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Information Science and Technology in Romania

Editors:
Florin Gheorghe Filip
Vasile Apopei
Daniela Gîfu

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INFORMATION SCIENCE AND TECHNOLOGY IN ROMANIA

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Editors

Florin Gheorghe FILIP Vasile APOPEI Daniela GÎFU

EDITURA ACADEMIEI ROMÂNE
București, 2024

Florin Gheorghe Filip was born in 1947 in Bucharest, Romania. He graduated from the Automation and Computers Faculty of Polytehnic Institute of Bucharest in 1970 and received his PhD degree from the same university in 1982. He was elected as corresponding member of the Romanian Academy in 1991 and became full member of the Academy in 1999. His main scientific interests include optimization and control of large-scale complex systems, decision support systems (DSS), technology management and foresight, and IT applications in the cultural sector. He authored/co-authored over 400 papers published in international journals (IFAC J Automatica, IFAC J Control Engineering Practice, Annual Reviews in Control, Computers in Industry, Large-Scale Systems, and so on) and contributed to volumes printed by Pergamon Press, Elsevier, Kluwer, Chapman & Hall, and so on. He is also the author/co-author of thirteen monographs published by Editura Tehnică, Hermès-Lavoisier, Paris, J. Wiley & Sons, Springer, and editor/co-editor of 35 volumes of contributions and conference proceedings published by Editura Academiei Române, Pergamon Press, North Holland, Elsevier, IEEE Computer Society, and so on. He presented invited lectures in universities and research institutions, and plenary papers at scientific conferences in Brazil, Chile, China, Czech Republic, France, Germany, Lithuania, Poland, Portugal, Republic of Moldova, Romania, Spain, Sweden, Tunisia, and UK.

Vasile Apopei was born in 1959 in Dumbraveni, Suceava county, Romania. He is Senior Researcher at the Institute of Computer Science of the Romanian Academy Iași Branch. He graduated from Electrical Engineering at "Gheorghe Asachi" Polytechnic Institute of Iași in 1984. He was formed as a researcher at the Institute for Computing Technology Bucharest, Iași Branch. In 2008, he obtained the Ph.D. degree in Electronic and Telecommunications Engineering at the School of Advanced Studies of the Romanian Academy (SCOSAAR).

He has over 35 years of experience in signal processing, in the design of automatic control systems and in the development of supervised learning systems. In recent years, he has been concerned with the development of methods and algorithms for management, processing and publication of the linguistics resources within the fundamental Linguistic Atlases project of the Romanian Academy; the development of algorithms and methods of audio signal analysis with applications in the detection of the occurrence of dangerous events and in the modeling of speech prosodic elements. For the results of his research, he received, together with the teams he coordinated, the "Mihai Drăgănescu Award" of the Romanian Academy in 2017 and the "Octav Mayer Award" of the Romanian Academy Iași Branch in 2006.

Daniela Gîfu (born in Bârlad on January 10, 1973) is a Senior Researcher at the Institute of Computer Science, Romanian Academy – Iași Branch, and an Associate Professor at the Faculty of Economics, Depart. of Computer Science, "Petre Andrei" University of Iași as well as at the Faculty of Engineering and Information Technology, "George Emil Palade" University of Medicine, Pharmacy, Science and Technology (UMFST) of Târgu Mureș, Romania. She holds a PhD in Computer Science (2016) and a PhD in Philosophy (2010). She obtained her bachelor's degree in Physics (1997) from "Alexandru Ioan Cuza" University of Iași (UAIC) and completed a master's degree in Communication and Public Relations at the National University of Political Studies and Public Administration (SNSPA), Bucharest (2004).

She has significant experience in the field of computational linguistics, natural language processing, particularly in the analysis of the printing press (subject identification, semantic annotation, epoch detection, diachrony, word sense disambiguation, entity recognition, sentiment analysis, information retrieval) in Romanian, English, and Italian.

