



HAL
open science

Artificial Intelligence Applications and Innovations

Ilias Maglogiannis, John Macintyre, Lazaros Iliadis

► **To cite this version:**

Ilias Maglogiannis, John Macintyre, Lazaros Iliadis. Artificial Intelligence Applications and Innovations: 17th IFIP WG 12.5 International Conference, AIAI 2021, Hersonissos, Crete, Greece, June 25–27, 2021, Proceedings. Springer International Publishing, AICT-627, 2021, IFIP Advances in Information and Communication Technology, 978-3-030-79149-0. 10.1007/978-3-030-79150-6 . hal-03287655

HAL Id: hal-03287655

<https://inria.hal.science/hal-03287655>

Submitted on 16 Jul 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

Editor-in-Chief

Kai Rannenber, Goethe University Frankfurt, Germany

Editorial Board Members

TC 1 – Foundations of Computer Science

Luis Soares Barbosa , University of Minho, Braga, Portugal

TC 2 – Software: Theory and Practice

Michael Goedicke, University of Duisburg-Essen, Germany

TC 3 – Education

Arthur Tatnall , Victoria University, Melbourne, Australia

TC 5 – Information Technology Applications

Erich J. Neuhold, University of Vienna, Austria

TC 6 – Communication Systems

Burkhard Stiller, University of Zurich, Zürich, Switzerland


TC 7 – System Modeling and Optimization

Fredi Tröltzsch, TU Berlin, Germany

TC 8 – Information Systems

Jan Pries-Heje, Roskilde University, Denmark

TC 9 – ICT and Society

David Kreps , National University of Ireland, Galway, Ireland

TC 10 – Computer Systems Technology

Ricardo Reis , Federal University of Rio Grande do Sul, Porto Alegre, Brazil

TC 11 – Security and Privacy Protection in Information Processing Systems

Steven Furnell , Plymouth University, UK

TC 12 – Artificial Intelligence

Eunika Mercier-Laurent , University of Reims Champagne-Ardenne, Reims, France

TC 13 – Human-Computer Interaction

Marco Winckler , University of Nice Sophia Antipolis, France

TC 14 – Entertainment Computing

Rainer Malaka, University of Bremen, Germany

IFIP – The International Federation for Information Processing

IFIP was founded in 1960 under the auspices of UNESCO, following the first World Computer Congress held in Paris the previous year. A federation for societies working in information processing, IFIP's aim is two-fold: to support information processing in the countries of its members and to encourage technology transfer to developing nations. As its mission statement clearly states:

IFIP is the global non-profit federation of societies of ICT professionals that aims at achieving a worldwide professional and socially responsible development and application of information and communication technologies.

IFIP is a non-profit-making organization, run almost solely by 2500 volunteers. It operates through a number of technical committees and working groups, which organize events and publications. IFIP's events range from large international open conferences to working conferences and local seminars.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is generally smaller and occasionally by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is also rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

IFIP distinguishes three types of institutional membership: Country Representative Members, Members at Large, and Associate Members. The type of organization that can apply for membership is a wide variety and includes national or international societies of individual computer scientists/ICT professionals, associations or federations of such societies, government institutions/government related organizations, national or international research institutes or consortia, universities, academies of sciences, companies, national or international associations or federations of companies.


More information about this series at <http://www.springer.com/series/6102>

Ilias Maglogiannis · John Macintyre ·
Lazaros Iliadis (Eds.)

Artificial Intelligence Applications and Innovations

17th IFIP WG 12.5 International Conference, AIAI 2021
Hersonissos, Crete, Greece, June 25–27, 2021
Proceedings

Editors

Ilias Maglogiannis 
University of Piraeus
Piraeus, Greece

John Macintyre
University of Sunderland
Sunderland, UK

Lazaros Iliadis 
Democritus University of Thrace
Xanthi, Greece

ISSN 1868-4238 ISSN 1868-422X (electronic)
IFIP Advances in Information and Communication Technology
ISBN 978-3-030-79149-0 ISBN 978-3-030-79150-6 (eBook)
<https://doi.org/10.1007/978-3-030-79150-6>

© IFIP International Federation for Information Processing 2021

Chapter “Improving the Flexibility of Production Scheduling in Flat Steel Production Through Standard and AI-Based Approaches: Challenges and Perspectives” is licensed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>). For further details see license information in the chapter.

