ALFA BK UNIVERSITY

THE BOOK OF ABSTRACTS

International Scientific and Professional Conference
“ALFATECH “
Smart Cities and modern technologies

Belgrade,
February 28th, 2025

THE BOOK OF ABSTRACTS
International Scientific and Professional Conference “ALFATECH“ Smart Cities and modern technologies
February 28th, 2025, Belgrade, Serbia

Publisher:
ALFA BK University, Belgrade, 2025

For publisher:
Prof. Jovan Veselinovic, PhD, rector of the ALFA BK University

Editor in chief:
Prof. Milan Gligorijevic, PhD, Dean of the Faculty of Information Technologies

Editor:
Assistant Professor Dejan Đukić, PhD of Electrical Engineering – ALFA BK University, Serbia
Professor Željko Stojanov, PhD of Information Technology, University of Novi Sad, Faculty of Technical Sciences Zrenjanin
Assistant Professor Violeta Dimić, PhD in Information Technology, Faculty of Information Technology, ALFA BK University
Professor Mimica Milosevic, PhD in Applied Mathematics, Faculty of Mathematics and Computer Science, ALFA BK University, Serbia
Professor Indrit Enesi, PhD, Vice Dean of Faculty of Information Technology, Polytechnic University of Tirana, Albania
Assistant Professor Milan Brkljač, PhD, ALFA BK University, Serbia
Assistant Maja Gaborov, MSc of Information Technology, University of Novi Sad, Faculty of Technical Sciences Zrenjanin
Assistant Ninoslava Tihi, MSc of Information Technology, Novi Sad, Serbia
Assistant Mitar Miki Tepic, MSc of Computer Science, JUSSS Derventa, Bosna and Hercegovina
Assistant Vladimir Mikic. MSc in Information Technology, Faculty of Information Technology, ALFA BK University
Aleksandar Stokic, PhD in Information Technology, National library in Derventa, Bosna and Hercegovina
Assistant Professor Stevan Jokic, PhD in Information Technology, Faculty of Information Technology, ALFA BK University

Prepress:
PhD Miloš Ilić
MSc Stefan Popovic

The press:
GLAMUR, Kraljevo

Circulation:
200 copies

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

711.45:[004.78:004.35(048)
004(048)
711.4:005.591.6(048)

INTERNATIONAL Scientific and Professional Conference “ALFATECH“ Smart Cities and modern technologies (2025 ; Beograd)
The Book of Abstracts / International Scientific and Professional Conference “ALFATECH“ Smart Cities and modern technologies, Belgrade, February 28th, 2025 ; [editor in chief Milan Gligorijevic]. - Belgrade : Alfa BK University, 2025 (Kraljevo : Glamur). - 62 str. ; 21 cm

Tiraž 200.

ISBN 978-86-6461-085-8

1. Глигоријевић, Милан, 1966- [главни уредник]
а) Градови -- Интернет ствари -- Апстракти б) Информациона технологија -- Апстракти в) Урбанистичко планирање -- Технолошки развој -- Апстракти

COBISS.SR-ID 164184841

ISBN: 978-86-6461-085-8
DOI:

ORGANIZATIONAL BOARD OF INTERNATIONAL SCIENTIFIC AND PROFESSIONAL CONFERENCE "ALFATECH" SMART CITIES AND MODERN TECHNOLOGIES

Chairman of the Board: Associate Professor Gligorijević Milan, PhD in Information Technology, dean of Faculty of Information Technology, ALFA BK University, Serbia
Secretary: MSc. Stefan Popović, ALFA BK University, Serbia
Technical Support: Assistant Professor Milan Brkljač, ALFA BK University, Serbia
Technical Support: MSc. Vladimir Šašo, ALFA BK University, Serbia
Technical Support: Dejan Anđelković, ALFA BK University, Serbia
Member Colonel Slobodan Nedeljković, Ministry of the Interior RS, Serbia
Member: Assistant Professor Violeta Dimić, PhD in Information Technology, Faculty of Information Technology, ALFA BK University, Serbia
Member: MSc. Ana Pälchen, Energy Markets and Regulation consulting and revision, Germany
Member: Assistant Professor Miloš Todorov, PhD in Applied Mathematics, Faculty of Mathematics and Computer Science, ALFA BK University, Serbia
Member: MSc. Brankica Kovačević, ALFA BK University, Serbia
Member: Assistant Professor Goran Kekovic, PhD in Information Technology, Faculty of Information Technologies, ALFA BK University

INTERNATIONAL SCIENTIFIC BOARD AND REVIEWERS OF PAPERS AND APSTRACT OF INTERNATIONAL SCIENTIFIC AND PROFESSIONAL CONFERENCE "ALFATECH" SMART CITIES AND MODERN TECHNOLOGIES

Chairman of the Board: Associate Professor Gligorijević Milan, PhD in Information Technology, dean of Faculty of Information Technology, ALFA BK University, Serbia
Secretary: MSc. Stefan Popović, ALFA BK University, Serbia
Professor Elinda Kajo Mece, PhD of Information Technology, Dean of Faculty of Information Technology, Polytechnic University of Tirana, Albania
Professor Riste Temjanovski, PhD, Goce Delcev University of Štip, North Macedonia
Assistant Professor Dejan Rančić, PhD, Faculty of Electronic Engineering, University of Niš, Serbia
Professor Željko Stojanov, PhD of Information Technology, University of Novi Sad, Faculty of Technical Sciences Zrenjanin
Professor Indrit Enesi, PhD, Vice Dean of Faculty of Information Technology, Polytechnic University of Tirana, Albania
Professor Nebojša Denić, PhD of Technical Science, University of Priština, Serbia
Dr. Ivan Vulić – University of Defense Belgrade, Serbia
Slaviša Trajković, PhD of Business Informatics, Faculty of Economics Kosovska Mitrovica, Serbia
Associate Professor Krsto Jakšić, PhD of Business Informatics, Faculty of Economics Kosovska Mitrovica, Serbia
PhD Elma Zanaj, Faculty of Information and Technology, Polytechnic University of Tirana, Albania
Associate professor Zsolt Illési, PhD, Milton Friedman University, Budapest, Hungary
Assistant Professor Dejan Đukić, PhD of Electrical Engineering – ALFA BK University, Serbia
Marko Zakić, PhD of Digital economy, Wolken-ASM GmbH, Germany
Assistant Professor Violeta Dimić, PhD in Information Technology, Faculty of Information Technology, ALFA BK University
Associate Professor Edis Mekić, PhD, High polytechnic school Doboj, Bosnia and Herzegovina
Associate Professor Duško Bogdanić, PhD of Mathematics, Faculty of Mathematics and Computer Science, ALFA BK University, Serbia
Associate Professor Vojkan Nikolić, PhD in Information Technology – University of Criminal Investigation and Police Studies, Serbia
Radoje Jevtić, PhD in Technical Science, Serbia
Associate professor József Udvaros PhD, Programming methodology, Milton Friedman University, Department of Informatics, Budapest, Hungary
Associate Professor Marija Paunović, PhD in Applied Mathematics, University of Kragujevac, Serbia
sci med Slobodan Kapor, PhD Institute of Anatomy "Niko Miljanić", Faculty of Medicine in Belgrade, University of Belgrade, Serbia

