Article

Artificial Intelligence Applications for Disability Support

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Abstract: People with disabilities are often dependent on others to complete their tasks. The healthcare industry has invented many mechanical instruments and aids in the past to make their lives better. The evolution of Artificial Intelligence (AI) has opened up new avenues for improving existing aids like prosthetics and also creating new ones like AI powered apps to help the disabled navigate problems with finding objects, remote controlling them, speech, memory, and dexterity. The present paper covers the problems faced by the disabled and how AI helps them overcome these.

Keywords: Artificial Intelligence, disability

1. Introduction

People with disabilities face one or more challenges with walking, hearing, seeing etc. Often they are dependent on their families and friends to perform daily tasks. Disability aids have been designed for them to help them complete their tasks independently as much as possible.

According to the World Health Organization (WHO), more than one billion people are living with some significant disability. The market for AI-related technologies is expected to grow to over \$2 trillion in the next seven years [1].

An algorithm is a set of step-by-step instructions to be followed to achieve the result. An AI system can learn and take decisions by analyzing data and recognizing patterns or by using algorithms to take decisions.

2. AI Powered Apps for the Disabled

With the evolution of Artificial Intelligence, disability aids have been made to make it easier for people with handicaps to work.

2.1. Visual Impairment

Machine vision Artificial Intelligence models are fed with pre-labeled data to teach them to recognize images they have never seen before for image recognition. Once the dataset is ready, data annotation or labels are applied to the images to maximize efficiency for training the model. Once a label is assigned, it is remembered by the software in subsequent frames. Location and intensity of the pixels of an image is the information given to the model. This information makes image recognition work by finding patterns in the subsequent images supplied to it in the learning process. Convolutional Neural Networks (CNN) yield the best results with deep learning image recognition [2].

2.1.1. Support Vector Machines (SVMs)

SVMs create histograms of images to describe features. They move the image around with a sliding detection window technique. The algorithm then takes the test picture and compares the trained histograms values to make the final decision.

2.2. Popular Deep Learning Models for Image Recognition

YOLO (You Only Look Once) processes a frame only once using a fixed grid size and then determines whether a grid box contains an image or not.

Single-Shot Detectors (SSD) divide an image into a default number of bounding boxes in the form of a grid over different aspect ratios. The feature map that is obtained from the hidden layers of neural networks applied on the image is combined at the different aspect ratios to naturally handle objects of varying sizes.

Visually impaired people can read documents with smartphone cameras. They can also be used to recognize faces. Some apps read out emails, messages, and electronic documents. Wearables like AI Smart Glasses use AI, computer vision, and Natural Language Processing to scan objects and text, and provide scene description [3].

2.3. Mobility Impairment

People can use personal assistance AI tools such as Alexa to remotely control a number of things using their voice. For example, they can give voice commands to get answers to their questions, play music etc. It can also control things like lights, air conditioners, curtains with smart devices that are connected with it. Alexa can be used to set up a routine to reduce repetitive commands like turning on lights and thermostat at a particular time. Alexa also has hunches, for example, if you are away from home or everyone has gone to bed, it can proactively turn off lights [4].

Self-driving cars or driverless cars offer a new solution for mobility of people with disabilities. Self-driving cars use sensors, cameras, radars and AI to get to the destination [5]. AI-powered wheelchairs can take audio inputs from the user. AI is also used in exoskeletons and prosthetic limbs, and improves movements by boosting the power of nerve interfaces for electronic prosthetics [1].

2.4. Hearing Impairment

AI can be used to transcribe conversations. It adds conversation subtitles automatically. AI is also being used to develop sign language translation and lip-reading software.

2.5. Dexterity Impairment

An ML-enabled prosthetic limb can be trained to observe muscle signals with regards to various motions. Artificial Intelligence allows for generating more life-like movements that do not rely on pre-programmed movement patterns. It allows wearers to make intuitive movements using muscle signals from their residual limbs. An ML-powered prosthetic limb observes muscle signals with regards to different motions [6]. It can generate more realistic movements and provide better dexterity and grip.

2.6. Speech Impairment

The Artificial Intelligence approach is the mixture of the pattern recognition approach and acoustic phonetic approach, so it is called hybrid approach of pattern recognition and acoustic phonetic approach [7].

There are apps that normalize speech to create an output of audio or text so that people with speech impediments can communicate with others [5]. Apps like Speech Trainer 3D show how muscles and lips move to produce sounds. TouchChat HD provides phrases with which users can build complete sentences. This app is meant for Autism, Apraxia, or ALS patients whose speech is difficult to understand [8].

2.7. Mental Impairment

Text or speech summarization can help people with mental disabilities understand what people are talking about. There are apps like Peace and Lumosity for improving memory, mental agility, and attention. These apps have intuitive, short games to test and improve cognitive skills, mathematics. They use repetition to make users remember information for a longer span [9]. Some apps provide personalized training that users can learn on their own pace.

3. Limitations and Future Scope

Lower and lower income groups AI is not always accurate. Algorithms are being revised to achieve higher accuracy. It is important to include people with disabilities in the implementation, training, and testing of AI systems to ensure that AI systems are serving their needs, reduce errors, risks, and side effects. At present AI systems do not inform users about the probability of error, which can be very important for them [10]. For example, a blind person would find this

information very useful about the decision or location of an object. AI systems cannot deal with situations and data they have not been exposed to. People with disabilities may be more vulnerable to privacy violations when using AI systems, as these systems may collect and use sensitive personal information. High cost of assistive technology is a barrier for many people [11].

The reach and use of AI powered Assistive Technology can be increased in the following ways:

1. Reduce the price of products and their maintenance.
2. Provide wider options and variety for people with different degrees of disability.
3. Develop better safety standards for AI, robotics, and other Assistive Technologies for the disabled.
4. Expand product and service availability to cover more regions including rural areas.
5. Increase public awareness and reduce stigma associated with disability and the need of Assistive Technologies.

4. Conclusion

AI can greatly improve the lives of people with various forms of disabilities despite its limitations. It can reduce their dependence on other people and make it easier for them to communicate. With its user-centered approach and inclusive design, AI helps in breaking down barriers. In the future, the focus should also be on reducing the cost of assistive technology.

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