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Editorial
Image and Video Processing for Disability

Alice Caplier,[1] Thierry Pun,[2] and Dimitrios Tzovaras[3]

[1] *Laboratoire des Image et des Signaux (LSI), Institute National Polytechnique de Grenoble (INPG), 46 Avenue Félix Viallet, 38031 Grenoble Cedex, France*
[2] *Centre Universitaire d'Informatique (CUI), Université de Genèva, 24 Rue Général Dufour, 1211 Geneva 4, Switzerland*
[3] *Centre for Research and Technology Hellas, Informatics and Telematics Instituite, 1st Km Thermi-Panorama Road, 57001 Thermi_Thessaloniki, Greece*

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New technologies represent a great opportunity for the improvement of life and independent living of the disabled and elderly people. Over the last decade, active researches have produced novel algorithms for visually impaired, deaf, mute people, or for people with severe motor disabilities. These researches are strongly related to the development of new dedicated systems for human-computer interaction. Whatever the kind of handicap, image and video processing can provide a significant help for disability compensation. It can also contribute to decrease the gap between disabled and nondisabled people with respect to the new technologies.

Developments of new systems for disabled persons are essentially of a multidisciplinary nature. Disciplines involved range from engineering sciences (computer science, signal processing, human factors, robotics, electronics, etc.) to human sciences (psychology, cognition, etc.). This special issue focuses on work involving image and video processing as their core technologies. The papers are divided into three categories, respectively, concerning motor disability, hearing disability, and vision disability.

The articles in the motor disability category start with a paper entitled "An omni-directional stereo vision-based smart wheelchair" written by Y. Satoh and K. Sakaue. To support safe self-movement of the disabled and the aged, the paper proposes an electric wheelchair that realizes the functions of detecting both the potential hazards in a moving environment and the postures and gestures of a user. For that purpose, the electric wheelchair is equipped with the stereo omnidirectional system (SOS), which is capable of acquiring omnidirectional color image sequences and range data simultaneously in real time. The two other papers are related to gaze detection and analysis. The paper entitled "Automated eye winks interpretation system for human machine interface" by C. Wei-Gang et al. proposes an automatic eye wink interpretation system for human machine interface to benefit the severely handicapped people. The system consists of (1) applying a support vector machine (SVM) classifier to detect the eyes, (2) using a template matching algorithm to track the eyes, (3) using the SVM classifier to verify whether eyes are open or closed and to convert the eye winks into a sequence of codes (0 or 1), and (4) applying dynamic programming to translate the code sequence into a certain valid command. The paper "Model for gaze tracking systems" by A. Villanueva and R. Cabeza proposes to explore more deeply the elements of a video-oculographic system, that is, eye, camera, lighting, and so forth. from a purely mathematical and geometrical point of view. The main contribution is to find out the minimum number of hardware elements and image features that are needed to determine the point the subject is looking at.

The articles in the hearing disability category start with a review on "Image and video for hearing impaired people" by A. Caplier et al. In this review, a global overview of image and video processing-based methods to help the communication of hearing impaired people is presented. Two directions of communication have been considered: from a hearing person to a hearing impaired person and vice versa. The article entitled "Telescopic vector composition and polar accumulated motion residuals for feature extraction in Arabic sign language recognition" written by T. J. Shanableh and K. Assaleh introduces two novel approaches for feature extraction applied to video-based Arabic sign language recognition, namely, motion representation through motion estimation and motion representation through motion residuals. The paper entitled "Cued speech gesture recognition: a first prototype based on early reduction" by T. Burger et al. is about the automatic recognition of the manual gestures of cued speech which is a specific linguistic code for hearing

impaired people. This language is based on both lip-reading and manual gestures. The proposed method is essentially built around a bioinspired method called *Early Reduction*.

The articles in the vision disability category start with a review on "Image and video processing for visually handicapped people" by T. Pun et al. In this review, the importance of modality conversion is advocated, and particular examples of audio, haptic, and audio-haptic rendering of visual information are discussed. Two articles then present portable devices aiming at helping users in their daily life. In "Color targets: fiducials to help visually impaired people find their way by camera phone," J. Coughlan and R. Manduchi propose a new way of finding aid based on a camera cell phone that searches for particular color targets; they introduce a principled method for optimizing the design of these color targets. In "A multifunctional reading assistant for the visually impaired," C. Mancas-Thillou et al. present a portable device that allows reading of textual material in mobile condition; it also permits recognition of banknotes, colors, and of objects through their barcode labels. The following two papers are concerned with more generic approaches. In "Enabling seamless access to digital graphical contents for visually-impaired individuals via semantic-aware processing," Z. Wang et al. describe a methodology for transforming images into a simplified form suitable for tactile rendering, based on a series of image segmentation steps guided by contextual information. In "Transforming 3D coloured pixels into musical instrument notes for vision substitution applications," G. Bologna et al. introduce the use of musical instrument sounds to represent colors in a scene, in the context of the development of a mobility aid.

Alice Caplier
Thierry Pun
Dimitrios Tzovaras