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

Artificial Intelligence (AI) continues to advance, following extreme development rhythms in the new era of the 21st century. It has already made its way into our daily lives in various forms. It is estimated that more than 80 billion USD have been invested by car industries for the design and development of autonomous self-driving vehicles. AI technologies like *Google Duplex* are accomplishing real-world conversations and arrangements with humans, using *Deep Neural Networks* (e.g., Google voice search, Wavenet). It is estimated by the International Data Corporation, a global provider of market intelligence, that investments in AI business globally will reach up to 110 billion USD by 2024.

AI is a major part of the Fourth Industrial Revolution, together with other technologies like the *Internet of Things*, *Genetic Engineering*, *Quantum Computing*, and its impact in the evolution of our post-modern societies in various domains is huge and growing. On the other hand, there are major areas of ethical concern for our societies, namely privacy, surveillance, bias-discrimination, and elimination of entire job categories. Moreover, serious questions arise on the superiority and indispensability of human judgment on important aspect of life. In other words, “Can smart machines outthink our human judgment?”.

The *17th International Conference on Artificial Intelligence Applications and Innovations* (AIAI 2021) offered insight into all timely challenges related to technical, legal, and ethical aspects of intelligent systems and their applications. New algorithms and potential prototypes employed in diverse domains were introduced.

AIAI is a mature international scientific conference series that has been held all over the world and it is well established in the scientific area of AI. Its history is long and very successful, following and propagating the evolution of intelligent systems.

The first event was organized in Toulouse, France, in 2004. Since then, it has had a continuous and dynamic presence as a major global, but mainly European, scientific event. It has been organized in China, Greece, Cyprus, Australia, and France. It has always been technically supported by the International Federation for Information Processing (IFIP) and more specifically by Working Group 12.5, which is interested in AI applications.

Following a long-standing tradition, this Springer volume belongs to the IFIP AICT series and it contains the papers that were accepted to be presented orally at the AIAI 2021 conference. An additional volume comprises the papers that were accepted and presented at the workshops and were held as parallel events. The event was held during June 25–27, 2021, in Greece (virtually). The diverse nature of papers presented demonstrates the vitality of AI algorithms and approaches. It certainly proves the very wide range of AI applications as well.

The response of the international scientific community to the AIAI 2021 call for papers was more than satisfactory, with 113 papers initially submitted by authors in 21 different countries from all over the globe, namely Australia, Austria, Belgium, Czech

Republic, Egypt, France, Germany, Greece, Lebanon, Netherlands, India, Italy, China, Poland, Portugal, Romania, Sweden, Taiwan, Turkey, UK, and USA.

All papers were peer reviewed by at least two independent academic referees. Where needed, a third referee was consulted to resolve any potential conflicts. A total of 54 papers (47.79% of the submitted manuscripts) were accepted to be published as full papers (12 pages long) in the proceedings. Owing to the high quality of the submissions, the Program Committee decided that it should accept 7 more papers to be published as short papers (10 pages long).

The accepted papers cover the following thematic topics:

- Activity Recognition
- Adaptive Learning
- Adversarial Neural Networks
- AI for Media
- AI for Music Composition
- Anomaly Detection and AI
- Anxiety Recognition and AI
- Autoencoders
- Autonomous Driving
- Bioinformatics and AI
- Classification in Pattern Recognition
- Clustering
- Computer Vision
- Convolutional and Recurrent ANN
- Cybersecurity and AI
- Cyber Supply-Chain and AI
- Data Mining
- Deep Learning ANN
- Dialogue Act Recognition
- Embedded Machine Learning
- Fake News Detection and AI
- Feature Selection
- Financial Applications of AI
- Fuzzy Modeling
- Genetic Algorithms and Optimization
- Hybrid Intelligent Models
- Interoperability and AI
- Image Analysis for Face Recognition
- Machine Learning
- Meta-Learning and AutoML
- Multi Agent Systems
- Natural Language
- Recommendation Systems
- Robotics
- Social Media Intelligent Modeling
- SOM

Swarm Intelligence
Text Mining and Machine Translation
Time Series
Emotion recognition

Eight keynote speakers were invited to give lectures on timely aspects of AI. We wish to thank all keynote speakers for enlightening our conference with their state-of-the-art lectures.

In addition to the main conference, the following eight scientific workshops on timely AI subjects were organized under the framework of AIAI 2021:

- The *6th Workshop on 5G-Putting Intelligence to the Network Edge* (5G-PINE 2021)
- The *1st Workshop on Artificial Intelligence in Biomedical Engineering and Informatics* (AI-BIO 2021)
- The *1st Workshop on Defense Applications of AI* (DAAI 2021)
- The *1st Workshop on Distributed AI for REsource-Constrained Platforms* (DARE 2021)
- The *1st Workshop on Energy Efficiency and Artificial Intelligence* (EEAI 2021)
- The *10th Mining Humanistic Data Workshop* (MHDW 2021)
- The *1st Workshop on AI and Ethics* (AIETH 2021)
- Designing a Novel Adaptive Cybersecurity Solution for Internet-of-Vehicle Workshop (nIoVe)

We are grateful to everyone who made AIAI 2021 such a success, and we hope that we can meet again in person at the next event.

