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Reviews on Various Technologies Used For Visually Disable People

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Abstract: *In an effort to overcome a variety of challenges encountered by individuals with disabilities including visual impairment, motor disability, and communication difficulties computer vision has demonstrated considerable promise. This report provides an examination of the current state of computer vision-based assistive technology, as well as significant challenges and areas for future research. This study specifically investigates the applications of computer vision in the domains of gesture-based control interfaces, object recognition, navigation, facial recognition, and sign language interpretation. Additionally, the article examines the advantages and disadvantages of different methodologies and technologies, and provides illustrations of how computer vision can be integrated into existing assistive technologies to enhance their effectiveness. This investigation addresses the privacy and ethical concerns associated with the application of computer vision to assistive technologies. Additionally, the research emphasizes the necessity for protocol standardization, enhanced user-centered design, and practical efficacy evaluation as prospective areas of investigation to refine the application of computer vision in assistive technology. In general, this article illuminates the potential transformative impact that computer vision could have on assistive technologies designed for individuals with disabilities.*

Keywords: Computer Vision, Assistive Technologies, Disabilities, Visual Impairment, Accessibility, Human-Computer Interaction (HCI)

I. INTRODUCTION

The term "assistive technology" encompasses any hardware, software, or device intended to enhance the autonomy and quality of life of people with disabilities. The term "assistance technologies" comprises an extensive array of devices, such as those designed to assist people with cognitive disabilities, hearing or vision impairments, mobility restrictions, and other similar conditions. Assistive technology aims to facilitate individuals with disabilities in surmounting obstacles and engaging more extensively in societal activities. There are numerous applications for assistive technology, ranging from straightforward modifications to intricate systems, and it finds utility in diverse environments, including the workplace, residence, and community. New opportunities arise with the progression of technology to create inventive assistive technologies that can aid people with disabilities in attaining their objectives and living more autonomously. As a result, there is a growing interest in the application of computer vision to assistive technologies, given that computer vision has the capacity to offer innovative and effective methods of aiding people with disabilities. Investigating the application of computer vision in assistive technologies for people with disabilities has emerged as a significant field of study and advancement.

Globally, assistive technology devices and services are estimated to benefit millions of individuals, although data on this subject varies by country and region. Many of the approximately 15% of the world's population, or one billion people, who have a disability could benefit from assistive technology, according to the World Health Organization. An estimated 61 million people in the United States, for instance, are affected by a disability; of these, around 26 million have a severe disability that significantly hinders their ability to carry out daily tasks (Krahn, 2011). By facilitating their engagement in activities they might not otherwise be able to and allowing them to participate more completely in their communities, assistive technology can enhance the quality of life for people with disabilities.

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A multitude of entities, including governmental agencies, non-profit advocacy groups, and professional associations, publish reports on assistive technology. These organizations frequently engage in research, disseminate reports and white papers, establish standards and guidelines, and offer technical assistance and training to policymakers, service providers, individuals with disabilities, and caregivers. Their research may center on particular domains of assistive technology, such as mobility devices, augmentative and alternative communication, or more comprehensive concerns pertaining to inclusivity and accessibility. These organizations contribute to the advancement of policies and funding that support the needs of individuals with disabilities, raise awareness, identify emergent trends and technologies, and promote best practices through their reporting on assistive technology. The following are some examples:

Assistive Technology Industry Association (ATIA) - The mission of ATIA, a professional membership organization, is to enhance the quality of life for people with disabilities through the advancement of assistive technology. The organization releases reports and resources encompassing a range of subjects pertaining to assistive technology. These include policy updates, emergent trends, and optimal methodologies (Smith, 2016).

World Health Organization (WHO) - WHO is a United Nations specialized agency concerned with matters of global public health. Among the many subjects on which they issue reports and guidelines is assistive technology. The World Health Organization (WHO, 2021) presents a thorough examination of the worldwide impact of disability and emphasizes the critical role that assistive technology plays in mitigating this issue.