Personalization of Learning in Smart Cities: Using AI Technologies to Create Adaptive Educational Platforms

Ildar SHAIKHISLAMOV[1], Andrey PESTUNOV[2], Olga SHVETS[3]

Abstract: This article considers an urgent problem of personalization of learning in the context of the development of smart cities, where educational processes should be not only effective, but also adapted to the individual needs of students. The authors present an innovative adaptive educational platform developed using advanced artificial intelligence (AI) and machine learning technologies. The platform analyzes students real-time data, including their academic achievements, preferences and learning styles, to offer personalized learning trajectories. The main goal of the research is to demonstrate how AI technologies can be integrated into smart city education systems to improve learning and inclusion. The platform uses machine learning algorithms to automatically customize learning materials, allowing for individualized learning experiences for each student. This not only improves the learning process, but also reduces the workload of teachers, freeing up their time for more creative and strategic tasks. An important aspect of the study is the integration of the platform into the infrastructure of smart cities. The authors emphasize that such technologies not only improve educational processes, but also contribute to the sustainable development of the urban environment. The platform helps optimize the use of educational resources, reduce the cost of education and provide equal access to quality education for all individuals, regardless of their social status or physical capabilities. In conclusion, the article proposes new approaches to the organization of educational processes in smart cities based on AI technologies. The presented platform shows potential for scaling and implementation in various educational institutions, which makes it an important tool for shaping the future of education. The authors also discuss possible challenges associated with the implementation of such technologies, including data privacy and ethical issues in the use of AI, and suggest ways to address them.

Keywords: Personalization of Learning, Smart Cities, Artificial Intelligence, Adaptive Education Platforms, Machine Learning, Inclusive Education.

Contact information:

Ildar SHAIKHISLAMOV 1, Doctoral student
(Corresponding author)

Novosibirsk State University of Economics and Management**,** Kamenskaya st., 52, Novosibirsk, Novosibirsk region, Russian Federation, 630099
ildar.inkin@gmail.com
https://orcid.org/0000-0002-5501-7307

Andrey PESTUNOV 2, Ph.D. of Physico-mathematical Sciences

Novosibirsk State University of Economics and Management**,** Kamenskaya st., 52, Novosibirsk, Novosibirsk region, Russian Federation, 630099
a.i.pestunov@nsuem.ru
https://orcid.org/0000-0002-4909-7953

Olga SHVETS 3, Ph.D. of Engineering Sciences

Novosibirsk State University of Economics and Management, Kamenskaya st., 52, Novosibirsk, Novosibirsk region, Russian Federation, 630099
o.y.shvec@edu.nsuem.ru
https://orcid.org/0000-0001-5710-9056

Peak Loads Reduction Optimizing Strategies in District Heating System – Case Study Of Maribor

Etjan KIRALJ[1], Filip KOKALJ[2]

Abstract: District heating systems provide centralised heat generation and efficient distribution in urban environments, enhancing energy efficiency and mitigating local uncontrolled emissions. Nonetheless, district heating is influenced heavily by fluctuations in energy prices, environmental and climate issues, and the necessity of maintaining reliable operations during the heating season. These systems often depend on continuously functioning equipment to meet fundamental heating requirements, while peak demands are addressed with supplementary flexible heat sources. This frequently results in system oversizing, elevating operating expenses and inefficiencies. An effective strategy to mitigate peak demand challenges is heat consumption shifting, which reallocates energy usage more uniformly over the day. Shifting heat demand from peak hours to times of lesser consumption enhances overall system efficiency and diminishes the necessity for extra peak-load capacity. This method can be very advantageous in current district heating networks without necessitating significant infrastructure modifications. A simulation of heat load shifting was performed on the district heating system of the City of Maribor. The research employed altered heat consumption patterns to examine the viability of load shifting and its effects on system performance. The results indicate that optimised energy distribution may augment operational stability, decrease expenses, and boost sustainability.

Keywords: District Heating System, Energy Efficiency, Heating Schedule, Optimization.

Contact information:

Etjan KIRALJ 1, mag. inž. stroj.

Energetika Maribor, Jadranska cesta 28, SI-2000 Maribor, Slovenia
etjan.kiralj@energetika-mb.si

Filip KOKALJ 2, prof. dr., univ. dipl. inž. stroj.
(Corresponding author)
1973
Faculty of Mechanical Engineering, University of Maribor, Smetanova 17, SI-2000 Maribor, Slovenia
filip.kokalj@um.si
https://orcid.org/0000-0001-9234-7834

Air Poluttion – Case Study Podgorica UB

Biljana STAMATOVIĆ[1], Sinisa STAMATOVIĆ[2]

Abstract: In December 2024, the EU defined new rules of air quality standards by cutting allowed limit values. Five years' data about air pollutants, PM2.5, PM10, and SO2, are extracted from the measuring station in Podgorica – Podgorica UB. Analysis of the data is presented. The study used classical statistical analysis and machine learning K-mean and K-medoid methods to classify data and to make conclusions about air quality and air pollutants in Podgorica.

Keywords: Statistics, Data Analysis, K-mean, K-monoid.

Contact information:

Biljana Stamatovic 1, PhD, Full Professor
(Corresponding author)
1968
Faculty of Philosophy, University of Montenegro
biljana.stamatovic@gmail.com
https://orcid.org/0000-0002-3934-9686

Sinisa Stamatovic 2, PhD, Full Professor
1957
University of Montenegro
sstamatovic@ucg.ac.me
https://orcid.org/0000-0002-7013-3154

Digital Transformation of Education: The Impact of Generative AI on Programmer Training

Egor CHEGLOV[1], Andrey PESTUNOV[2], Olga SHVETS[3]

Abstract: With the development of generative artificial intelligence (AI), students are increasingly using it to solve programming tasks. This leads to changes in the educational process and requires revision of traditional teaching methods. The study analysed the patterns of AI usage, its advantages and disadvantages, and identified key differences between code written manually and generated by neural networks. Possible approaches to the integration of AI into the learning system are considered in order to increase the effectiveness and ensure the objectivity of knowledge assessment.

Keywords: Code Generation, Digital Transformation, Generative AI, Knowledge Assessment, Programmer Training, Programming Education, Teaching Methods Integration.