June 2021

Ilias Maglogiannis
Lazaros Iliadis
John MacIntyre

Workshops Co-chairs

Christos Makris	University of Patras, Greece
Katia Kermanidis	Ionian University, Greece
Phivos Mylonas	Ionian University, Greece
Spyros Sioutas	University of Patras, Greece

Program Committee

Georgios Alexandridis	University of the Aegean, Greece
Serafin Alonso Castro	University of Leon, Spain
Ioannis Anagnostopoulos	University of Thessaly, Greece
Costin Badica	University of Craiova, Romania
Giacomo Boracchi	Politecnico di Milano, Italy
Francisco Carvalho	Polytechnic Institute of Tomar, Portugal
Diego Casado-Mansilla	Polytechnic School of the University of Alcalá, Spain
Ioannis Chamodrakas	National and Kapodistrian University of Athens, Greece
Kostantinos Delibasis	University of Thessaly, Greece
Konstantinos Demertzis	Democritus University of Thrace, Greece
Georgios Drakopoulos	Ionian University, Greece
Mauro Gaggero	National Research Council of Italy, Italy
Eleonora Giunchiglia	University of Oxford, UK
Peter Hajek	University of Pardubice, Czech Republic
Giannis Haralabopoulos	University of Nottingham, UK
Lazaros Iliadis Democritus	University of Thrace, Greece
Andreas Kanavos	Ionian University, Greece
Nikos Karacapilidis	University of Patras, Greece
Petros Kefalas	CITY College, International Faculty of the University of Sheffield, Greece
Katia Kermanidis	Ionian University, Greece
Petia Koprinkova-Hristova	Bulgarian Academy of Sciences, Bulgaria
Stelios Krinidis	Centre for Research and Technology Hellas, Greece
Florin Leon	Technical University of Iasi, Romania
Aristidis Likas	University of Ioannina, Greece
Pietro Liò	University of Cambridge, UK
Ioannis Livieris	University of Patras, Greece
Doina Logofătu	Frankfurt University of Applied Sciences, Germany
Ilias Maglogiannis	University of Piraeus, Greece
Goerge Magoulas	Birkbeck, University of London, UK
Christos Makris	University of Patras, Greece
Mario Malcangi	University of Milan, Italy
Andreas Menychtas	University of Piraeus, Greece
Vangelis Metsis	Texas State University, USA
Nikolaos Mitianoudis	Democritus University of Thrace, Greece
Antonio Moran	University of Leon, Spain

Konstantinos Moutselos	University of Piraeus, Greece
Phivos Mylonas	Ionian University, Greece
Stefanos Nikiforos	Ionian University, Greece
Stavros Ntalampiras	University of Milan, Italy
Vladimir Olej	University of Pardubice, Czech Republic
Mihaela Oprea	University Petroleum-Gas of Ploiesti, Romania
Ioannis P. Chochliouros	Hellenic Telecommunications Organization (OTE), Greece
Basil Papadopoulos	Democritus University of Thrace, Greece
Antonis Papaleonidas	Democritus University of Thrace, Greece
Pavlidis George	Centre for Research and Technology Hellas, Greece
Isidoros Perikos	University of Patras, Greece
Elias Pimenidis	University of the West of England, UK
Panagiotis Pintelas	University of Patras, Greece
Bernardete Ribeiro	University of Coimbra, Portugal
Antonio Staiano	University of Naples Parthenope, Italy
Christos Timplalexis	Centre for Research and Technology Hellas, Greece
Nicolas Tsapatsoulis	Cyprus University of Technology, Cyprus
Tsolakis Apostolos	Centre for Research and Technology Hellas, Greece
Petra Vidnerová	Czech Academy of Sciences, Czech Republic
Paulo Vitor de Campos Souza	CEFET-MG, Brazil
Gerasimos Vonitsanos	University of Patras, Greece

Abstracts of Keynotes

Is “Big Tech” Becoming the “Big Tobacco” of Artificial Intelligence?

John Macintyre

Pro Vice Chancellor at the University of Sunderland, UK gave a Keynote Lecture on a very hot topic related to AI and Ethics.