National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) - Funding research and development initiatives pertaining to assistive technology and other topics associated with disabilities, NIDILRR is a federal agency. The organization disseminates reports and resources pertaining to accessibility, assistive technology standards, and the technological ramifications experienced by people with disabilities (Amtmann et al., 2020).

Global Initiative for Assistive Technology (GATE) - GATE is an international consortium of organizations and individuals dedicated to advancing worldwide accessibility to assistive technology. Layton et al. (2020) state that the organization disseminates reports and resources pertaining to policy frameworks, service delivery models, and the utilization of technology to attain the United Nations Sustainable Development Goals.

Assistive Technology Outcomes and Benefits (ATOBA) - ATOBA is an organization dedicated to investigating the advantages and results of assistive technology as it pertains to people with disabilities. The organization disseminates research studies and reports pertaining to assistive technology cost-effectiveness, quality of life, and user satisfaction (Lenker et al., 2013).

International Society for Augmentative and Alternative Communication (ISAAC) - ISAAC is a professional organization that advocates for augmentative and alternative communication (AAC), which encompasses the utilization of technological devices to aid speech and language impaired individuals in their communication endeavors. Hemsley et al. (2017) state that they disseminate research studies, guidelines, and additional resources pertaining to assistive technology and AAC.

Accessible Technology Coalition (ATC) - ATC is a non-profit organization that assists organizations in making their technology and online content accessible to individuals with disabilities by providing training and resources. The publication encompasses a range of subjects, including the procurement of accessible technology, web accessibility, and digital accessibility standards (Ymous et al., 2020).

European Disability Forum (EDF) - EDF is a non-governmental organization that advocates at the European Union level for the rights and interests of individuals with disabilities. The organization releases policy briefs and reports pertaining to subjects including technology accessibility and the digital divide as it relates to people with disabilities (Priestley, 2007).

Association for the Advancement of Assistive Technology in Europe (AAATE) - AAATE is a professional organization dedicated to the advancement and advocacy of assistive technology throughout Europe. The organization disseminates research studies, reports, and guidelines pertaining to user-centered design, assistive technology standards, and the incorporation of technology into healthcare systems (Andrich, 2013). These and similar organizations provide policymakers, caregivers, individuals with disabilities, and researchers with valuable information and resources in order to enhance the lives of people with disabilities and advance the field of assistive technology.

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Classification of Assistive technology based on use

Different forms of assistive technology may be categorized based on the roles they play. A wide range of assistive devices are available to help those with disabilities. A few common types of assistive technology are listed in Table 1.

Table 1 Types of assistive technology

Sl. No.	Type of Assistive Technology	Description	Examples
1	Mobility Aids	Devices that help individuals with mobility impairments to move around more easily.	Wheelchairs, scooters, walkers, canes
2	Communication Devices	Devices that help individuals with communication impairments to communicate with others.	Speech generating devices, communication boards, software
3	Sensory Aids	Devices that help individuals with sensory impairments to better perceive their environment.	Hearing aids, visual aids, tactile aids
4	Cognitive Aids	Devices that help individuals with cognitive impairments to manage their daily lives.	Memory aids, organization tools, task management software
5	Environmental Controls	Devices that allow individuals with disabilities to control their environment.	Home automation systems, remote controls, voice-activated assistants
6	Prosthetics and Orthotics	Devices that help individuals with physical impairments to perform daily activities.	Prosthetic limbs, braces, supportive de- vices
7	Assistive Software	Computer software and mobile applications that help in- dividuals with disabilities to perform tasks.	Speech recognition software, screen readers, text-to-speech software

This table briefly describes assistive technology categories and gives examples of devices and software in each area. Computer vision technology can recognize things and provide audio or tactile input to visually impaired people. Gesture and voice recognition may help people with mobility or communication issues use computers, mobile devices, and other electronics in novel ways.