She has participated in over 250 conferences and workshops and has published an equal number of articles indexed in international databases (SCOPUS, ISI Web of Knowledge, Springer, DBLP, IEEE Computer Society). She made her editorial debut at the Publishing House of the Romanian Academy: *Temeliile Turnului Babel. O perspectivă integratoare asupra discursului politic*, 2013.

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FOREWORD

In the General Assembly meeting of the Romanian Academy on November 24, 1998, Academician Mihai Corneliu Drăgănescu defined *Information Science and Technology* (IS&T) as *"the multidisciplinary field of science and technology that underlies the information society. It encompasses the physical substrate of information, telecommunications, computers, software, information systems, theoretical informatics, information theory, the Internet, web technology, automation, and systems theory. Additionally, IS&T finds specific applications in diverse fields such as economics, sociology, healthcare, biology, and philosophy."*

The present volume has been designed in accordance with the above definition. It contains chapters that describe, within the context of international developments, the key moments, influential scientists, and achievements that have contributed to the progress of IS&T in Romania and, more broadly, to the Information and Communications Technology (IC&T) sector in Romania.

The first chapter, authored by Dan Dascălu (coordinator) along with Andreas Wild, Gheorghe Brezeanu, Gheorghe M. Ştefan, Anca Manolescu, Petru Dan, Radu Bârsan, Cornel Stănescu, Octavian Buiu, Traian Vişan, Marius Bâzu, Alexandru Müller, Raluca Müller, Gheorghe Pascovici, and Aurel Millea, is dedicated to the development of semiconductor devices, integrated circuits, micro, and nanoelectronics. It also covers the evolution of the doctoral school at the Faculty of Electronics and Telecommunications of the "Politehnica"[1] University of Bucharest, scientific research, and technological development in the Băneasa industrial platform. Furthermore, it highlights research and development activities carried out after December 1990, including those related to nuclear electronics and the professional achievements of companies and specialists trained in Romania.

In the chapter entitled "From the History of Romanian Theoretical Informatics", Gheorghe Păun begins by presenting the characteristics of the domain. Subsequently, the author describes a series of significant moments in the evolution of the field in our country, starting with the "prehistory" of theoretical computing, even before the formal establishment of the "computer science" discipline. The decisive role of the two founders of theoretical computer science in Romania, Grigore C. Moisil and Solomon Marcus, is highlighted. Additionally, the chapter discusses the current multitude of contributions made by Romanian computer theorists across diverse and internationally active research directions.

[1] The technical universities in Bucharest, Cluj-Napoca, Iasi and Timisoara have changed their names several times over the period we are analyzing. For the sake of history, we mention their names which have equivalence: "Politehnica" University of Bucharest with Polytechnic Institute of Bucharest; Technical University of Cluj-Napoca with Polytechnic Institute of Cluj-Napoca; Politehnica University of Timişoara with Polytechnic Institute of Timişoara; "Gheorghe Asachi" Technical University of Iaşi with "Gheorghe Asachi" Polytechnic Institute of Iasi.

The chapter titled “Development of Computers in Romania”, authored by Nicolae Ţăpuş, provides a comprehensive chronology of the most significant moments in the evolution of the field. It emphasizes the personalities, universities, institutes, and companies that have made important contributions during the 65 years since Victor Toma created the first Romanian computer in 1955. Ţăpuş himself has been an effective participant in the design and construction of many Romanian computers over the last 45 years.

In another chapter, titled “Romanian Forerunners of Modern Communications: School Creators”, Victor Croitoru surveys into the history of communications within the present territory of Romania. He begins with the commissioning of the first telegraph lines in Transylvania in 1853, followed by telegraphic communications in Wallachia and Moldova over the subsequent two years. The author highlights the contributions of Romanian scientists in the field of communications and cybernetics, drawing parallels with international developments.

The evolutions in the field of computer networks, which combine information and communication technologies, are described in the chapter elaborated by Nicolae Ţăpuş and Florin Gheorghe Filip. The authors present a chronology of the most significant events globally, as well as those specific to Romania and the Republic of Moldova, which have influenced the progress of the field over the last five decades.

