Editorial: 2021 editors' pick: Computer science

Paul Lukowicz[1], Anton Nijholt[2], Kaleem Siddiqi[3]*, Marcello Pelillo[4], Kristof Van Laerhoven[5], Luca Viganò[6] and Nicola Zannone[7]

[1]Department of Computer Science, University of Kaiserslautern, Kaiserslautern, Germany, [2]Human Media Interaction Group, University of Twente, Enschede, Netherlands, [3]School of Computer Science, McGill University, Montreal, QC, Canada, [4]Department of Computer Science, Ca' Foscari University of Venice, Venice, Italy, [5]Department of Electrical Engineering and Computer Science, University of Siegen, Siegen, Germany, [6]Department of Computer Science, King's College London, London, United Kingdom, [7]Department of Mathematics and Computer Science, Eindhoven University of Technology, Eindhoven, Netherlands

Editorial on the Research Topic
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Introduction

We are pleased to highlight the following ten articles which appeared in Frontiers in Computer Science in 2021. We have chosen to feature contributions from the following sections of the journal: Computer Security, Computer Vision, Human-Media Interaction and Mobile and Ubiquitous Computing. Computer science has grown to be a multi-faceted field where some of the most exciting developments are at its intersection with other disciplines. The articles below cover a wide array of topics including human behavior, technologies for the visually impaired, color representation and perception, pattern formation, facial action coding, mobile sensors, gait recognition, and phishing and reentrancy attacks. These articles have all been widely read and collectively their content reflects the interdisciplinary nature of our journal and aspects of our vision for its future.

Human-media interaction

Three papers have been chosen from the Human-Media Interaction section. These papers focus on design rather than on (interaction) technology.

In a "Mini Review" Lemke and de Vries investigate how theories from psychology and the social sciences can help guide the design of persuasive technology. They focus on social comparison theory (Festinger, 1954) in which one's abilities and opinions are compared to others. The research question underlying this review is how social comparison can be operationalized as part of persuasive technology and be used to

develop a design prototype. Twelve research papers are discussed in detail, highlighting current trends and potential gaps.

In an "Original Research" paper Nwadiugwu and Nwadiugwu discuss leadership and mechanisms that influence followership in online knowledge-building communities. In-depth interviews were conducted with experienced leaders of a social media online platform and leadership theory (Burns, 1978) was used to distinguish and discuss themes in leadership-followership relations. Design implications for knowledge-building in online communities, platforms, and the services they provide should follow from understanding the mechanisms involved.

In another "Original Research" paper of the Human-Media Interaction section, Angkananon et al. introduce a framework for designing accessible technologies for visually impaired people. The framework helps to identify user requirements and it provides technology suggestions that support the design stage. The framework has been developed and evaluated using various scenarios (shopping, crossing the road, attending a lecture, et cetera) with the participation of (novice) developers, accessibility experts and visually impaired people.

Mobile and ubiquitous computing

Two articles have been chosen from the Mobile and Ubiquitous Computing section. The first article (Wang et al.) addresses aspects of a recognition challenge to evaluate the efficacy of sensors in today's personal devices while the second (Liu et al.) provides a review of wearable devices in healthcare applications.

In a "Review" article Wang et al. observe that the number of sensors that have been embedded in our personal and wearable devices has increased at a staggering pace, leading to a lot of research investigating how robustly one can detect information about the devices' users hidden in these data, including their whereabouts, and performed activities. Over the past 3 years these authors have organized the Sussex-Huawei Locomotion-Transportation (SHL) Recognition Challenge as a way to galvanize these research activities from researchers across the world and support replicable and comparable evaluations in this field. The article discusses the various methods seen in the challenges and presents baseline results to compare the three challenges using a single processing pipeline.

In a "Mini-Review" article, Liu et al. discuss the role of wearable devices in healthcare applications where gait analysis proves useful for monitoring the effect of injuries, neurodegenerative diseases, and musculoskeletal disorders. In these scenarios sensors are used to record data from walking and running, from which spatiotemporal and kinematic variables are extracted. The ultimate goal is to provide useful technologies to support doctors carry out early diagnosis and also to help physicians working on patient rehabilitation.

Computer vision

Three articles have been chosen from the Computer Vision section. The first (Koenderink et al.) proposes fundamentally new ways to analyze color spaces, motivated by ecological considerations. The second (Duin) considers the classic problem of pattern recognition and perception. The third (Niinuma et al.) carries out a systematic evaluation of design choices when deep learning is applied to facial action coding.

In a fascinating "Original Research" article Koenderink et al. promote an ecological approach to understand representations and models of color spaces. Taking into account optical considerations such as the fact that radiant power is non-negative and reflectance factors are fractional, as well as daylight viewing conditions, they show rigorously that color is naturally described by a spectral tripartition. This insightful paper offers a unique and novel perspective on color as a property of objects in the physical world, and provides a unified way to treat color mixing, relations between scenes and image data and a host of other phenomena related to color and color perception.

In a philosophical "Review" article Duin develops and contrasts two opposing but related views of pattern formation and pattern understanding. The author considers whether patterns are elements of the external world in which we live, or whether they are an emergent property in the mind of an observer due to the manner in which that observer interacts with their surrounding environment. Duin contrasts these two opposing strategies where in one an experienced observer can directly perceive or recognize an object without reasoning while in the other an artificial perception system must consider actual physical sensors or measurements followed by explicit reasoning. This debate is developed in the context of a concrete example in pattern analysis: the classification of digital histopathology slides.

In a "Original Research" article Niinuma et al. rightly point out that current deep learning systems, which appear to dominate so many disciplines these days, and in particular classification and detection, also require a fair amount of fine tuning and parameter selection in application to particular datasets and specific problems. Considering the problem of facial action unit coding, and the Facial Expression Recognition and Analysis 2017 (FERA, 2017) dataset, the authors carry out a systematic evaluation of design choices and their effects on performance. A particular consideration is robustness in the presence of pose variation or in application to new datasets. The authors offer a practical view of the relative importance of design choices in pre-training, including: feature alignment, model size selection, and optimizer details, and the overall effect on performance in facial action coding.

Computer security

Two articles have been chosen from the Computer Security Section. The first article (Alkhalil et al.) provides an in-depth review of current phishing attack strategies, while the second (Alkhalifa et al.) examines attacks in blockchain smart contracts and proposes potential algorithmic solutions to them.

In a "Review" article Alkhalil et al. investigate the current state of phishing and review existing phishing techniques. The authors characterize the types of phishing attacks based on several dimensions including attacker's types, vulnerabilities, threats, targets, attack mediums, and attacking techniques. They also focus on the lifecycle of phishing attacks, which in combination with the previous dimensions, provides an in-depth understanding of how phishing attacks work and can help the design and development of protection measures to counter those attacks.

In an "Original Research" article Alkhalifa et al. analyze the root cause of reentrancy attacks in Ethereum blockchain and propose a solution to improve the cybersecurity of smart contracts against those attacks. The proposed solution is based on the assumption that the difference between the contract balance and the total balance of all participants in a smart contract before and after any operation, must be the same before and after any operation that changes the state of a contract. A proof-of-concept implementation shows that the proposed solution enables the detection and prevention of reentrancy attacks during the execution of smart contracts.

Conflict of interest

Publisher's note

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