While computer vision in assistive technology is relatively new, research has showed promise. As technology advances, computer vision-based assistive solutions will become more inventive. Computer vision in assistive technology might increase disability accessibility in education, work, and everyday life. Computer vision can develop accessible learning materials for visually impaired pupils or enable mobility-impaired people handle home automation systems. However, computer vision in assistive technologies may also help society. Helpful technology may minimize social isolation, increase career possibilities, and encourage inclusion for disabled people by boosting accessibility and independence. Assistive technology helps disabled people live freely and avoid institutional care, lowering healthcare expenses.

There are obstacles and limits to using computer vision in assistive technology. The technology may not be accessible or inexpensive for all disabled people. Privacy and data security must also be addressed when utilizing computer vision in assistive technology. Computer vision in assistive technology offers a promising possibility to enhance the lives of disabled people and make society more inclusive and accessible (Silva et al., 2020). Smart homes are one area where computer vision in assistive technology has enormous promise. Computer vision-enabled smart homes may be adapted for disabled people, improving their freedom and quality of life. By gesture or speech, computer vision can operate household equipment including lighting, heating, cooling, and security systems.

Besides smart houses, computer vision may be utilized to create novel mobility assistance for disabled people. To increase autonomy and movement, wheelchairs and prosthetic limbs might use computer vision technology. Computer

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vision may assist people with mobility issues navigate new surroundings by giving information about barriers and layout. Augmented reality systems are another promising computer vision application in assistive technology. Augmented reality may assist disabled people navigate and engage with their surroundings by providing real-time feedback (Jafri et al., 2013). Augmented reality may provide visually impaired people aural or tactile input about items and their surroundings. Computer vision in assistive technology may help disabled people become more independent and accessible. By using computer vision, researchers and engineers are creating new assistive technologies that may improve lives.

Demands of users and associated Computer Vision activities

Computer Vision-based assistive solutions may meet several disability requirements. Visually impaired people may have problems finding items. Computer vision algorithms may recognize things in real time using cameras or sensors (Lee and Hang, 2017). A Smartphone app employing Computer Vision can detect and describe items in the user's environment using the camera.

Cognitive or neurological problems may make facial recognition difficult, making social interactions challenging. Computer vision algorithms can categorize faces in photos and movies. This may provide visual clues or notify the user to a familiar presence (Hitelman et al., 2022). Physically disabled people may have trouble using keyboards or mice. To operate computers and other devices, computer vision algorithms can recognise hand motions and face expressions (Sharadhi et al., 2022). A wheelchair user may maneuver the chair using facial expressions or hand motions.

Hearing-impaired people may lipread to understand speech. Computer vision algorithms recognize lip movements and transform them into text or speech. Use with voice recognition for more accurate and effective communication (Zhou et al., 2021). Vision-impaired people struggle in unfamiliar environments. Computer vision algorithms can analyse visual circumstances and give location, structure, and environmental data to guide travellers (Ren et al., 2022). Visually impaired people may use a Smartphone app that uses computer vision to deliver aural signals and navigation guidance.

Visually impaired people may struggle to read. Computer vision algorithms can extract text from photos or movies and transform it to voice or an accessible format (Abraham et al., 2020). Smartphone apps can read printed documents aloud.

Mobility-impaired persons may struggle with object handling and environment interaction. Computer vision algorithms can follow things in real time to operate robotic devices and other assistive technologies. Computer vision can control a robot arm for dressing and feeding. People with autism or other developmental problems may have trouble reading facial expressions. Computer vision algorithms can identify expressions and offer feedback to assist people understand social signals (Balen et al., 2020). A smart phone app may show or tell the user how others feel.

Cooking, cleaning, and dressing may be difficult for those with cognitive or physical limitations. Using visual input, computer vision algorithms can identify activities and give guidance or support (Ward et al., 2021). Smartphone apps may walk users through culinary recipes.

People with cognitive or neurological limitations may have problems understanding and expressing emotions. Computer vision algorithms can evaluate facial expressions and give advice to help individuals manage their emotions. Virtual assistants can customize emotional support to user behaviors and facial expressions (Ki et al., 2020). These are a few ways Computer Vision technology may help disabled people. As technology advances, additional applications and use cases may improve disability accessibility and inclusion.

