Machine Vision and Applications (2020) 31:14
https://doi.org/10.1007/s00138-020-01061-w

EDITORIAL

Special issue on Advanced Machine Vision

Preface by the guest editors

Steven Puttemans[1] · Toon Goedemé[1] · Ajmal Mian[2] · Thomas B. Moeslund[3] · Rikke Gade[3]

Received: 22 January 2020 / Accepted: 24 January 2020 / Published online: 25 March 2020

Abstract
This preface acts as an introduction to the special issue on Advanced Machine Vision. It highlights the goal of this special issue on Advanced Machine Vision as well as discusses the reviewing process. On top of that, it highlights the selected submissions and describes them briefly.

1 Topic description

A large variety of industrially oriented applications (e.g. quality control, pick and place) have in the past decades been successfully implemented throughout a wide range of industries. These implementations are characterised by very controlled surroundings and objects (e.g. CAD models of objects available, controlled lighting). Advanced Machine Vision refers to computer vision-based systems where such assumptions do not hold (e.g. when handling biological objects as seen in the food-production industry or when operating outdoors).

With recent advancements in sensing and processing power, the potential for further automation in industry based on computer vision and machine learning is clearly present. Furthermore, the exploding domain of computer vision (e.g. deep learning) provides dozens of new opportunities. The field of Advanced Machine Vision clearly raises the need of applied research that focuses on the technology transfer from academics towards practitioners, yielding several challenges like top-notch accuracies, real-time processing, minimal training data, minimal manual input, user-friendly interfaces, etc.

2 Purpose of special issue

The ambition of this special issue on Advanced Machine Vision is to bring together research results from both practitioners and researchers from different disciplines related to Advanced Machine Vision with the aim to share ideas and methods on current and future use of computer vision in real-life and industrially relevant systems.

To this end, the special issue on Advanced Machine Vision welcomed high-quality contributions (full papers) with a strong focus on (but not limited to) the following topics within Advanced Machine Vision:

- Sensing (camera selection, camera setup, different wavelengths, multi-modal data, etc.)
- Improving robustness of algorithms (real-time performance, non-controlled illumination, non-trivial intra-object variability, top-notch accuracies, etc.)
- Removing or reducing the need of training data (data augmentation, artificial data, etc.)
- Processing power and memory requirements
- Obtaining training data and ground truth annotations

✉ Toon Goedemé
toon.goedeme@kuleuven.be

Steven Puttemans
steven.puttemans@kuleuven.be; steven.puttemans@vlaio.be

Ajmal Mian
ajmal.mian@uwa.edu.au

Thomas B. Moeslund
tbm@create.aau.dk

Rikke Gade
rg@create.aau.dk

[1] EAVISE Research Group, KU Leuven, Leuven, Belgium

[2] School of Physics, Mathematics and Computing, The University of Western Australia, Perth, Australia

[3] Visual Analysis of People Lab, Aalborg University, Aalborg, Denmark

- Lab testing versus inline testing
- Transfer learning towards new applicational domains
- Deep learning for Advanced Machine Vision
- Quality assessment of non-trivial objects
- Real-life and industrially relevant applications

3 Explanation of submissions

Based on the non-exclusive list of possible topics within this special issue, we received a total of 10 submissions, through an open call for papers. All submissions have undergone rigorous peer-review according to the journal's high standards, by at least three reviewers of our program committee. After a first round of reviews, five manuscripts remained. All of them were asked to perform major revisions of the manuscript, given the feedback of both reviewers and editor. After a second round of reviews, three manuscripts we accepted, one manuscript was rejected, and one manuscript was transferred to a more fitting journal or special issue within the Springer portfolio, leading to an acceptance rate of 33%.

4 List of accepted papers

The following three manuscripts were accepted for publication after a rigorous review process.

4.1 Rosette plant segmentation with leaf count using orthogonal transform and deep convolutional neural network

In this paper, a new plant region segmentation scheme is proposed in the orthogonal transform domain based on orthogonal transform coefficients. Initially, an analysis of orthogonal transform coefficients is carried out in terms of the response of orthogonal basis vectors to extract the plant region. After extracting the plant region, the L * a * b and CMYK colour spaces are used for noise removal in the segmentation scheme. Finally, the leaves are counted using fine tuned deep convolutional neural network (DCNN) models.

4.2 Convolutional networks for appearance-based recommendation and visualisation of mascara products

In this work, the authors explore the problems of recommending and visualising makeup products based on images of customers, and more specifically. Focusing on mascara, we propose a two-stage approach that first recommends products to a new customer based on the preferences of other customers with similar visual appearance (*using a Siamese convolutional neural network*), and then visualises how the recommended products might look on the customer (*using per-product generative adversarial networks*).

