Best Research Papers in the Field of Sensors, Signals, and Imaging Informatics 2021

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Summary

Objective: In this synopsis, we identify and highlight research papers representing noteworthy developments in signals, sensors, and imaging informatics in 2021.

Method: A broad literature search was conducted on PubMed and Scopus databases. We combined Medical Subject Heading (MeSH) terms and keywords to construct particular queries for sensors, signals, and imaging informatics. Except for the sensor section, we only consider papers that have been published in journals providing at least three articles in the query response. Using a three-point Likert scale (1 — not include, 2 — maybe include, and 3 — include), we reviewed the titles and abstracts of all database returns. Only those papers which reached two times three points were further considered for full paper review using the same Likert scale. Again, we only considered works with two times three points and provided these for external review. Based on the external reviews, we selected three best papers, as it happens that the three highest ranked papers represent works from all three parts of this section: sensors, signals, and imaging informatics.

Results: The search for papers was executed in January 2022. After removing duplicates and conference proceedings, the query returned a set of 88, 376, and 871 papers for sensors, signals, and imaging informatics, respectively. For signals and images, we filtered out journals that had less than three papers in the query results, reducing the number of papers to 215 and 512, respectively. From this total of 815 papers, the section co-editors identified 35 candidate papers with two times three Likert points, from which nine candidate best papers were nominated after full paper assessment. At least three external reviewers then rated the remaining papers and the three best-ranked papers were selected using the composite rating of all external reviewers. By accident, these three papers represent each of the three fields of sensor, signal, and imaging informatics. They were approved by consensus of the International Medical Informatics Association (IMIA) Yearbook editorial board. Deep and machine learning techniques are still a dominant topic as well as concepts beyond the state-of-the-art.

Conclusions: Sensors, signals, and imaging informatics is a dynamic field of intense research. Current research focuses on creating and processing heterogeneous sensor data towards meaningful decision support in clinical settings.

Keywords:
Sensors, signals, imaging informatics, medical informatics

1 Introduction

Hsu *et al.*, have defined sensors, signals, and imaging informatics (SSII) as three independent parts, although signal and imaging informatics are more related [1]. A biomedical signal and a medical image can be considered as a one-dimensional and a two- or more-dimensional stream, respectively, and the methods applied are similar. Contrarily, the sensor's part is more device-oriented [2]. SSII spans a huge field of research, and thousands of papers are published every year [3-5]. Searching for "sensor informatics", "signal informatics", or "imaging informatics" in the title of papers published in 2021, we identified two new reviews, both focusing on the role of medical images in fighting the COVID-19 pandemic [6, 7]. In contrast, our annual task is to identify notable research in the entire field. Again, the majority of research papers have applied deep learning approaches to well-documented SSII problems and identifying real novelty is difficult. However, SSII is more than "just" deep learning [8]. As such, our objective was to systematically catch the spectrum of work—including all machine learning techniques—that best represent the SSII developments and achievements in 2021.

2 Paper Selection Process

The process of searching the literature for candidate best papers of the SSII section remained a challenging task, given the broad nature of the SSII category. This year, we harmonized the search terms and acronyms and completed the queries that were applied over the last years [1, 4, 5]. Still, we focused on research articles in the English language and excluded review papers. Then, we ran the queries separately for sensors, signals, and images in PubMed and Scopus (see Appendix 2).

In mid-January 2022, we executed the final query. After removing duplicates and conference proceedings, the query returned a set of 88, 376, and 871 papers for sensors, signals, and imaging informatics, respectively. As we did last year [1], we set the threshold of at least three papers in a relevant journal and excluded articles from irrelevant journals. Due to the retrieval numbers, we applied this rule to signals and images only, resulting in 215 and 512 papers, respectively.

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