Abstract. Recent developments in research, development, implementation and use of AI include worrying trends which ask big questions about the future direction of the whole field. As part of this, the role of “Big Tech” – the huge corporate entities who now dominate the development of AI technologies and products – is crucial, both in terms of the technology they develop, and the researchers they employ. Their dominance places them at the apex of the R&D and product development activity in AI, which in turn means they have a great responsibility to ensure that this activity leads to fair, transparent, accountable, and ethical AI systems and products. They also have a great responsibility to support and nurture their staff. This talk will examine recent developments in AI and the role of Big Tech, and ask whether they are stepping up to these responsibilities.

Machine Learning: A Key Ubiquitous Technology in the 21st Century

Hojjat Adeli

Ohio State University, Columbus, USA, Fellow of the Institute of Electrical and Electronics Engineers (IEEE), Honorary Professor, Southeast University, Nanjing, China, Member, Polish and Lithuanian Academy of Sciences, Elected corresponding member of the Spanish Royal Academy of Engineering.

Abstract. Machine learning (ML) is a key and increasingly pervasive technology in the 21st century. It is going to impact the way people live and work in a significant way. In general, machine learning algorithms simulate the way brain learns and solves an estimation/recognition problem. They usually require a learning phase to discover the patterns among the available data, similar to the humans. An expanded definition of ML is advanced as algorithms that can learn from examples and data and solve seemingly intractable learning and unteachable problems, referred to as ingenious artificial intelligence (AI). Recent and innovative applications of ML in various fields and projects currently being pursued by leading high-tech and industrial companies such as Boeing, Google, IBM, Uber, Baidu, Facebook, and Tesla are reviewed. Then, machine learning algorithms developed by the author and his associates are briefly described. Finally, examples are presented in different areas from health monitoring of smart highrise building structures to automated EEG-based diagnosis of various neurological and psychiatric disorders such as epilepsy, the Alzheimer's disease, Parkinson's disease, and autism spectrum disorder.

Human-Centered Computer Vision: Core Components and Applications

Antonis Argyros^{1,2}

¹ Computer Science Department, University of Crete, Greece

² Researcher, Foundation for Research and Technology – Hellas (FORTH)

Abstract. Computer vision is an area of artificial intelligence aimed at developing technical systems capable of perceiving the environment through image and video processing and analysis. In this talk, we mainly focus on human-centered computer vision, that is, computer vision for capturing aspects of human presence such as the geometry and motion of the human body, as well as for recognizing human actions, behavior, intentions and emotional states. Such technologies may constitute a fundamental building block for the development of a variety of applications in almost all aspects of human life (health, security, work, education, transportation, entertainment, etc.). In this special area, we give specific examples of our research activity and highlight the significant boost achieved due to the exploitation of state-of-the-art machine learning techniques and deep neural networks. We also give examples of applications developed based on these technologies in the field of robotics and ambient intelligence environments.

Unveiling Recurrent Neural Networks - What Do They Actually Learn and How?

Peter Tino

School of Computer Science, University of Birmingham, UK

Abstract. When learning from “dynamic” data where the order in which the data is presented does matter, the key issue is how such temporal structures get represented within the learning machine. In the case of artificial neural networks, an often-adopted strategy is to introduce feedback-connections with time delays. This enables the neurons to form their activation patterns based on the past, as well as the current neural activations. Neural networks of this kind became known as Recurrent Neural Networks (RNN). Many diverse architectures fall under this umbrella, with a wide variety of application domains. We will briefly review past attempts to understand the way RNNs learn to represent the past in order to perform the tasks they are trained on.

To that end, we will adopt the general view of RNNs as parameterized state space models and input driven non-autonomous dynamical systems. We will then present some new results connecting RNNs to a widely known class of models in machine learning - kernel machines. In particular, we will show that RNNs can be viewed as “temporal feature spaces”. This framework will enable us to understand how high-dimensional RNNs constructed with very few degrees of freedom in their parameterization can still achieve competitive performances. Such observations can be viewed as “dynamical analogs” to classical “static” kernel machines that often achieve excellent performance using rich feature spaces constructed with very few degrees of freedom (e.g. single scale parameter in Gaussian kernels).

Deep Learning and Kernel Machines

Johan Suykens

KU Leuven, ESAT-Stadius and Leuven AI Institute, Belgium

Abstract. Over the last decades, with neural networks and deep learning, several powerful architectures have been proposed, including e.g., convolutional neural networks (CNN), stacked autoencoders, deep Boltzmann machines (DBM), deep generative models and generative adversarial networks (GAN). On the other hand, with support vector machines (SVM) and kernel machines, solid foundations in learning theory and optimization have been achieved. Within this talk, we outline a unifying picture and show several new synergies, for which model representations and duality principles play an important role. A recent example is restricted kernel machines (RKM), which connects least squares support vector machines (LS-SVM) to restricted Boltzmann machines (RBM). New developments on this will be shown for deep learning, generative models, multi-view and tensor-based models, latent space exploration, robustness and explainability.