4.3 Detection of difficult airway using deep learning

Whenever a patient needs to enter the operating room, in case the surgery requires general anaesthesia, the patient must be intubated, and an anesthesiologist has to make a careful check of the patient in order to evaluate his/her airway, in order to avoid difficulties during intubation. This paper proposes to use a mobile app to detect a difficult airway by means of deep learning, achieving an average accuracy of the predictive model of 82.36%.

5 Conclusions

While the number of accepted submissions for this special issue was rather low, we clearly notice a need from the preceded workshop and the discussions held there show that there is a specific need for these applied special issues, with a clear focus on challenges when moving towards practical applications. With this first issue, we would like to open the path towards more discussion between practitioners and researchers in this very promising field of Advanced Machine Vision.

Acknowledgements The special issue was preceded by an international workshop on Advanced Machine Vision (AMV2018), held in conjunction with the ACCV2018 conference (December 3, 2018 in Perth, Australia). Some of the submissions are extended versions of papers presented at this workshop.

Steven Puttemans (Belgium, 1985) obtained a master's degree in Artificial Intelligence at the KU Leuven in 2012. Triggered by this intriguing field of work, he decided to start as a doctoral researcher under the supervision of Prof. Toon Goedemé, at the EAVISE Research Group. He received his PhD at KU Leuven in 2017, in which he focussed on applying scene constraints in combination with object detection techniques, to develop robust and accurate industrial applicable object detection algorithms. He continued as a post-doctoral researcher at KU Leuven on zero-effort object detection and focuses on the transfer of academically developed state-of-the-art algorithms towards robust and accurate industrial applicable solutions. As postdoc, he supervised multiple PhD students, wrote grant and project proposals as well as actively focused on science communication. He is now working as a project advisor on innovation support at Flanders Innovation & Entrepreneurship, Belgium.

Toon Goedemé (Belgium, 1979) received his PhD at KU Leuven in 2006 on vision-based topological navigation, under guidance of prof. Luc Van Gool and Tinne Tuytelaars. Afterwards, he started teaching at the Technical University De Nayer at Sint-Katelijne-Waver, where he founded his research group EAVISE (Embedded and Artificially intelligent Vision Engineering) in 2008. Nowadays, his group is integrated in the KU Leuven and consists of about 14 researchers, playing a vital role in the transfer of computer vision know-how from academic research towards the industry. From 2010, he is an associate professor and from 2014 professor at KU Leuven. He is (co-)author of more than 120 international publications and was project leader of more than 40 industrially co-founded research projects. He is an Associate Editor of the IET Computer Vision journal.

Ajmal Mian is a Professor of Computer Science at The University of Western Australia. He is the recipient of two prestigious fellowships and ten research grants from the Australian Research Council and the National Health and Medical Research Council of Australia with a combined funding of over $12 million. He was the West Australian Early Career Scientist of the Year 2012 and has received several other awards including Excellence in Research Supervision and Outstanding Young Investigator. He has published over 160 scientific papers in the top journals and conferences of computer vision including PAMI, IJCV, TNNLS, CVPR, ECCV and ICCV. He was a General Co-Chair if ACCV 2018, Program Co-Chair of DICTA 2012 and Area Chair of WACV 2019, WACV 2018, ICPR 2016 and ACCV 2014. He is currently the General Chair of DICTA 2019. His research interests are in computer vision, machine learning, 3D shape analysis, facial recognition and video description.

Professor Thomas B. Moeslund (Denmark, 1971) received his PhD from Aalborg University in 2003 and is currently the head of the Visual Analysis of People lab at Aalborg University (20 people) as well as the head of the Media Technology section at Aalborg University (40 people). His research covers all aspects of software systems for automatic analysis of images and videos, and he has been involved in more than 25 research projects. He has published 200+ articles. Google Scholar: H-index 37. Citations 10.000+. Awards include a most cited paper award in 2009, a teacher of the year award in 2010, an innovation award in 2013 and best paper awards in 2010, 2012, 2014, 2016, and 2017.

Rikke Gade (Denmark, 1986) is currently employed as Associate Professor at Aalborg University, Denmark. She received her MSc and PhD degrees from Aalborg University in 2011 and 2015, respectively. During her studies, she also spend a semester at University of Auckland, New Zealand, and had a 4-month research stay at University of Adelaide, Australia. The PhD thesis in Computer Vision focused on analysis of activities in sports arenas; mainly occupancy analysis, activity recognition, and tracking of players. Most of her work revolves around the use of thermal video, to preserve privacy in public sports facilities. This has led to publications in top journals and international conferences, and she has been co-organizing workshops at CVPR, ICCV, and ACCV. Her research interests include computer vision analysis of human activities, applied both for analysis of human behavior at public spaces as well as for analyzing sports activities. She also works with robot vision.