Contact information:

Egor CHEGLOV 1, senior lecturer, Doctoral student
(Corresponding author)

Novosibirsk State University of Economics and Management**,** Kamenskaya st., 52, Novosibirsk, Novosibirsk region, Russian Federation, 630099
e.r.cheglov@edu.nsuem.ru

Andrey PESTUNOV 2, PhD in Physics and Mathematics, Associate Professor

Novosibirsk State University of Economics and Management**,** Kamenskaya st., 52, Novosibirsk, Novosibirsk region, Russian Federation, 630099
a.i.pestunov@nsuem.ru
https://orcid.org/0000-0002-4909-7953

Olga SHVETS 3, PhD in Engineering Science, Associate Professor

Novosibirsk State University of Economics and Management, Kamenskaya st., 52, Novosibirsk, Novosibirsk region, Russian Federation, 630099
o.y.shvec@edu.nsuem.ru
https://orcid.org/0000-0001-5710-9056

Smart City Challenges: Prioritization Methods

Aybeyan SELIM[1], Mimica MILOŠEVIĆ[2], Dušan MILOŠEVIĆ[3]

Abstract: Substantial shifts in our way of life prompt us to consider creating smarter, more sustainable cities. The construction of smart cities has become increasingly popular in both systematic studies and international policies. The research seeks to identify the main barriers to smart cities by reviewing the existing literature and consulting with subject-matter experts. In order to identify the most significant obstacle category and rank certain challenges within the categories to the development of smart cities in Serbia and the surrounding area, this investigation also attempted to prioritize the barriers. The foundation for all planned actions in the administration of the urban environment, including its sectors and infrastructure, is the Fourth Industrial Revolution and digitization. Multi-criteria decision-making (MCDM) has used the following fuzzy logic techniques to identify key indicators that are pertinent preconditions for the creation of a smart city: triangular and trapezoidal fuzzy analytic hierarchy process (FAHP) and triangular and trapezoidal interval type-2 fuzzy sets (IT2FS). The creation of a legislative and strategic framework for the Smart City platform, its implementation in the post-COVID-19 era, and the standardization of ICT and ICT management have been identified as the prominent indicators based on six groups of criteria and a significant number of sub-criteria.

Keywords: Smart City, FAHP, IT2FS, MCDM, Algorithm Ranking.

Contact information:

Aybeyan SELIM 1, PhD, Associate Professor, Dean
(Corresponding author)
1980
Faculty of Engineering and Architecture, International Vision University, 1230 Gostivar, North Macedonia
aybeyan@vision.edu.mk
https://orcid.org/0000-0001-8285-2175

Mimica Milošević 2, PhD, Full Professor
(Corresponding author)
1964
Faculty of Mathematics and Computer Science, Alfa BK University, Palmira Toljatija 3, 11070, Belgrade, Serbia
mimica.milosevic@alfa.edu.rs
https://orcid.org/0000-0002-9524-9663

Dušan MILOŠEVIĆ 3, Full Professor
1963
Faculty of Electronics, University of Niš, Aleksandra Medvedeva 4, 18104 Niš, Serbia
dusan.milosevic@elfak.ni.ac.rs
https://orcid.org/0000-0003-2248

Modern Technologies for Innovative Urban Water Management in Smart Cities

Snežana ĐORIĆ-VELJKOVIĆ[1], Borislava BLAGOJEVIĆ[2], Milan GOCIĆ[3], Emina HADŽIĆ[4]

Abstract: The efficient usage of resources is essential to the development and operation of smart cities, with recent technologies playing a pivotal role. In particular, advanced electronics and digital innovations are transforming energy and water management, integrating clean technologies and promoting sustainability. Smart sensors, IoT networks, and automated systems enable real-time data collection and analysis, allowing for predictive maintenance, timely interventions, and optimized resource allocation. Leading-edge technologies such as AI-powered analytics and machine learning models enhance decision-making processes by providing actionable insights for urban management. Additionally, blockchain technology can ensure secure data exchange, while 5G connectivity facilitates faster communication between devices, improving the overall productivity of urban systems. These advancements are increasingly integrated into the infrastructure of newly developed smart cities built with technology at their fundamental. At the same time, in many cities of Europe the existing infrastructure is retrofitted with smart solutions to improve their operations. This study will examine these achievements and point out two possibilities of their potential application in cities of Serbia, as well as Bosnia and Herzegovina. The goal is to systematize the ways in which modern electronic technologies are involved for sustainable water management, intelligent urban infrastructure, and resilient urban development.

Keywords: Smart Cities, Sensors and Systems, Water Management.

Contact information:

Snežana ĐORIĆ-VELJKOVIĆ 1, PhD, Full Professor
(Corresponding author)
1963
Faculty of Civil Engineering and Architecture, University of Nis, Aleksandra Medvedeva 14, 18000 Nis, Serbia
snezana.djoric.veljkovic@gaf.ni.ac.rs
https://orcid.org/0000-0003-0475-040X

Borislava BLAGOJEVIĆ 2, PhD, Associate Professor
1964
Faculty of Civil Engineering and Architecture, University of Nis, Aleksandra Medvedeva 14, 18000 Nis, Serbia
borislava.blagojevic@gaf.ni.ac.rs
https://orcid.org/0000-0002-5304-5902

Milan GOCIĆ 3, PhD, Full Professor
1977
Faculty of Civil Engineering and Architecture, University of Nis, Aleksandra Medvedeva 14, 18000 Nis, Serbia
milan.gocic@gaf.ni.ac.rs
https://orcid.org/0000-0001-8398-6570

Emina HADŽIĆ 4, PhD, Full Professor
1965
Faculty of Civil Engineering, University of Sarajevo, Višnjik 35 A, 71 000 Sarajevo, Bosnia and Herzegovina
emina_hadzic@gf.unsa.ba
https://orcid.org/0000-0003-0494-8803

Implementation of Smart Solutions in Serbian Cities: Are We Close to Smart Cities?

Ninoslava JANKOVIĆ[1], Nikola MILIĆ[2], Gradimirka POPOVIĆ[3], Srđan MITROVIĆ[4], Đorđe ŠARČEVIĆ[5], Dragan Vučković[6]

Abstract: In this paper, the aim of the research refers to the analysis of the views of the citizens of seven cities in Republic of Serbia on the concept of smart cities. The concept of smart cities is being adopted worldwide, with the exponential growth of smart technologies. In the empirical part of the paper, research was conducted by the author of the paper in connection with the subject of the research. The research instrument used in this paper is a survey that was created online and then distributed to survey students. The sample of respondents consisted of 294 respondents, from whom it was planned to get opinions on the concept of smart cities, to what extent it positively or negatively affects everyday life. The research results indicate the level of respondents' ignorance of the concept of smart cities. Also, there is the uneven implementation of smart solutions in rural and urban areas in Republic of Serbia. The recommendation is to enable the even development of all cities and educate the population about the concept of smart cities, in the sense that there are no significant threats to security and privacy, and that resources such as time and costs are highly, their savings, closely connected with the concept of smart cities.

Keywords: Artificial Intelligence, Republic of Serbia, Smart Cities, Smart Solutions, Survey.

Contact information:

Ninoslava JANKOVIĆ 1,
(Corresponding author)

Singidunum University, Danijelova 32, 11000 Belgrade, Serbia
ninoslava.jankovic.18@singimail.rs

Nikola MILIĆ 2,

Soda So Company, 11000 Belgrade, Serbia
nikola.milic.98@outlook.com

Gradimirka POPOVIĆ 3, Lecturer in Vocational Studies
1975
Kosovo and Metohija Academy of Applied Studies, 38218 Leposavic, Serbia
gradimirka.popovic@akademijakm.edu.rs
https://orcid.org/0009-0007-9045-6739

Srđan MITROVIĆ 4,

Singidunum University, Danijelova 32, 11000 Belgrade, Serbia
srdjan.mitrovic.22@singimail.rs

Đorđe ŠARČEVIĆ 5, Teaching Assistant
1988
Academy of Vocational Studies Šabac, Dobropoljska 5, 15000 Šabac, Serbia
sarcevicdjordje@gmail.com
https://orcid.org/0000-0003-0746-744X

Dragan VUČKOVIĆ 6, PhD, Assistant Professor
1974
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
dragan.vuckovic@alfa.edu.rs
https://orcid.org/0009-0001-8699-9374

Project Management in Smart City Development: Challenges and Best Practices

Miloš ILIĆ[1], Vladimir MIKIĆ[2]

Abstract: Successful project management represents the basis of effective smart city development, demanding a systematic approach that integrates technology, infrastructure, and urban requirements. However, the proper management of smart city projects encounters different challenges, such as managing budgets, coordinating employees, defining deadlines, and ensuring stakeholder collaboration. Effective project management is essential for overcoming these difficulties and ensuring successful project completion. That is why this study will focus on project management as a means for effective smart city development, and it will also explore challenges and best practices in that context. The goal is to provide a thorough framework for project managers, offering insights into balancing innovation with practical execution in the context of smart city development.