How Can Artificial Intelligence Efficiently Support Sustainable Development?

Eunika Mercier-Laurent

Université de Reims Champagne-Ardenne, CReSTIC/MODECO, France

Abstract. This talk considers the multiple role AI may play in sustainability. Actually, sustainable development is among the greatest challenges for humanity. Sustainability and development are apparently opposite. The current efforts to face the Planet Crisis by separate actions generate less impact than expected. Artificial Intelligence approaches and capacity of available technologies are underexplored. Eco-innovation actions focus mainly on smart transportation, smart use of energy and water and waste recycling but do not consider the necessary evolution of behaviors and focus. The trendy Digital transformation follows mostly traditional approaches. The concepts such as Smart, Intelligent, Innovative, Green or Wise City invented to promote existing technology transform the IT market. Most of offers consist in data processing with statistical/optimization methods. But AI can do better – the AI approaches and techniques combined with adequate thinking may help innovating the way of facing Planet Crisis.

Backpropagation Free Deep Learning

Jose C. Principe

University of Florida, USA

Abstract. This talk presents recent results that show the feasibility of training deep networks classifiers without backpropagation. We will prove that it is possible to substitute error propagation in general conditions and practically achieve the same performance as conventional algorithms. This methodology allows modularization of the algorithmic pipeline and improves explainability. We will then address some of the benefits of this technology for applications.

Brain-Inspired Data Analytics for Incremental and Transfer Learning of Cognitive Spatio-Temporal Data and for Knowledge Transfer

Nikola Kasabov

Fellow IEEE, Fellow RSNZ, Fellow INNS College of Fellows
Professor of Knowledge Engineering and Founding Director KEDRI
Auckland University of Technology, Auckland, New Zealand
George Moore Chair/Professor, University of Ulster, UK
Honorary Professor Teesside University UK and the University of Auckland, NZ

Abstract. The talk argues and demonstrates that brain-inspired spiking neural network (SNN) architectures can be used for incremental and transfer learning, i.e. to learn new data and new classes/tasks/categories incrementally utilising some previously learned knowledge. Similarly to how the brain manifests transfer learning, these SNN models do not need to be restricted in number of layers, neurons in each layer, etc. as they adopt self-organising learning principles. The new learned knowledge can be extracted in forms of graphs and symbolic fuzzy rules and its evolution traced over time. The presented approach is illustrated on an exemplar brain-inspired SNN architecture NeuCube (free software and open source available from www.kedri.aut.ac.nz/neucube and from www.neucube.io). The extraction of symbolic rules from NeuCube at each learning tasks and each subject allows for knowledge transfer between humans and machines in an adaptive, evolving, interactive way. This opens the field to build new types of open and transparent BCI and AI systems.

More details can be found in: N.Kasabov, Time-Space, Spiking Neural Networks and Brain-Inspired Artificial Intelligence, Springer, 2019, <https://www.springer.com/gp/book/9783662577134>.

Abstracts of Tutorials

Modern Methods and Tools for Human Biosignal Analysis

Vangelis Metsis

Texas State University, USA

Abstract. The term biosignal refers to any signal that can be measured from living organisms. Biosignals have been used in medicine, sports science, and psychology for diagnoses, and there have been impressive advancements in these areas. Recently, the fields of human-computer interaction and affective computing have found an interest in using biosignals as a means of understanding the human state and intention. This interest has been reinforced by the fact that acquiring information with sensors and interfacing electrically with the human body has become much easier in the past few years. Moving from large analog technologies to digital ones has led to the miniaturization of sensing devices. Wireless transmission technologies (e.g., Bluetooth low energy), which can be easily integrated with the acquisition hardware, have removed the need for bulky wiring. This tutorial will present an overview of modern applications of human biosignals and will provide practical examples of machine learning-based methods and tools for biosignal analysis. Traditional machine learning algorithms for feature extraction and classification will be compared with recent developments in deep learning and its applications to biosignal and time-series data processing in general.