II. LITERATURE REVIEW

Computing vision helps computers comprehend and analyze digital photos and videos. Robotics, medical imaging, surveillance, and self-driving cars employ it. Computer vision has advanced thanks to deep learning and large datasets. CNNs are a major computer vision invention. CNNs outclass humans in image categorization on various benchmarks. Since 2010, the ImageNet Large Scale Visual Recognition Challenge has used CNN-based computer vision. CNN's AlexNet had the lowest top-5 error rate in 2012 at 15.3% (Akilan et al.).

Generative models like GANs for realistic images are another computer vision advancement. GANs have a discriminator that detects bogus images and a generator that creates them. The discriminator tries to spot false photos,

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while the generator tricks it. Minimax games train both networks simultaneously. GANs provide realistic, high-quality images for VR, gaming, and editing.

In addition to CNNs and GANs, computer vision has developed attention approaches to increase task performance and transformer-based image recognition models (Chai et al., 2021). These advances improved object detection, semantic segmentation, and posture assessment.

Transfer learning employs a previously learnt model to train on a new problem, another computer vision advance. This approach helps transmit work knowledge in low-labeled data environments. Computer vision uses transfer learning for object identification, semantic segmentation, and picture classification (Jhiang et al., 2020). In recent years, domain knowledge in computer vision models has grown. This entails using study subject information to enhance model design and task performance. Chen et al. (2017) advocate building medical imaging abnormality detection models employing domain knowledge of human anatomy and physiology.

Training computer vision with massive labeled data is difficult. Thus, data augmentation modifies photos to produce synthetic data. Data augmentation boosts model performance and training dataset size (Sahoo and Choudhury, 2022). Finally, self-driving car computer vision systems use lidar, radar, and cameras. System must detect, categorize, and decide on things in real time. Autonomous cars may change travel, but they also pose ethical and technical issues (Milakis, 2019).

One of the most intriguing computer vision findings is generative models, which can create or transform images. Image synthesis, style transfer, and inpainting employ GAN or VAE models (Shamsolmoali et al., 2021; Sahoo & Goswami, 2024). In computer vision, comprehensive representations of scenes and objects are being constructed. Modeling object-context relationships extends beyond item recognition and classification. Augmented reality, robotics, and intelligent video analysis use scene understanding models (Finco et al., 2023).

Improving computer vision system interpretability and explaining ability and creating new models and methodologies are popular. Driverless automobiles and medical imaging require this since mistakes may be serious. Explainability and interpretability may detect deficiencies, build system trust, and enhance decision-making (Sahoo & Choudhury, 2021; Antoniadi et al., 2021). Finally, computer vision technologies' ethical and societal effects are becoming obvious. Stronger and more broad mechanisms may improve society and aggravate social inequality. More study and debate are required on training data bias, algorithmic fairness, and privacy (Fazelpour & Danks, 2021; Mhasawade et al., 2021). Models, methods, and applications have advanced computer vision rapidly in recent years. Better interpretability, holistic scene knowledge, and ethical and societal issues with this technology are key issues.

Computer vision methods used in assistive technology tasks

There are several computer vision methods that can be used in assistive technology tasks for individuals with disabilities.Here are some methods:

Object recognition

Computer vision algorithms can identify and categorize things in real life. Blind people may find this beneficial since it makes navigation and communication simpler. Object identification systems assist users comprehend their environment by providing audio descriptions of items. These assistive technology apps use object recognition:

Environmental awareness: Users may learn more about their surroundings by hearing object recognition systems describe them. This is beneficial for visually impaired persons who have problems navigating unfamiliar circumstances.

Object identification: The user may learn about items by identifying and classifying them using object recognition systems. An object recognition system might recognize a chair or table and provide aural feedback on its size, shape, and placement.

Navigation assistance: Object identification systems may be combined with navigation aids to provide users more precise and trustworthy environmental information. An object recognition system might assist a visually impaired individual traverse a busy space by identifying barriers and offering voice directions.