Keywords: Best Practices, Challenges, Development, Project Management, Smart City.

Contact information:

Miloš ILIĆ 1, MSc, Teaching Assistant
(Corresponding author)
1991
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
milos.ilic@alfa.edu.rs
https://orcid.org/0000-0003-1190-1181

Vladimir MIKIĆ 2, MSc, Teaching Assistant
1996
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
vladimir.mikic@alfa.edu.rs
https://orcid.org/0000-0003-3971-8725

Municipal Solid Waste Grate Furnace Complete Combustion Conditions Optimisation

Filip KOKALJ[1], Niko SAMEC[2]

Abstract: The waste incineration process is complex and optimizing it requires a detailed understanding of various phenomena. It is influenced by numerous input parameters, such as waste properties, air-inlet velocity, and seasonal factors, as well as output parameters like temperature and mass flow of combustible products. Managing the variability and interdependence of these factors can be challenging during the plant-design phase, especially in achieving optimal combustion with minimal pollutant emissions. A waste incinerator with a grate furnace was investigated using computational fluid dynamics with ANSYS CFX. This approach utilized variable input boundary conditions and appropriate turbulence, combustion, radiation, and heat transfer models. Optimization was achieved through a trade-off study, and 3D predictions were made for parameters like residence time, temperature fields, velocity, ash particle tracking, and nitric oxide formation. The aim was to identify the input parameters that lead to optimal operating conditions. The results were presented in response charts and correlation matrices, providing insights into the critical operating regimes and how to avoid them. The computational fluid dynamics approach enables numerical optimization of operating conditions early in the project phase, leading to faster product development, improved reliability, reduced research costs, and a competitive edge in the industry.

Keywords: Municipal Solid Waste, Incineration Modelling, Computational Fluid Dynamics, Ash Particle Tracking, Combustion Operation Conditions, Combustion Chamber Optimization.

Contact information:

Filip KOKALJ 1, prof. dr., univ. dipl. inž. stroj.
(Corresponding author)
1973
Faculty of Mechanical Engineering, University of Maribor, Smetanova 17, SI-2000 Maribor, Slovenia
filip.kokalj@um.si
https://orcid.org/0000-0001-9234-7834

Niko SAMEC 2, prof. dr., univ. dipl. inž. stroj.

Faculty of Mechanical Engineering, University of Maribor, Smetanova 17, SI-2000 Maribor, Slovenia
niko.samec@um.si
https://orcid.org/0000-0001-8500-5393

Implementation of Artificial Intelligence and Machine Learning in Smart Water Projects in the Balkans

Mitar Miki TEPIĆ[1], Stefan POPOVIĆ[2]

Abstract: Smart cities represent a key concept in modern urban planning, where smart water resource management plays a central role. This paper analyzes current Smart Water projects in Serbia, Bosnia and Herzegovina, Croatia, and Montenegro, with a special focus on the implementation of artificial intelligence (AI) and machine learning (ML). The emphasis is placed on practical examples such as water consumption prediction, leakage detection, and water quality monitoring. Through an analysis of projects like the Green AI initiative, the SMART-Water system, and innovations by the Kolektor Sisteh company, the paper examines the technologies and algorithms utilized. The main findings demonstrate the significant efficiency of AI/ML models in improving the sustainability of water resources and optimizing costs. However, challenges such as technical implementation and the lack of local expertise remain open issues. In conclusion, the paper provides a comprehensive overview of the current state and proposes future steps toward advancing AI/ML technologies within Smart Water projects in the Balkans.

Keywords: Smart Water, Artificial Intelligence (AI), Machine Learning (ML), Water Management, Sustainability, Balkans.

Contact information:

Mitar Miki TEPIĆ 1, Lecturer
(Corresponding author)
1988
JU SŠC "Mihajlo Pupin", 74400 Derventa, Bosnia and Herzegovina
mitarmikitepić@gmail.com
https://orcid.org/0009-0004-3567-095X

Stefan POPOVIĆ 2, Lecturer
1983
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
stefan.popovic@alfa.edu.rs
https://orcid.org/0000-0002-5288-4560

Cybersecurity Aspects of Critical Infrastructure in Scenario of Smart City

Duško LAKOVIĆ

Abstract: People organize their lives and work in a space for which it is important to have adequate infrastructure. Critical infrastructure is the most important part of the infrastructure that has a great impact on the security of the state, its economy and society as a whole. These are interconnected systems, which are part of a larger system, where their functioning relies heavily on the ability of another subsystem to provide the necessary service. The cyber security of such systems is particularly important because such vulnerabilities are singled out and can cause a chain effect that extends from the subsystem to the state. With the development of sensor technologies, the Internet of Things, cloud computing, big data, and artificial intelligence, a range of solutions can benefit business operations. Critical infrastructure companies are not immune to global changes, embodied in the vision of smart cities, which should bring improvement to humanity. On the other hand, introducing "things" into critical infrastructure opens up a whole set of problems that were previously unknown. This paper deals with those aspects.

Keywords: Cybersecurity, Critical Infrastructure, Smart City.

Contact information:

Duško LAKOVIĆ, PhD, assistant professor
(Corresponding author)
1973
Ministry of the Interior of the Republic of Serbia, Bulevar Mihajla Pupina 2, Belgrade, Serbia
duskolakovic1@gmail.com
https://orcid.org/ 0000-0001-9984-9669

Global Location Coding (Universal Geographical Indicator System)

Dejan DJUKIC[1], Stefan POPOVIC[2], Snezana OCOKOLJIC[3]

Abstract: In today's globalised society, where more and more of the goods and services are being routed automatically, there is a growing necessity to use a global location coding system. The longitude and the latitude are global indicators of dimensionless points on the sphere, but, in reality, most locations of practical interest could be considered as areas covering a definite surface. It may be argued that a point within that surface may be used as a location indicator, but this indicator is not unique. The other issue with the geographical coordinates is that to the coordinate of any particular point of interest a tolerance interval need be included. Thus, location indication through area codes is natural and more useful. In this work, the authors propose a global system for indicating geographic areas through limited sequences of decimal digits. Each such sequence of a certain length indicate in a unique manner a definite geographic area. Sequences of increasing lengths indicate the smaller areas, i.e. with a narrower tolerance. This method for location coding is achieved by dividing recursively the surface of the Earth in sections, and then recursively into smaller and smaller subsections, with each new division encoded by a single digit. E.g. a twelve digit sequence indicates an area of about 50 m in diameter. Using such global coding system for geographic locations may substantially simplify the delivery of goods and services, direct and focus a remedial effort in emergencies, or be used advantageously for planning and improvement of city management.