The chapter titled “The Contribution of Romanian Automatic Control Community to the Development of Civilization” is written by Ioan Dumitrache (coordinator) and a team composed of Tiberiu Coloşi, Mihail Voicu, Toma Dragomir, Vladimir Răsvan, Emil Ceangă, and Nicolae Paraschiv. The chapter describes the main Romanian contributions to the development of automation, brought about by teams from technical universities located in major university centers such as Cluj-Napoca, Iaşi, Timişoara, Craiova, Galaţi, and Ploieşti. It also highlights the technical achievements with socio-economic impact resulting from these universities, as well as research and development institutes in the field.

The chapter entitled “Artificial Intelligence in Romania” was authored by Horia-Nicolai Teodorescu (editor), Vasile Apopei, Tudor Barbu, Bogdan Brânzilă, Corneliu Burileanu, Iulian Ciocoiu, Hariton Costin, Dan Cristea, Inge Gavăţ, Marian Petrescu, Radu-Emil Precup, Gheorghe M. Ştefan, Gheorghe Tecuci, and Dan Tufiş. The covered topics include the achievements of early times, cognitive training agents, knowledge engineering, natural language processing, contributions to voice signal technology in Romania, artificial neural networks, contributions to “soft computing”, hardware for Artificial Intelligence (AI), AI applications in medicine, biology, and social media, understanding and interpretation of images and films, and research conducted in Romanian companies.

In the chapter titled “Industrial Informatics”, Adrian Davidoviciu describes a series of significant moments, practical achievements, personalities, and publications in the field of computer-based control of technological processes, robotics, and real-time systems. This includes systems for computer-based decision support, exports of information systems, and international collaboration.

In the chapter entitled "Economic Informatics: Past, Present, and Future", Ion Ivan presents the evolution of an important field of application of IS&T. The author describes the distinctive characteristics of the field, the history of domain education, the specializations of economists, the main personalities and results in research in the field, and the most important publications. A distinct subchapter refers to Cybernetics, a discipline in which significant and internationally recognized Romanian priorities can be highlighted.

At the end of the volume, the evolution of the IS&T field in the Romanian Academy and the establishment of the specialized section, in 1992 are reviewed. In 1967, when the National Program to endow the Romanian economy with computing techniques was launched, 1.6 computers per inhabitant were reported in Romania, compared to 10 in Greece, 32 in France, or 46 in the Federal Republic of Germany. In 2019, in the IT&C sector activated over 100,000 people who contributed by 6% to the GDP of Romania.

This volume represents the English version of the work entitled "Ştiinţa şi tehnologia informaţiei în România", published by Editura Academiei Române in 2018. The content of the chapters represents the views of the authors as in 2019. In Romania, as in the rest of the world, IS&T is a highly dynamic field where new challenges emerge every year due to the rapid evolution of technologies. We must mention that, in accordance with the decision made, early this year, this volume does not include any update concerning the events over the past four years. The final editing, translation verification, and adaptation of the manuscript were carefully managed by the two editors, Vasile Apopei and Daniela Gîfu, in 2024 at the Institute of Computer Science, Iași, as part of the work plan of the Institute.

We extend our gratitude to all colleagues who contributed with materials included in this volume and have patiently waited the publication of their chapters. We deeply regret that three of them passed away and did not have the chance to see their work published.

Our thanks are due to Editura Academiei Române (EAR) for the prompt and fine work carried out to have the volume published.

București-Iași, 2019–2024

Florin Gheorghe FILIP
Vasile APOPEI
Daniela GÎFU

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In the General Assembly meeting of the Romanian Academy on November 24, 1998, Academician Mihai Corneliu Drăgănescu defined *Information Science and Technology (IS&T) as "the multidisciplinary field of science and technology that underlies the information society. It encompasses the physical substrate of information, telecommunications, computers, software, information systems, theoretical informatics, information theory, the Internet, web technology, automation, and systems theory. Additionally, IS&T finds specific applications in diverse fields such as economics, sociology, healthcare, biology, and philosophy."*

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