Object manipulation: Disabled people can control items better using object recognition systems. An object recognition system might recognize a cup or spoon and offer audible feedback on its position and orientation, helping the user hold it. Object recognition helps disabled people navigate and engage with their surroundings. Object recognition systems may

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help disabled people live more freely and confidently by giving precise and trustworthy information about their environment.

Facial recognition

Identification and tailored support may be done using facial recognition algorithms. A face recognition system might identify a person and deliver tailored voice directions for navigating a museum or retail area. Facial recognition aids assistive technology in several ways:

Access control: Secure building, device, and resource access may be achieved using facial recognition systems. Facial recognition may be easier for disabled people to use than passwords or keycards.

Emotion recognition: Facial recognition systems can identify and interpret emotions, making assistance devices more individualized. For instance, an emotion recognition system may identify tension or anxiety and provide relaxation methods or other help.

Personalization: Facial recognition technologies can adapt the user experience for disabled people. Facial recognition allows assistive devices to recognize and help people based on their requirements and preferences.

Communication: Face recognition systems may aid people with communication disorders like autism by evaluating facial expressions and emotional clues. This may improve social communication and understanding for those with communication issues.

Navigation assistance: Facial recognition technology help visually impaired people navigate new situations. Facial recognition helps visually impaired persons navigate crowds and other complicated surroundings by recognizing and identifying people and providing audible input on their position and orientation. Facial recognition may aid disabled people in many ways. Facial recognition technologies may help disabled persons live more freely and confidently by giving precise and trustworthy information about their environment. Facial recognition advantages must be weighed against privacy and security issues.

Gaze detection

Gaze detection techniques capture eye movements and indicate where the user is looking. This allows mobility-impaired people to operate assistive equipment with their sight. Here are several ways gaze detection might improve assistive technology:

Communication: Gaze detection devices may improve communication for those with cerebral palsy or ALS. Glance detection systems let users to pick letters or words on a computer screen or other interface utilizing augmentative and alternative communication (AAC).

Navigation assistance: Quadriplegics may employ gaze detection technologies to navigate. Gaze detection systems allow users to operate wheelchairs and other assistive devices by sensing their gaze.

Attention monitoring: Autism and ADHD patients may utilize gaze detection devices to track their attention. Gaze detection systems can tell whether a person is focused by sensing their gaze direction.

Environmental control: Gaze detection systems may let disabled people switch on lights and change the temperature. Gaze detection systems allow users to interact with their surroundings by sensing their gaze direction.

Gaming and entertainment: Gaze detection technologies allow disabled people to play games and enjoy other entertainment. Gaze detection systems allow users to control game characters or interact with virtual surroundings by sensing their gaze direction. Gaze detection may aid disabled people in many ways. Gaze detection systems allow people to connect with their environment and participate in additional activities by giving an alternate input option.

Motion detection

Computer vision algorithms can follow user movements. The user's movements may trigger assistive devices to modify lighting, temperature, and other ambient conditions to fit their requirements. Motion detection aids assistive technology in several ways:

Fall detection: Motion detection devices can identify falls in elderly folks and Parkinson's patients. Motion detection devices inform caregivers or emergency agencies to help swiftly by sensing abrupt motion changes.

Activity monitoring: Motion detection devices can track disabled people including elderly persons and dementia patients. Motion detection devices may help caretakers and family members understand people's activities and behavior by monitoring movement in their surroundings.

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Object recognition: Motion detection systems can monitor wheelchairs and mobility aids in an area. Motion detection systems help disabled people navigate by sensing and monitoring these items.

Gesture recognition: Motion detection systems can translate hand motions and head nods for assistive technology. Motion detection systems let disabled people operate equipment and engage with their surroundings by recognizing and interpreting these gestures.

Security monitoring: Home and workplace security may be monitored via motion detection systems. Motion detection systems alert users to security concerns and intrusions by detecting and monitoring persons and objects.

Motion detection may benefit disabled people in many ways. Motion detection systems may improve navigation by recognizing and monitoring movement in an area.