Keywords: Location Coding, Geographic Information System, Smart City Area Numbers.

Contact information:

Dejan DJUKIC 1, PhD, Assistant Professor
(Corresponding author)
1965
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
dejan.djukic@alfa.edu.rs
https://orcid.org/0000-0001-7581-148X

Stefan POPOVIC 2, MSc, Lecturer
1983
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
stefan.popovic@alfa.edu.rs
https://orcid.org/0000-0002-5288-4560

Snezana OCOKOLJIC 3, MSc, Lecturer
1974
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
snezana.ocokoljic@alfa.edu.rs
http://orcid.org/0009-0003-4040-8078

Robotization and Artificial Intelligence in the Function of Industry 4.0

Nebojša DENIĆ[1], Milan GLIGORIJEVIĆ[2], Saša MIHALJOVIĆ[3], Jelena STOJANOVIĆ[4], Kostadinka STOJANOVIĆ[5]

Abstract: This research paper will present how advances in robotics and artificial intelligence affect economic and social transformation. Based on the review of the latest literature and research conducted in practice, the relationship between artificial intelligence (AI) and robots will be evolved due to rapid technological development and the increasing application of methods, techniques and tools of artificial intelligence in various spheres of life and work. Starting with a clear definition and tracing the evolution of artificial intelligence in robotics, the paper will highlight its role, importance and application in various fields. Studies show that artificial intelligence and robotics offer great opportunities for improving life and work, improving efficiency and precision, reducing costs, errors, etc. In this context, this research study presents a critical assessment of the application of the phenomenon of artificial intelligence and robots, based on successive studies of relevant literature, evaluating artificial intelligence and robots, their development, characteristic forms and application in everyday life. Due to their capabilities, robots with elements of artificial intelligence have successfully replaced humans in performing many difficult and physically demanding and dangerous jobs, as well as in mentally simple and repetitive activities, which certainly justifies their humane application. Practice indicates that the process of implementing artificial intelligence and robots requires an adequate ICT infrastructure, followed by specialized training of key users, as well as compliance with all ethical rules of use. Research results indicate that robotics and artificial intelligence have become key players in the transformation of the world, opening the door to new ways of working and optimizing existing business processes. In this sense, the application of artificial intelligence and robots opens the door to new technological innovations and potential opportunities for the improvement of the product and service sectors. Considering the topicality of the topic, there are still insufficient studies dealing with the application of artificial intelligence (AI) in robotics by researching the integration, progress and implications of intelligent robotic systems based on artificial intelligence. Practice shows that in addition to all the benefits, one should be extremely careful and not ignore the criticism of experts in this field about the exponential development of robotics and artificial intelligence and the present fear that robots will one day become a threat to human society.

Keywords: Digitization, Industry 4.0, Robots, Artificial Intelligence.

Contact information:

Nebojša DENIĆ 1, PhD, Associate Professor
(Corresponding author)
1965
Faculty of Sciences and Mathematics, University of Priština, Kosovska Mitrovica, Serbia, 38232 Lipljan
nebojsa.denic@pr.ac.rs
https://orcid.org/0000-0003-2584-259X

Milan GLIGORIJEVIĆ 2, PhD, Associate Professor
1966
Faculty of information technologies, Alfa BK University, 11000 Belgrade, Serbia
milan.gligorijević@alfa.edu.rs
https://orcid.org/0000-0003-1653-7091

Saša MIHAJLOVIĆ 3, Student
1982
Faculty of Mathematics and Computer Sciences, Alfa BK University, 11000 Belgrade, Serbia
sasamihajlovic56@gmail.com
https://orcid.org/0009-0002-0146-4459

Jelena STOJANOVIĆ 4, PhD, Asistent profesor
1991
Faculty of Mathematics and Computer Sciences, Alfa BK University, 11000 Belgrade, Serbia
jelena.stojanovic@alfa.edu.rs
https://orcid.org/0009-0004-6729-2746

Kostadinka STOJANOVIĆ 5, Student
1997
Faculty of Mathematics and Computer Sciences, Alfa BK University, 11000 Belgrade, Serbia
kostadinka.stojanovic@alfa.edu.rs
https://orcid.org/0009-0008-5796-312X

ALFA BK UNIVERSITY
FACULTY OF INFORMATION TECHNOLOGIES
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
ALFATECH
Book of Abstracts

Computer Network Security and Intrusion Detection

Filip PETRIČKOVIĆ

Abstract: Computer network security has become a critical field of study due to the increasing number of cyber-attacks that target data integrity, confidentiality, and availability. This paper explores the state-of-the-art techniques for intrusion detection in computer networks, focusing on the application of artificial intelligence and machine learning algorithms. We discuss various methods for identifying suspicious activities, detecting anomalies, and preventing unauthorized access. Furthermore, the paper highlights the challenges faced by traditional intrusion detection systems (IDS) and proposes novel approaches to enhance the effectiveness of current security measures.

Keywords: Computer Networks, Protection, Intrusion Detection, Artificial Intelligence, Security, Unwanted and Unauthorized Access.

Contact information:

Filip PETRIČKOVIĆ, Student
(Corresponding author)
1994
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
filip.petrickovic@gmail.com
orcid

Electric Cars and Their Integration into Modern Power Networks

Miloš JOVANIĆ[1], Violeta DIMIĆ[2]

Abstract: Electric vehicles are becoming more widespread in modern times; however, with this green technology comes a new challenge of supporting charging requirements and integrating said requirements into our current power networks. In this paper, we will explore the modern technologies and concepts that are being considered for the enhancement of various power networks around the world, as well as the challenges of integrating a growing number of electric vehicles into the networks. We will also review the immense rise of electric vehicle sales in modern times to showcase why a seamless integration into the power networks is required and how big the industry has become. We will also highlight various guidelines being put in place by the three main markets to ease this complex process.

Keywords: Electric cars, Power networks, Challenges, Integration.

Contact information:

Miloš JOVANIĆ 1, Student of Second Degree Master's Studies
(Corresponding author)
2000
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
mima2k@gmail.com
https://orcid.org/0009-0006-3767-9805

Violeta DIMIĆ 2, PhD, Associate Professor
1964
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
violeta.dimic@alfa.edu.rs
https://orcid.org/0000-0002-0157-436X

Optimization of AI Methods for Air Pollution Prediction

Goran KEKOVIĆ[1], Rade BOŽOVIĆ[1]

Abstract: One of the biggest problems of large urban areas is air pollution, and in this regard, artificial intelligence (AI) methods can predict the level of pollution using a wide range of parameters. The use of artificial neural networks (ANN) based on Levenberg-Marquardt algorithm with Bayesian regularization (LMBR) is considered in this paper. It is shown that this algorithm achieves very high prediction accuracy, competitive with radial basis neural networks, which are commonly used for regression tasks. It is also shown that by choosing the optimal sample size, in addition to tuned ANN parameters, a balance can be achieved between the desired accuracy of the method and the deviation between simulated and real data. Relative error was used as a measure of that deviation. At the same time, it has been shown that sample size is not always a decisive factor affecting the efficiency of the AI method itself, but that a complete picture can be obtained by taking into account the entire structure of the input data.

