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Editorial

# Special Issue on Assistive Computer Vision and Robotics - "Assistive Solutions for Mobility, Communication and HMI"

In the last decades, there has been a tremendous increase in demand for assistive technologies useful to overcome functional limitations of individuals and to improve their quality of life. Assistive technologies provide a set of advanced tools that can improve the quality of life not only for impaired people, patients and elderly but also for healthy people struggling with everyday actions. Recently, novel assistive tools have been successfully commercialised bringing the Computer Vision and Robotics research from theory to applications exploited by the society. After a period of slow but steady progress, this new scientific area is mature for new research and application breakthroughs.

This CVIU special issue gathers very recent and various works on assistive computer vision and robotics. We have received 121 papers of authors from different countries. The submissions went through an initial check by the guest editors for suitability to the scope of the special issue, and 54 submissions had to be rejected without review because they were considered out of scope. The remaining papers went then through the standard review process, with up to three rounds of revisions for some papers. In the end, 31 papers were considered suitable for publication in this special issue that is divided in two parts. Part I contains papers related to computer vision and machine learning issues such as motion analysis, image segmentation and annotation, object recognition, extreme learning, statistical classification, feature extraction, tracking, 3D morphometric analysis. Part II collects papers dealing with some computer vision issues which have applications in robotics such as multi-modal human-robot interaction, autonomous navigation, object usage, place recognition, robotic manipulator, egocentric vision.

We would like to thank here all the authors who submitted their work to our special issue, and our reviewers who put their precious expertise and time in their reviews in a very professional manner. We also wish to thank the Editor-in-Chief, Professor Nikos Paragios and the editorial staff at the Computer Vision and Image Understanding Journal who have guided and supported us throughout the process of producing this special issue.

In the following, we briefly describe the papers related to the Part II of the CVIU special issue on Assistive Computer Vision and Robotics.

The paper "Localization and Tracking in Known Large Environments using Portable Real-time 3D Sensors" by Sanchez et al. proposes a framework that uses a single portable 3D sensor to solve the place recognition problem and continuously tracks its position even when leaving the known area or when significant changes occur in the observed environment.

In the paper "RGB-D camera based wearable navigation system for the blind" by Lee and Medioni, a novel wearable {RGB-D} camera based indoor navigation system for the visually impaired is presented. The system guides the visually impaired user from one location to another location without a prior map or GPS information.

The paper "An assistive haptic interface for appearance-based indoor navigation" by Rivera et al. explores the use of an appearance-based navigation technique that uses low-resolution wearable or hand-held cameras to identify landmarks that are indicative of position along crowdsourced paths.

The paper "Vision-based adaptive assistance and haptic guidance for safe wheelchair corridor following" by Narayanan et al. introduces a low-cost assistive and guidance system for indoor corridor navigation in a wheelchair, which uses purely visual information, and which is capable of providing automatic trajectory correction and haptic guidance in order to avoid wall collisions.

The paper "Semantic Labelling for Prosthetic Vision" Horne et al. introduces semantic labelling as a technique to improve navigation outcomes for prosthetic vision users. It describes also a novel egocentric vision dataset to demonstrate how semantic labelling can be applied to this problem.

The paper "An integrated artificial vision framework for assisting visually impaired users" by Chessa et al. proposes a conceptual framework for semantic annotations of the scene and 3D environment interpretation. The framework, inspired by biological vision, integrates low-level vision functionalities oriented to actions with identification and recognition capabilities.

The paper "Pedestrian Lane Detection in Unstructured Scenes for Assistive Navigation" by Phung et al. presents a vision-based algorithm for pedestrian lane detection in unstructured scenes, where lanes vary significantly in color, texture, and shape and are not indicated by any painted markers.

The paper "A Multi-modal Perception based Assistive Robotic System for the Elderly" by Mollaret et al. present a multi-modal perception based architecture to realize a non-intrusive domestic assistive robotic system. It is non-intrusive in that it only starts interaction with a user when it detects the user's intention to do so.

In the paper "A Real-time Human-Robot Interaction system based on gestures for assistive scenarios" by Canal et al. a system able to recognize gestures usually employed in human non-verbal

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communication is introduced, and an in-depth study of its usability is performed.

The paper "Model-Based Head Pose-Free Gaze Estimation for Assistive Communication" by Cristina and Camilleri proposes a method based on a cylindrical head and spherical eyeballs model to estimate the 3-dimensional eye-gaze under free head movement from a single camera integrated into a notebook computer.

The paper "Interactive Multiple Object Learning with Scanty Human Supervision" by Villamizar et al. presents a fast and online human-robot interaction approach that progressively learns multiple object classifiers using scanty human supervision.

The paper "You-Do, I-Learn: Egocentric Unsupervised Discovery of Objects and their Modes of Interaction Towards Video-Based Guidance" by Damen et al. presents an unsupervised approach towards automatically extracting video-based guidance on object usage, from egocentric video and wearable gaze tracking, collected from multiple users while performing tasks.

The paper "Gender and Gaze Gesture Recognition for Human-Computer Interaction" by Zhang et al. presents a novel gender recognition algorithm, a modular eye centre localisation approach and a gaze gesture recognition method, aiming to escalate the intelligence, adaptability and interactivity of HCI systems by combining demographic data (gender) and behavioural data (gaze) to enable development of a range of real-world assistive-technology applications.

The paper "Robust multi-dimensional motion features for first-person vision activity recognition" by Tadesse et al. proposes robust multi-dimensional motion features for human activity recognition from first-person videos. The proposed features encode information about motion magnitude, direction and variation, and combine them with virtual inertial data generated from the video itself.

The paper "Multi-Face Tracking by Extended Bag-of-Tracklets in Egocentric Videos" by Aghaei et al. proposes a novel method to find correspondences of multiple faces in low temporal resolution egocentric videos acquired through a wearable camera.

The paper "Enhanced Control of a Wheelchair-Mounted Robotic Manipulator Using 3-D Vision and Multimodal Interaction" by Jiang et al. presents a multiple-sensors, 3D vision-based, autonomous wheelchair-mounted robotic manipulator. Two 3D sensors were employed: one for object recognition, and the other for recognizing body parts (face and hands). The goal is to recognize everyday items and automatically interact with them in an assistive fashion.

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