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Brain Function Assessment in Learning

Second International Conference, BFAL 2020 Heraklion, Crete, Greece, October 9–11, 2020 Proceedings

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Preface

This volume contains the refereed papers presented at the Second International Conference on Brain Function Assessment in Learning (BFAL 2020). The BFAL conference addresses a multidisciplinary domain which regroups specialists in neuroscience, computer science, medicine, education, human-computer interactions, and social interaction. It promotes a cross-disciplinary approach to better understanding how to use the brain's capabilities to improve cognition and learning. The convergence of cognitive studies, tools of artificial intelligence, neuroscience approaches, and health applications opens a new era of multidisciplinary research tracks. The emergence of new assessment devices allows new ways of experimentation in laboratories, with light, non-intrusive, and low-cost sensors.

The call for scientific papers focused on a variety of topics of interest, including, but not limited to:

- Alzheimer's and Related Disorders
- Bioethics
- Biofeedback Systems
- Biometric Systems
- Brain Activity and Neurocognitive Functions
- Brain-Computational Mechanisms
- Brain Control for Learning
- Brain Data Extraction
- Brain Imaging
- Brain Plasticity
- Brain Training
- Consciousness and Social Behaviors
- Data Mining
- Emotional Processes in Learning and Memory
- Internet of Things
- Human-Computer Interface
- Healthcare Applications
- Image Processing
- Intelligent Environments
- Intelligent Training
- Intelligent Agents
- Intelligent Video Games
- Memory Neural Processes
- Mental Health
- Neurocognitive Development
- Neurolinguistics

- Sleep, Plasticity, and Memory
- Social Cognition
- Virtual Reality

The conference gave the researchers the opportunity to examine multiple applications of brain function assessment in learning – mainly in the education and health fields – which are becoming more and more promising, initiating an exchange of ideas on important open questions. For example, what is the role of virtual reality in medical training, for Alzheimer treatment, or for virtual patients? How can brain assessment foster serendipitous learning, considering a set of cooperative viewpoints? How can EEG help to distinguish between writing and typing? How can gesture recognition be useful for Alzheimer behavior? How can brain function analysis and technology improve dyslexia and autism? How can mobile technology improve mild cognitive impairment? What is the influence of emotions in medical education? What are adults stress responses to unexpected tasks? How can brain-based quiz games improve cognitive functions? How can mathematical problem solving and fuzzy logic improve learning? What is the role of neuroscience to knowledge transformation and distance learning?

There were 35 submissions. Each submission was reviewed by at least 1, and on average 2.1, Program Committee (PC) members, according to a double-blind process. The PC decided to accept 11 full papers leading to an acceptance rate of 31%. 10 additional short papers were accepted, building a complete and well-balanced program structured into two main sections: Neural Assessment and Learning.

BFAL 2020 was initially scheduled to take place in Heraklion, Greece, as a side-event of the GENEDIS 2020 conference. However, due to COVID-19 related constraints, the conference was held as an online event. The hosting institution of the conference was the University of West Attica, Greece, under the auspices of the Institute of Intelligent Systems (IIS).

We would like to express our gratitude to many different contributors for the success of the BFAL 2020 conference:

– All the authors for presenting original and high-quality research work, promoting innovation in the fields of Neural Assessment and Learning.
– The keynote speakers, Dr. Themis Exarchos, Dr. Anastasios Mikropoulos, and Dr. Dimitrios Vlachakis for honoring the conference with their input to the vibrant scientific discourse of the conference.
– The members of the PC for their constructive work in making suggestions and improvements to the papers.
– The program chairs for their devoted work towards the success of the conference.
– The University of West Attica for hosting this conference virtually, with special thanks to the Vice Rector, Prof. Cleo Sgouropoulou.
– The GENEDIS conference, and in particular Dr. Panagiotis Vlamos for inviting BFAL 2020 as a side-event.
– The organization team of NEOANALYSIS, and in particular Dr. Kitty Panourgia (organization chair), Elisavet Vasileiou, Isaak Tselepis, and Aggelos Amarantos.

We would like to emphasize that the BFAL 2020 conference series opens challenging yet intriguing endeavors in the original and multidisciplinary sphere of Brain Function Assessment in Learning, and we look forward to the next BFAL conference.

August 2020

Panagiotis Bamidis
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Abstract of Invited Talks

Decision Support Systems in Neurodegenerative Diseases Diagnosis, Treatment and Management

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Abstract. Neurodegenerative diseases are an heterogeneous group of disorders that are characterized by the progressive degeneration of the structure and function of the central or peripheral nervous system. The most common ones include Alzheimer's disease and Parkinson's disease. The presentation will focus on the most recent achievements and research results of decision support systems, both defined using data driven as well as knowledge based methods towards the diagnosis, treatment, and management of the most common neurodegenerative disorders. Systems, platforms, and methodologies employing typical clinical data, wearable, or ambient sensors, as well as more complex omics information will be presented, with the advantages and disadvantages of each.

Keywords: Decision support systems · Neurodegenerative diseases · Diagnosis · treatment · Management

Educational Neuroscience in General and Special Education

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In neuroscience, learning can be described as the process of creating neural connections in response to external stimuli; accordingly, education is defined as the process of creating and controlling these external stimuli. The basis of educational neuroscience is that anything that influences learning has its foundation in the human brain. Neuroscientific methods act collaboratively with the methodology of social sciences and contribute to the field of education. Under this framework, EEG signals were used to investigate how feedback could be best incorporated in a digital educational game. Our findings showed that the auditory feedback was preferred compared to visual, because the alpha and beta brain oscillations of participants were increased. In special education, our results from a study with Auditory Evoked Potentials showed that visually impaired individuals processed auditory stimuli faster, regardless if these lacked semantic content, in comparison to their non-visually impaired counterparts, since the N400 component was presented earlier in the waveforms of visually impaired individuals. Findings like these indicate that the understanding of the way the human brain functions could affect instructional practices and provide a conceptual framework of how the human brain creates cognitive schemata.

Introducing Drugonfly; A Novel Computer-Aided Drug Repurposing Pipeline Based on Genomic, Structural and Physicochemical Profiles

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Abstract. Herein, we are proposing a novel and radical pipeline that will facilitate the repurposing of approved drugs in an unprecedented way that will eventually yield invaluable insights and results that will aid the pharma-medical domain to tackle many more pathologies using weaponry that has already been approved, is safe for the public, is very rapid relative to conventional drug design, and requires no further significant investment to be made. The ultimate goal is to develop a novel clinical concept and establish a computer-aided pipeline that will facilitate and rationalize the repurposing of approved drugs, orphan drugs, and generics. The end result of the described pipeline is a competitive and reliable software that will be made available for the scientific community.

Keywords: Drug design · Drug repurposing · Bioinformatics · Metagenomics · Data mining · Data analytics

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