Keywords: Air Pollution, Artificial Neural Networks, Bayesian Regularization, Levenberg - Marquardt algorithm.

Contact information:

Goran KEKOVIĆ 1, PhD, Assistant Professor
(Corresponding author)
1967
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
goran.kekovic@alfa.edu.rs
https://orcid.org/0000-0003-1429-0582

Rade BOŽOVIĆ 2, PhD, Assistant Professor
1983
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
rade.bozovic@alfa.edu.rs
https://orcid.org/0000-0002-8580-714X

The Role of Artificial Intelligence in Cyber Security

Ana Urošević

Abstract: Artificial intelligence is becoming an indispensable tool in modern cyber security, enabling advanced threat detection and prevention techniques. This paper explores how artificial intelligence, through machine learning methods, deep neural networks and anomaly detection algorithms, contributes to the protection of network systems. In addition to attack analysis, technologies that enable automatic recognition and response to cyber threats in real-time are also considered. Also, challenges in implementing artificial intelligence in this context are discussed, as well as potential directions of future development, including integration with new technologies and improvement of systems for better protection of data and infrastructure.

Keywords: Artificial Intelligence, Cyber Security, Anomaly Detection, Attack Prevention, Machine Learning.

Contact information:

Ana UROŠEVIĆ, Student
(Corresponding author)
2002
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
anaurosevic12@gmail.com
https://orcid.org/0009-0001-1972-8558

ALFA BK UNIVERSITY
FACULTY OF INFORMATION TECHNOLOGIES
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
ALFATECH
Book of Abstracts

Security of IoT (Internet of Things) Devices

Saša CVETKOVIĆ

Abstract: This paper provides a comprehensive analysis of the key challenges, opportunities, and security issues related to the Internet of Things (IoT). The research highlights critical vulnerabilities in IoT systems, their practical implications, and potential mitigation strategies. By examining relevant case studies and literature, the paper offers a detailed perspective on the current IoT ecosystem, identifying both its potential and weaknesses. The importance of securing IoT devices and networks to ensure the safety and functionality of connected environments is strongly emphasized.

Keywords: Internet of Things, Security, Encryption, Access Control.

Contact information:

Saša CVETKOVIĆ, Student
(Corresponding author)
1991
Faculty of Mathematics and Computer Science, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
sasa_le@hotmail.com
https://orcid.org/0009-0009-9436-0253

Implications of the Application of Artificial Intelligence and Industry 4.0 on Society

Nebojša DENIĆ[1], Ivana Bulut BOGDANOVIĆ[2], Kostadinka STOJANOVIĆ[3], Saša MIHALJOVIĆ[4], Jelena STOJANOVIĆ[5]

Abstract: In this research paper, based on a systematic research of recent relevant literature, the possibilities of developing artificial intelligence and industry 4.0 will be presented with the aim of improving business processes and life and love in the continent. Companies and business systems are increasingly using advanced technological solutions to improve their operations. In the paper, the evolved problems accompanying the development of the artificial intelligence implementation process will be identified and the key success factors of the implementation process will be identified. The paper will examine in detail the possibility and feasibility of integrating artificial intelligence within the framework of Industry 4.0. Artificial intelligence undoubtedly brings numerous advantages and simplification of the operations of companies and organizations. The technological revolution, digital transformation and innovations have led to significant changes in all spheres of human activity, in this sense, the definition and determination of artificial intelligence plays a key role in achieving a balance between technological innovations and the protection of social norms and standards. The work will define the nature of cooperation and engagement of experts from different authorities for the optimal implementation of the integration of artificial intelligence within the framework of Industry 4.0. However, researches in practice indicate numerous problems and prejudices and the necessity of defining the security and risks involved in the implementation projects of artificial intelligence and Industry 4.0, to which experts dealing with the management of implementation and implementation projects must pay particular attention to the use of a reliable and responsible artificial intelligence system.

Keywords: Digitization, Digital transformation, Artificial intelligence.

Contact information:

Nebojša DENIĆ 1, Associate Professor
(Corresponding author)
1965
Faculty of Sciences and Mathematics, University of Priština, Kosovska Mitrovica, Serbia, 38232 Lipljan
nebojsa.denic@pr.ac.rs
https://orcid.org/0000-0003-2584-259X

Ivana BULUT BOGDANOVIĆ 2, Associate Professor
1983
Faculty of Social Sciences Belgrade, 11000 Belgrade, Serbia
ivana.bulut@fdn.edu.rs
https://orcid.org/0000-0003-0402-8839

Kostadinka STOJANOVIĆ 3, Student
1997
Faculty of Mathematics and Computer Sciences, Alfa BK University, 11000 Belgrade, Serbia
kostadinka.stojanovic@alfa.edu.rs
https://orcid.org/0009-0008-5796-312X

Saša MIHAJLOVIĆ 4, Student
1982
Faculty of Mathematics and Computer Sciences, Alfa BK University, 11000 Belgrade, Serbia
sasamihajlovic56@gmail.com
https://orcid.org/0009-0002-0146-4459

Jelena STOJANOVIĆ 5, Asistent profesor
1991
Faculty of Mathematics and Computer Sciences, Alfa BK University, 11000 Belgrade, Serbia
jelena.stojanovic@alfa.edu.rs
https://orcid.org/0009-0004-6729-2746

Malware Attacks on Public Data of Smart Cities

Čaba VARŠANDAN[1], Milica VARŠANDAN[2]

Abstract: Public data in smart cities is frequently targeted by malware. Protecting such data represents a serious threat, as basic security services, individuals, and the functionality of the system itself are at risk. Malware attacks are a growing threat due to the complex technologies used. Open data is utilized to improve the management of urban systems and increase efficiency. With the help of advanced technologies such as artificial intelligence, encryption, blockchain, and security measures, smart cities can enhance system protection and reduce the risk of attacks. This paper analyzes public data in smart cities, the types of attacks on public data, and how malware attacks affect it.

Keywords: Malicious Software, Open/Public Data, Attacks, Smart Cities.

Contact information:

Čaba VARŠANDAN 1, Quality Assurance Engineer
(Corresponding author)
1987
HTEC Group, Bulevar Milutina Milankovića 7Đ, 11070 Belgrade, Serbia
varsandancaba@gmail.com
https://orcid.org/0009-0009-4321-9276

Milica VARŠANDAN 2, MSc, Teaching Assistant
1983
Dr Lazar Vrkatic Faculty of Law and Business Studies, Bulevar oslobođenja 76, 21102 Novi Sad, Serbia
milicamarjanovic89@gmail.com
https://orcid.org/0009-0002-6500-2464

Project-Based Learning in Smart House Development: Artificial Intelligence and IoT Technologies for Efficient Living

Olga DUKIĆ[1], Milan VESKOVIĆ[2], Olga RISTIĆ[3]

Abstract: This paper examines the application of project-based learning in the development of smart houses, emphasizing the integration of artificial intelligence (AI) and Internet of Things (IoT) technologies to enhance efficiency and comfort in daily life. Through project-based activities, students acquired technical skills such as programming, working with sensors, and implementing machine learning algorithms, alongside soft skills like teamwork and problem-solving. The evaluation of the results revealed significant improvements in students' understanding of STEM (science, technology, engineering, and mathematics) concepts, as well as increased motivation and engagement throughout all stages of the project. The use of the Multi-Role Project (MRP) model facilitated the combination of practical engineering tasks with reflective learning processes. The findings indicate that such projects not only enhance students' competencies in STEM fields but also prepare them to contribute to the advancement of smart cities and sustainable technologies.