Image and video analysis

Computer vision algorithms can evaluate camera-captured photos and movies to provide content feedback. A computer vision system might evaluate a kitchen picture and deliver voice cooking directions. Image and video analysis aids assistive technology in several ways.:

Object recognition: Image and video analysis can detect furniture, appliances, and tools in a particular environment. Image and video analysis technologies may help disabled people navigate by identifying these things.

Facial recognition: Facial traits may be used to identify people in images and videos. Image and video analysis technologies may assist people with cognitive impairments like Alzheimer's or autism recognize and engage with caregivers and family members by identifying familiar faces.

Emotion detection: Machines can infer emotions and moods from facial expressions and other nonverbal clues using image and video analysis. Image and video analysis may assist people with social or emotional disabilities like autism or depression communicate and engage by identifying emotions.

Scene analysis: Image and video analysis can comprehend a scene's visual context, such as a room's layout or item placement. Image and video analysis tools assist visually impaired people navigate by delivering visual insights.

Image and video captioning: Textual descriptions or image and video analysis captions allow visually challenged persons to access visual information.

Strong technology like image and video analysis may help disabled persons in numerous ways. These techniques may increase people's capacity to interact, communicate, and navigate by processing visual information from photos and videos.

Gesture recognition

Computer vision algorithms can comprehend hand and body motions. This lets people with mobility issues control assistive gadgets by waving or fist-making. Some ways gesture recognition may aid assistive technology:

Control devices: Hand motions or other gestures may operate wheelchairs and computers using gesture recognition. A disabled individual might use hand gestures to operate a wheelchair or a computer cursor.

Communicate: Gesture recognition can comprehend nonverbal communication like sign language. Gesture recognition may help deaf and hearing-impaired people communicate.

Assistive technology input: Prosthetic limbs and voice recognition systems may employ gesture recognition. To make using assistive technology more natural for disabled people, gesture recognition can recognize and interpret certain motions.

Rehabilitation: Rehabilitation using gesture recognition may enhance motor skills and range of motion in disabled people. Gesture recognition might help a stroke or injury patient monitor their progress and get feedback.

Environmental control: Gesture recognition can switch lights on and off, regulate the temperature, and open and close doors. Gesture detection makes environment control easier for those with mobility issues.

Gesture recognition may aid disabled people in many ways. Gesture recognition makes device interaction, communication, and environment control more natural and intuitive.

Text recognition

Text recognition and reading algorithms allow visually impaired people to access written information. Text recognition systems may transform printed text into audio or Braille, enabling visually impaired people to access the same information. Text recognition may aid disabled people in numerous ways:

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Reading assistance: Text recognition can convert photographs and videos to audio or braille for blind people. Restaurant and drug bottle labels may be scanned using text recognition.

Document scanning: Text recognition can scan and digitize books and articles for disabled people. Digital text may be read aloud, recorded in braille, or displayed on a computer with customizable font sizes and other accessibility features.

Text input: Text recognition may help keyboard-challenged people type. Text recognition makes entering information into a computer or other device easier by identifying text on paper or screens.

Captioning and subtitling: Text recognition can automatically caption or subtitle videos for deaf or hard of hearing people.

Signage recognition: Text recognition may help visually impaired people read public signs and labels. A text recognition system might read a business name or bus stop sign number. Text recognition may aid disabled people in various ways. Text recognition may make reading, writing, and communicating easier by identifying and interpreting text in photos and videos.

Emotion recognition

Computer vision algorithms can identify and understand facial expressions and body language, making assistive devices more individualized. For instance, an emotion recognition system may identify tension or anxiety and provide relaxation methods or other help. Emotion recognition may benefit disabled people in numerous ways using assistive technology:

Communication: Emotion awareness may help those who struggle to articulate their emotions. A facial expression and body language detection system may assist others comprehend and communicate with a person's emotions.

Mental health: Emotion recognition can examine and track mental wellness. An emotion recognition system may detect mood changes in facial expressions and speech, enabling people and healthcare professionals diagnose mental health issues and give support.