Anomaly Detection in Images

Giacomo Boracchi

Politecnico di Milano, Italy

Anomaly detection problems are ubiquitous in engineering: the prompt detection of anomalies is often a primary concern, since these might provide precious information for understanding the dynamics of a monitored process and for activating suitable countermeasures. In fact, anomalies are typically the most informative regions in an image (e.g., defects in images used for quality control). Not surprisingly, anomaly detection problems have been widely investigated in the image processing and pattern recognition communities and are key in application scenarios ranging from quality inspection to health monitoring. The tutorial presents a rigorous formulation of the anomaly-detection problem that fits with many imaging scenarios and applications. The tutorial describes, by means of illustrative examples, the most important anomaly-detection approaches in the literature, and their connection with the machine-learning perspective of semi-supervised and unsupervised learning/monitoring. Special emphasis will be given to anomaly-detection methods based on learned models, which are often adopted to handle images and signals. In particular, these will be divided into traditional models (including dictionaries yielding sparse representations) and deep learning models. The tutorial is accompanied by various examples from our research projects where we applied anomaly-detection algorithms to solve real world problems: visual quality inspection for monitoring chip and nanofiber production.

Contents

Adaptive Modeling/Neuroscience

- 'If Only I Would Have Done that...': A Controlled Adaptive Network Model for Learning by Counterfactual Thinking 3
Raj Bhalwankar and Jan Treur
- A Computational Model for the Second-Order Adaptive Causal Relationships Between Anxiety, Stress and Physical Exercise 17
Lars Rass and Jan Treur

AI in Biomedical Applications

- ebiMeIDB: Multi-modal Database for Melanoma and Its Application on Estimating Patient Prognosis 33
Aigli Korfiati, Giorgos Livanos, Christos Konstantinou, Sophia Georgiou, and George Sakellariopoulos
- Improved Biomedical Entity Recognition via Longer Context Modeling. 45
Nikolaos Stylianou, Panagiotis Kosmoliaptsis, and Ioannis Vlahavas
- Scalable NPairLoss-Based Deep-ECG for ECG Verification 57
Yu-Shan Tai, Yi-Ta Chen, and (Andy) An-Yeu Wu
- Comparative Study of Embedded Feature Selection Methods on Microarray Data 69
Hind Hamla and Khadoudja Ghanem

AI Impacts/Big Data

- The AI4Media Project: Use of Next-Generation Artificial Intelligence Technologies for Media Sector Applications. 81
Filareti Tsalakanidou, Symeon Papadopoulos, Vasileios Mezaris, Ioannis Kompatsiaris, Birgit Gray, Danae Tsabouraki, Maritini Kalogerini, Fulvio Negro, Maurizio Montagnuolo, Jesse de Vos, Philo van Kemenade, Daniele Gravina, Rémi Mignot, Alexey Ozerov, Francois Schnitzler, Artur Garcia-Saez, Georgios N. Yannakakis, Antonios Liapis, and Georgi Kostadinov
- Regression Predictive Model to Analyze Big Data Analytics in Supply Chain Management 94
Elena Puica

Automated Machine Learning

An Automated Machine Learning Approach for Predicting Chemical Laboratory Material Consumption	105
--	-----

António João Silva and Paulo Cortez

An Ontology-Based Concept for Meta AutoML	117
---	-----

Bernhard G. Humm and Alexander Zender

Object Migration Automata for Non-equal Partitioning Problems with Known Partition Sizes	129
--	-----

Rebekka Olsson Omslandseter, Lei Jiao, and B. John Oommen

Autonomous Agents

Enhanced Security Framework for Enabling Facial Recognition in Autonomous Shuttles Public Transportation During COVID-19.	145
---	-----

Dimitris Tsiktsiris, Antonios Lalas, Minas Dasygenis, Konstantinos Votis, and Dimitrios Tzovaras

Evaluating Task-General Resilience Mechanisms in a Multi-robot Team Task	155
--	-----

James Staley and Matthias Scheutz

Clustering

A Multi-view Clustering Approach for Analysis of Streaming Data	169
---	-----

Vishnu Manasa Devagiri, Veselka Boeva, and Shahrooz Abghari

Efficient Approaches for Density-Based Spatial Clustering of Applications with Noise	184
--	-----

Pretom Kumar Saha and Doina Logofatu

Self-organizing Maps for Optimized Robotic Trajectory Planning Applied to Surface Coating	196
---	-----

Maria Tzinava, Konstantinos Delibasis, and Spyros Kamnis

Convolutional NN

An Autoencoder Convolutional Neural Network Framework for Sarcopenia Detection Based on Multi-frame Ultrasound Image Slices	209
---	-----

Emmanuel Pintelas, Ioannis E. Livieris, Nikolaos Barotsis, George Panayiotakis, and Panagiotis Pintelas