Keywords: Project-Based Learning, Smart House, Artificial Intelligence, IoT; STEM Education, Sustainable Development, Smart Cities.

Contact information:

Olga DUKIĆ 1, PhD student of Faculty of Technical Sciences Čačak
(Corresponding author)
1976
Faculty of Technical Sciences Čačak, University of Kragujevac, Svetog Save 65, 32000 Čačak, Serbia
olgadukic@tehnickacacak.edu.rs
https://orcid.org/0009-0004-1694-9592

Milan VESKOVIĆ 2, Assistant Professor
1969
Faculty of Technical Sciences Čačak, University of Kragujevac, Svetog Save 65, 32000 Čačak, Serbia
milan.veskovic@ftn.kg.ac.rs
https://orcid.org/0000-0002-7668-4387

Olga RISTIĆ 3, Associate Professor
1974
Faculty of Technical Sciences Čačak, University of Kragujevac, Svetog Save 65, 32000 Čačak, Serbia
olga.ristic@ftn.kg.ac.rs
https://orcid.org/0000-0002-1723-0940

The Influence of Knowledge Management on Students' Future Employment Determination

Ana-Marija VUKIĆ[1], Dragana SAJFERT[2], Ana BAŠIĆ[3]

Abstract: The aim of this research was to examine the impact of knowledge management on students' future job choices. A questionnaire consisting of 11 questions was used as an instrument. A google table was created for statistical data processing, which was filled with data from the survey completed by students and provided the basis of the questionnaire for further statistical data processing. 80 students responded to the questionnaire, of which 65 filled out valid questionnaires. The results of the research were as follows: 32.3% of the students responded that they wanted to work in a foreign company. When asked what they expect from work, 50.8% of students said a high salary. When asked what is most important for motivation in your future work, the answers are: good working atmosphere 32.8%. This study examined the relationship between four components: vocation choice, job expectations, personal development, motivation for future work - academic satisfaction.

Keywords: Job Expectations, Knowledge Management, Motivation for Future Work, Personal Development, Vocation Choice.

Contact information:

Ana-Marija VUKIĆ 1, MSc, Student
2001
Technical faculty "Mihajlo Pupin", University of Novi Sad, Djure Djakovica bb, 23000 Zrenjanin, Serbia
anamvukic@gmail.com
https://orcid.org/0009-0006-8515-6419

Dragana SAJFERT 2, PhD, Senior Lecturer
(Corresponding author)
1977
ITS, Information Technology School, Cara Dušana 34, 11080 Zemun, Serbia
dragana.sajfert@its.edu.rs
https://orcid.org/0009-0005-4714-4495

Ana BAŠIĆ 3, PhD, Senior Lecturer
1981
ITS, Information Technology School, Cara Dušana 34, 11080 Zemun, Serbia
ana.basic@its.edu.rs
https://orcid.org/0009-0009-4137-3296

Testing IoT Devices and Systems in Smart Cities: Challenges and Solutions

Nikola MILOVIĆ[1], Dejan VIDUKA[2]

Abstract: Smart cities rely on complex IoT systems to enhance urban services, yet testing these large-scale, heterogeneous, and security-critical deployments poses unique challenges. This paper identifies key issues—scalability, interoperability, security, and resource constraints—and reviews state-of-the-art solutions, including simulation frameworks, standardization efforts, automated testing, and AI-driven approaches, providing actionable insights for robust, reliable IoT testing in smart cities.

Keywords: Interoperability, IoT Testing, Scalability, Security, Smart Cities.

Contact information:

Nikola MILOVIĆ 1, BCS
2001
Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
nikolamilovic2001@gmail.com
https://orcid.org/0009-0006-3581-6511

Dejan VIDUKA 2, PhD, Full Professor
(Corresponding author)
1980
Faculty of Mathematics and Computer Science, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
dejan.viduka@alfa.edu.rs
https://orcid.org/0000-0001-9147-8103

A Computationally Implemented Method for Assessing Air Pollution in Urban Traffic Based on Traffic Density Analysis

Stefan ĆIRKOVIĆ[1], Nikola STANIĆ[2], Katarina KARIĆ[3]

Abstract: Monitoring and assessing air pollution levels in urban areas represents a key challenge in environmental protection and traffic management. This paper proposes a computationally implemented method for indirect air pollution assessment based on traffic density analysis, eliminating the need for direct sensor-based measurements of pollutant concentrations. The proposed system employs computer vision for real-time vehicle detection and classification, while air pollution levels are estimated using a mathematical model that accounts for the average emission rates per vehicle. The system architecture includes an embedded computer (Raspberry Pi) for video data processing, network infrastructure connectivity, and data transmission to a central server for further analysis and visualization. Experimental results confirm that the proposed approach enables reliable and efficient air pollution assessment under real-world conditions, opening avenues for enhancing environmental monitoring strategies and optimizing traffic flow in urban environments.

Keywords: Air Pollution Assessment, Traffic Analysis, IoT, Computer Vision, Mathematical Modeling, Urban Ecosystems.

Contact information:

Stefan ĆIRKOVIĆ 1, Teaching Associate
(Corresponding author)
1999
Faculty of Technical Sciences Čačak, University of Kragujevac, Svetog Save 65, 32000 Čačak, Serbia
stefan.cirkovic@ftn.kg.ac.rs
https://orcid.org/0009-0004-6775-1543

Nikola STANIĆ 2, Teaching Assistant
1998
Faculty of Technical Sciences Čačak, University of Kragujevac, Svetog Save 65, 32000 Čačak, Serbia
nikola.stanic@ftn.kg.ac.rs
https://orcid.org/0000-0002-8306-0273

Katarina KARIĆ 3, Teaching Assistant
1996
Faculty of Technical Sciences Čačak, University of Kragujevac, Svetog Save 65, 32000 Čačak, Serbia
katarina.karic@ftn.kg.ac.rs
https://orcid.org/0000-0002-0309-3404

Performing EDA Techniques for Time Series Forecasting in Smart Cities

Ninoslava TIHI[1], Miloš TODOROV[2], Marko PAVLOVIĆ[3]

Abstract: In the age of smart cities, where interconnected technologies produce substantial data, time series forecasting has become a crucial instrument for efficient urban management. Exploratory Data Analysis (EDA) is an essential initial phase in comprehending and organising data for precise and insightful predictions. This study examines the utilisation of exploratory data analysis approaches for time series data in the framework of smart cities. It emphasises techniques for detecting trends, seasonality, autocorrelations, and correlations in data streams from sources like environmental monitoring systems. The research investigates ways to identify patterns, test hypotheses, and confirm assumptions using visual and quantitative methods. Employing diverse visualisation tools, statistical summaries, and decomposition techniques enhances the comprehension and preprocessing of time series datasets. The objective of the research is to perform and evaluate the efficacy of standard tools such as time plots, autocorrelation and correlation analysis, seasonality decomposition, and identifying trend patterns in conjunction with sophisticated techniques such as seasonal decomposition of time series (STL), correlation heatmaps, and trend detection techniques. The findings emphasise EDA's significance as a fundamental step in empowering researchers and practitioners to make informed decisions, ensuring strong analytical results, and developing resilient time-series forecasting models for contemporary urban issues.