Education: Disabled people may learn and communicate better using emotion detection. An emotion detection system may assist people comprehend their own and others' feelings by studying facial expressions and speech.

Assistive technology input: Speech recognition and prosthetic limbs may employ emotion recognition as input. Emotion recognition may make assistive technology more natural by recognizing facial emotions and speech.

Social interaction

Emotion recognition may help disabled people socialize. An emotion detection system may help people comprehend others' feelings and enhance their social skills by monitoring facial expressions and body language. Strong emotion detection may aid disabled people in numerous ways. Understanding a person's emotions via facial expressions, speech, and body language improves communication, mental health, education, and social engagement. These are some of the various computer vision approaches used in assistive technology for disabled people.

Open challenges

Despite advances in computer vision and AT, several difficulties remain. These challenges include:

Data bias: Data bias is a key AT computer vision difficulty. The datasets used to train computer vision models may not reflect disabled people, resulting in poor performance. Rare diseases or impairments that are underrepresented in databases are especially affected. Researchers must make sure computer vision model datasets are varied and representative of disabled people to meet this difficulty.

Real-world robustness: Controlled laboratory circumstances may benefit computer vision algorithms, but real-world illumination, background clutter, and other environmental variables might hinder performance. Researchers must create computer vision models that can adapt to changing settings and contexts to solve this problem.

Individual variability: Disability-specific demands and preferences may not be captured by conventional computer vision algorithms. For instance, visually impaired people may prefer alternative sizes, shapes, and colors. Researchers must create more personalised computer vision algorithms that meet the requirements and preferences of disabled people to solve this problem.

Integration with other technologies: AT typically uses voice recognition, haptic feedback, and robotics. Computer vision integration with other assistive technologies may be difficult, especially if they have distinct interfaces or input modalities. Researchers must create more seamless and integrated AT solutions that interact with other technology to serve disabled people.

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Ethics and privacy: AT devices may be utilized coercively or discriminatorily, and user data privacy and security are problems. Researchers must provide ethical and transparent AT development and usage frameworks and preserve user privacy and security to overcome this dilemma.

Cost: AT tools are expensive, which may limit access for disabled persons without the means to afford them. Researchers must develop more accessible and affordable AT solutions so disabled individuals may utilize them regardless of their income.

Adoption and acceptance: Social and cultural problems like disability stigma or a lack of understanding about AT's benefits may hinder its adoption and acceptance. Researchers must work closely with people with disabilities, their caregivers, and other key players to increase awareness and acceptance of assistive technology (AT) and ensure that it meets the needs and preferences of the disability community.

III. CONCLUSION

Computer vision has shown promise for assistive devices that help disabled people live. Computer vision approaches like object identification, face recognition, gaze detection, and gesture recognition may assist disabled people overcome their disability and gain more autonomy and independence. Computer vision technology has considerable potential for assistive technologies, but it faces several hurdles. Data bias, real-world robustness, individual heterogeneity, interaction with other technologies, ethics and privacy, cost, and adoption and acceptability are difficulties. Researchers must collaborate with people with disabilities, caregivers, and other stakeholders to develop inclusive and accessible computer vision technologies that meet the needs and preferences of the disability community. We can use computer vision to make society more inclusive and equal for disabled people.

Practical Implication

Practical Implications: Computer vision technology for assistive technologies has several potential benefits for disabled people. First, computer vision technology can aid disabled people with object and face identification. This may help them live freely and securely and lessen caregiver stress.

Second, developing computer vision technology for assistive devices involves collaboration between disabled people, caregivers, and researchers. By considering the requirements and preferences of disabled people and their caretakers, computer vision technology may be tailored to their needs and adopted.

Thirdly, computer vision technology for assistive technologies must be accessible and inclusive. This involves making the technology accessible to those with impairments and simple and easy to use. Privacy, data protection, and technical compliance with legislation and norms are also crucial.

Computer vision technology for assistive technologies has enormous promise to enhance disabled people's lives. We can enable disabled people to live more satisfying and meaningful lives by inventing inclusive and accessible technology that match their specific needs and preferences.

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