çalışır. Nasıl sesli asistan kullanarak hızlı mesaj yazabiliyorsak, aynı şekilde işaret dili kullanarak da aynı işlemi gerçekleştirebiliriz. Programcılara yardımcı olmak amacıyla literatürde projenin nasıl çalıştığını anlatan videolar, açık kaynak kodu ve kullanılan kütüphaneler paylaşılmıştır. Bu makale, bu projenin konusu olan önceki projelerin literatürünü ve araştırmalarını özetlemeyi amaçlamaktadır. Bu alanda nasıl çalışılacağını değerlendirmek için makine öğrenimi ve yapay zeka bilimi literatürünü de inceliyoruz.

Anahtar Kelimeler: İşaret dili, sağır insanlar, makine öğrenimi, yapay zeka

1. Introduction

According to the data of the World Health Organization (WHO), 466 million deaf people live worldwide and more than 3 million of them living in Turkey. Unfortunately, only 10 percent of people who are deaf today have hearing aids. Also, some of the people can not hear totally and hearing aids can not help them. Therefore, sign language is of great importance for deaf people. Using this language, they can communicate with the people they meet. We designed this project to make life easier for those with a high percentage (those without hearing aids).

We examined how existing projects work and what they benefit from. In addition, our literature research enabled us to identify gaps in the current literature. These shortcomings will contribute to the later stages of the project.

In the next section, the literature of previous projects is discussed. In the fourth section, we compare our project and previous projects. We mention the advantages of our project according to previous work. In the fifth part, we explain and conclude the contribution of the literature of the projects to us.

2. Related Work

The traditional way to prevent this issue is to use a mechanical tool for ears to improve the sound of the environment for deaf people. However, these devices only increase the sound, for totally deaf people this sort of device is not useful. There have been many studies on sign language in the past. We reviewed these studies, made improvements, and tried to fix the shortcomings we found in our project. We will examine a few examples made in the past below.

2.1 Real-Time Malaysian Sign Language Translation using Colour Segmentation and Neural Network[1]

Recommended automatic sign language translators provide a real-time English translation of Malaysian SL. A wearable glove is used in combination with colors to help identify fingertips in the color spectrum of the camera.

This project focuses solely on finger typing, which takes different approaches respectively. The working process takes place in 4 stages; First, read the frame, dissect the color, find the center of the image, and finally determine the result.

Finally, trained neural networks are used to describe signs to be translated into English.

2.2 A real-time continuous gesture recognition system for sign language[2]

First, a motion input is detected and analyzed, then motion is analyzed according to four parameters: stance, position, orientation, and motion.

The developers implemented a prototype system with a 250-word dictionary and collected 196 educational phrases in Taiwanese Sign Language (TWL). This system uses hidden Markov models (HMMs) for 51 basic postures, 6 orientations, and 8 motion principles.

The accuracy rate obtained in this study is approximately 80.4%.

2.3 A vision-based sign language recognition system using tied-mixture density HMM[3]

In this project, a vision-based vocabulary Chinese sign language recognition (SLR) system is presented.The system consists of two parts.

In the first part, hand sensing, background subtraction and pupil detection techniques are largely combined to show the movements in different environments with the help of appropriate colored gloves.Principal component analysis (PCA) is used to interpret finger features in more detail.

In the last section, the Bound Mix Density Hidden Markov Models (TMDHMM) framework for SLR is proposed.

The accuracy of this project reaches up to 92.5%.

2.4 A Video-Based Indian Sign Language Recognition System (INSLR) Using Wavelet Transform and Fuzzy Logic[4]

In this project, a simplified Video-Based Indian Sign Language Recognition System (INSLR) has been designed using a combination of various image processing techniques and computational intelligence techniques. At the same time, a wavelet-based video segmentation technique is used that detects many hand signals and head movements. The properties of hand gestures are understood using the feature vectors of the image using elliptical Fourier annotations.

Finally, the INSLR system uses a sound system to play recognized movements along with text output. The system was tested by 10 different programmers using a data set of 80 words and sentences.

It shows that it is 96% correct according to the results of the tests.

3. Sign Language Translator Using Machine Learning

According to research which was done in 2017, There is currently more than 3 million people have been suffering from deafness. Previous works work in English and translate word by word to text. Also, one of the project use gloves to recognize. These are not useful and efficient in real life. Translating word by word does not make sentences and it is hard to understand for people. Besides, people can not carry gloves all the time. People need a real-time translator to sign language to human languages. In addition to that, there is not any study in Turkey. In this project we want that solve this problem. Deaf people can use applications, which in their mobile phone, to communicate with other people. In addition to that, their relatives also want to translate human languages to sign language. To do this, people can use it with video or using the front camera of the mobile phone. Application translate it to writing and using voice assistants, other people can hear what deaf people sign. Another application area is similar to the voice assistant. While preparing some food or walking in the rain, writing text messages is very difficult. People use voice assistants at these times. Deaf people haven't that opportunity. To give them that chance, this application can be used as an assistant. Lastly, for online videos, movies, series, or tv shows, there exist subtitles but some people may want to sign language translation.

4. Conclusion

As a result, some projects have been carried out and designed to make life easy for 466 million deaf people around the world. There are not many applications for a sign language translator. The ones that exist could not use efficiently in real life. Based on these projects, we decided to identify the deficiencies and make an easier and more understandable project. Our project has been approaching issues in a different way. In this way, it will be ensured that deaf people without hearing aids can easily communicate with anyone they want to use this project.

5. References

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