Automatic Classification of XCT Images in Manufacturing	220
<i>Bertram Sabrowsky-Hirsch, Roxana-Maria Holom, Christian Gusenbauer, Michael Reiter, Florian Reiterer, Ricardo Fernández Gutiérrez, and Josef Scharinger</i>	
Cross-Lingual Approaches for Task-Specific Dialogue Act Recognition	232
<i>Jiří Martínek, Christophe Cerisara, Pavel Král, and Ladislav Lenc</i>	
Just-in-Time Biomass Yield Estimation with Multi-modal Data and Variable Patch Training Size	243
<i>Patricia O’Byrne, Patrick Jackman, Damon Berry, Thomas Lee, Michael French, and Robert J. Ross</i>	
Robustness Testing of AI Systems: A Case Study for Traffic Sign Recognition	256
<i>Christian Berghoff, Pavol Bielik, Matthias Neu, Petar Tsankov, and Arndt von Twickel</i>	
Data Mining/Word Counts	
BIBLIOCLUSTER: A Bicluster Algorithm for Bibliometrics	271
<i>Gloria Gheno</i>	
Topic Identification via Human Interpretation of Word Clouds: The Case of Instagram Hashtags	283
<i>Stamatios Giannoulakis and Nicolas Tsapatsoulis</i>	
Deep Learning	
A Comparative Study of Deep Learning Techniques for Financial Indices Prediction	297
<i>Argyrios P. Ketsetsis, Konstantinos M. Giannoutakis, Georgios Spanos, Nikolaos Samaras, Dimitrios Hristu-Varsakelis, Dimitrios Thomas, and Dimitrios Tzovaras</i>	
An Effective Loss Function for Generating 3D Models from Single 2D Image Without Rendering	309
<i>Nikola Zubić and Pietro Liò</i>	
Collaborative Edge-Cloud Computing for Personalized Fall Detection	323
<i>Anne H. Ngu, Shaun Coyne, Priyanka Srinivas, and Vangelis Metsis</i>	
Deep Dense and Convolutional Autoencoders for Machine Acoustic Anomaly Detection	337
<i>Gabriel Coelho, Pedro Pereira, Luis Matos, Alexandrine Ribeiro, Eduardo C. Nunes, André Ferreira, Paulo Cortez, and André Pilastrri</i>	

Neural Network Compression Through Shunt Connections and Knowledge Distillation for Semantic Segmentation Problems.	349
<i>Bernhard Haas, Alexander Wendt, Axel Jantsch, and Matthias Wess</i>	
System-Wide Anomaly Detection of Industrial Control Systems via Deep Learning and Correlation Analysis.	362
<i>Gordon Haylett, Zahra Jadidi, and Kien Nguyen Thanh</i>	
Verification of Size Invariance in DNN Activations Using Concept Embeddings.	374
<i>Gesina Schwalbe</i>	
Artificial Intelligence in Music Composition.	387
<i>Mincer Alaeddine and Anthony Tannoury</i>	
Deep Learning and AI for 5G Technology: Paradigms.	398
<i>Mahnaz Olfati and Kiran Parmar</i>	
Fuzzy Modeling	
Intuitionistic Fuzzy Neural Network for Time Series Forecasting - The Case of Metal Prices.	411
<i>Petr Hajek, Vladimir Olej, Wojciech Froelich, and Josef Novotny</i>	
Hyperdimensional Computing	
PQ-HDC: Projection-Based Quantization Scheme for Flexible and Efficient Hyperdimensional Computing.	425
<i>Chi-Tse Huang, Cheng-Yang Chang, Yu-Chuan Chuang, and An-Yeu (Andy) Wu</i>	
Hyperdimensional Computing with Learnable Projection for User Adaptation Framework.	436
<i>Yu-Ren Hsiao, Yu-Chuan Chuang, Cheng-Yang Chang, and An-Yeu (Andy) Wu</i>	
Internet of Things/Internet of Energy	
“SAVE” – An Integrated Approach of Personal and Home Safety for Active Assisted Living.	451
<i>Sorin-Aurel Moraru, Adrian Alexandru Moşoi, Dominic Mircea Kristaly, Florin Sandu, Dan Floroian, Delia Elisabeta Ungureanu, and Liviu Marian Perniu</i>	
BEMS in the Era of Internet of Energy: A Review	465
<i>Asimina Dimara, Christos-Nikolaos Anagnostopoulos, Konstantinos Kotis, Stelios Krinidis, and Dimitrios Tzovaras</i>	

Machine Learning

A Survey of Methods for Detection and Correction of Noisy Labels in Time Series Data. 479
Gentry Atkinson and Vangelis Metsis

An Automated Tool to Support an Intelligence Learner Management System Using Learning Analytics and Machine Learning. 494
Shareeful Islam, Haralambos Mouratidis, and Hasan Mahmud

Classification of Point Clouds with Neural Networks and Continuum-Type Memories 505
Stefan Reitmann, Elena V. Kudryashova, Bernhard Jung, and Volker Reitmann

Cyber Supply Chain Threat Analysis and Prediction Using Machine Learning and Ontology 518
Abel Yeboah-Ofori, Haralambos Mouratidis, Umar Ismai, Shareeful Islam, and Spyridon Papastergiou

Intelligent Techniques and Hybrid Systems Experiments Using the Acumen Modeling and Simulation Environment 531
Sotirios Tzamaras, Stavros Adam, and Walid Taha

Predicting CO₂ Emissions for Buildings Using Regression and Classification 543
Alexia Avramidou and Christos Tjortjis

Robust Pose Estimation Based on Maximum Correntropy Criterion. 555
Qian Zhang and Badong Chen

The Generative Adversarial Random Neural Network 567
Will Serrano

Using Machine Learning Methods to Predict Subscriber Churn of a Web-Based Drug Information Platform 581
Georgios Theodoridis and Athanasios Tsadiras

Analysis and Prediction for House Sales Prices by Using Hybrid Machine Learning Approaches. 594
S. M. Soliman Hossain, Jyoti Rawat, and Doina Logofatu

Multi Agent Systems

Dynamic Plume Tracking Utilizing Symbiotic Heterogeneous Remote Sensing Platforms 607
Iakovos T. Michailidis, Athanasios Ch. Kapoutsis, Elias B. Kosmatopoulos, and Yiannis Boutalis

Improving the Flexibility of Production Scheduling in Flat Steel Production Through Standard and AI-Based Approaches: Challenges and Perspectives. . .	619
<i>Vincenzo Iannino, Valentina Colla, Alessandro Maddaloni, Jens Brandenburger, Ahmad Rajabi, Andreas Wolff, Joaquin Ordieres, Miguel Gutierrez, Erwin Sirovnik, Dirk Mueller, and Christoph Schirm</i>	

Natural Language

A Comparative Assessment of State-Of-The-Art Methods for Multilingual Unsupervised Keyphrase Extraction.	635
<i>Nikolaos Giarelis, Nikos Kanakaris, and Nikos Karacapilidis</i>	

An Approach Utilizing Linguistic Features for Fake News Detection.	646
<i>Dimitrios Panagiotis Kasseropoulos and Christos Tjortjis</i>	

CEA-TM: A Customer Experience Analysis Framework Based on Contextual-Aware Topic Modeling Approach.	659
<i>Ariona Shashaj, Davide Stirparo, and Mohammad Kazemi</i>	

Machine Learning Meets Natural Language Processing - The Story so Far	673
<i>Nikolaos-Ioannis Galanis, Panagiotis Vafiadis, Kostas-Gkouram Mirzaev, and George A. Papakostas</i>	

SemAI: A Novel Approach for Achieving Enhanced Semantic Interoperability in Public Policies	687
<i>George Manias, Argyro Mavrogiorgou, Athanasios Kiourtis, and Dimosthenis Kyriazis</i>	

Recommendation Systems

Optimization of Multi-stakeholder Recommender Systems for Diversity and Coverage	703
<i>Iordanis Koutsopoulos and Maria Halkidi</i>	

Recommending Database Architectures for Social Queries: A Twitter Case Study.	715
<i>Michael Marountas, Georgios Drakopoulos, Phivos Mylonas, and Spyros Sioutas</i>	

Science4Fashion: An Autonomous Recommendation System for Fashion Designers	729
<i>Sotirios-Filippos Tsarouchis, Argyrios S. Vartholomaïos, Ioannis-Panagiotis Bountouridis, Athanasios Karafyllis, Antonios C. Chrysopoulos, and Pericles A. Mitkas</i>	

Sentiment Analysis

A Two-Step Optimised BERT-Based NLP Algorithm for Extracting Sentiment from Financial News 745
Rapheal Olaniyan, Daniel Stamate, and Ida Pu

Learning Sentiment-Aware Trading Strategies for Bitcoin Leveraging Deep Learning-Based Financial News Analysis 757
N. Passalis, S. Seficha, A. Tsantekidis, and A. Tefas

Smart Blockchain Applications/Cybersecurity

Federated Blockchained Supply Chain Management: A CyberSecurity and Privacy Framework 769
Konstantinos Demertzis, Lazaros Iliadis, Elias Pimenidis, Nikolaos Tziritas, Maria Koziri, Panagiotis Kikiras, and Michael Tonkin

Validation and Verification of Data Marketplaces 780
Will Serrano

Author Index 793