Keywords: EDA Techniques, Environmental Data, Preprocessing Time Series, Smart Cities, Time Series Forecasting.

Contact information:

Ninoslava TIHI 1, MSc, Lecturer
(Corresponding author)
1979
The Higher Education Technical School of Professional Studies in Novi Sad, 21000 Novi Sad, Serbia
tihi@vtsns.edu.rs
https://orcid.org/0009-0004-8009-8120

Miloš TODOROV 2, PhD, Assistant Professor
1982
Faculty of Mathematics and Computer Science, Alfa BK University, 11000 Belgrade, Serbia
milos.todorov@alfa.edu.rs
https://orcid.org/0000-0002-5614-3057

Marko PAVLOVIĆ 3, Student
2004
Faculty of Business and Law, MB University, 11000 Belgrade, Serbia
markuspavlovic98@gmail.com
https://orcid.org/0009-0009-5526-1244

Application of Blockchain Technologies as a Function of Progress

Nebojša DENIĆ[1], Jelena STOJANOVIĆ[2], Kostadinka STOJANOVIĆ [3], Ivana BULUT BOGDANOVIĆ[4], Saša MIHALJOVIĆ[5]

Abstract: In this paper, based on a studious, comprehensive review of the latest literature, the possibilities of applying blockchain technologies from the perspective of entrepreneurship, tourism, production, supply chain, media companies, and environmental protection and sustainable development are explored. In this context, the impact of blockchain technology on business, the evolved advantages and disadvantages of application, safety and security issues, future application trends and presented examples of good practice will be explored. It will be shown how the technology works, what changes it brings to the existing data storage infrastructure, and at the same time shed light on the possibilities of using the technology in other areas. In the theoretical consideration, the most promising sectors for the use of blockchain technology will be identified from the aspect of optimizing existing business processes. The latest research indicates that the widespread application of blockchain technologies will cause many changes in electronic business. Blockchain allows banks to simplify and automate many processes, further reducing operating costs. The results of research in practice indicate that the key disadvantage of Blockchain technology is that it is not 'green' enough, because the operation of the computers that generate the codes that make up the Blockchain requires a large amount of electricity. Research also indicates that currently the possibilities of using blockchain technology are unlimited, which will certainly initiate a technological revolution in many areas of business, because its time is yet to come.

Keywords: Digitization, Electronic Business, Blockchain Technology.

Contact information:

Nebojša DENIĆ 1, Associate Professor
(Corresponding author)
1965
Faculty of Sciences and Mathematics, University of Priština, Kosovska Mitrovica, Serbia, 38232 Lipljan
nebojsa.denic@pr.ac.rs
https://orcid.org/0000-0003-2584-259X

Jelena STOJANOVIĆ 2, Asistent profesor
1991
Faculty of Mathematics and Computer Sciences, Alfa BK University, 11000 Belgrade, Serbia
jelena.stojanovic@alfa.edu.rs
https://orcid.org/0009-0004-6729-2746

Kostadinka STOJANOVIĆ 3, Student
1997
Faculty of Mathematics and Computer Sciences, Alfa BK University, 11000 Belgrade, Serbia
kostadinka.stojanovic@alfa.edu.rs
https://orcid.org/0009-0008-5796-312X

Ivana BULUT BOGDANOVIĆ 4, Associate Professor
1983
Faculty of Social Sciences Belgrade, 11000 Belgrade, Serbia
ivana.bulut@fdn.edu.rs
https://orcid.org/0000-0003-0402-8839

Saša MIHAJLOVIĆ 5, Student
1982
Faculty of Mathematics and Computer Sciences, Alfa BK University, 11000 Belgrade, Serbia
sasamihajlovic56@gmail.com
https://orcid.org/0009-0002-0146-4459

Synergy of Smart Technologies: IoT as the Foundation for the Evolution of Smart Cities

Miloš ILIĆ

Abstract: The evolution of urban environments into smart cities depends on the integration of advanced technologies that aim to improve many aspects. Among these aspects are better quality of life, resource optimization, sustainability, efficient public administration, smart education, etc. The Internet of Things (IoT) plays a crucial role in this transformation by enabling seamless communication between a wide range of devices and systems. IoT can not only automate and optimize many important processes for smart cities, but it can also simplify them. IoT helps manage urban infrastructure more effectively, including energy, transportation, public safety, and many more, by facilitating real-time data collection. As cities face new challenges, IoT has the potential to reshape urban living, making cities more responsive and adaptable, which can be of great importance to residents. Nonetheless, the widespread adoption of IoT raises concerns over data security, privacy, and the necessity of a reliable infrastructure. This paper explores the role of IoT in the evolution of smart cities, examining both its opportunities and challenges and how it is driving innovation in urban development. In spite of many issues and complexities, IoT is still defining the future of cities by creating sustainable environments and making them smarter and more connected.

Keywords: Smart Cities, Internet of Things (IoT), Urban Sustainability, Technology Integration, Data Security.

Contact information:

Miloš ILIĆ, Teaching Assistant
(Corresponding author)
1991
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
milos.ilic@alfa.edu.rs
https://orcid.org/0000-0003-1190-1181

Authentication and Access Control

Nevena KRSTIĆ

Abstract: This study examines the fundamental concepts and importance of access control and authentication in relation to computer system security. The study looks at important authentication methods such one-time passwords, biometric data, and multi-factor authentication in addition to modern access control schemes like role-based access control (RBAC) and attribute-based access control (ABAC). Additionally, it examines how federated authentication, single sign-on (SSO), protocols like OAuth and SAML, and other cutting-edge technology can be combined with access management and authentication in contemporary artificial intelligence systems.

Keywords: Access Control, Authentication, MFA, Data Security, OAuth, SAML, RBAC, ABAC.

Contact information:

Nevena KRSTIĆ, Student
(Corresponding author)
1999
Faculty of Mathematics and Computer Science, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
nevena.krstic@gmail.com
https://orcid.org/0009-0008-5044-6314

The Role of Artificial Intelligence in Malware Detection in Smart Cities

Milica VARŠANDAN[1], Čaba VARŠANDAN[2]

Abstract: Smart cities have a complex structure and generate a large amount of data. This is precisely why the presence of artificial intelligence is necessary to effectively detect and neutralize any malware. Artificial intelligence allows not only for the detection of attacks, but also the improvement of the entire smart city protection system. Combining available protection solutions with constant improvements and reacting at the right time are of utmost importance. This paper will present the functioning of smart cities and discuss how artificial intelligence helps detect malware with the help of advanced technologies and methods that provide fast, accurate and simple detection. Artificial intelligence utilizes large number of algorithms and methods to monitor and analyze system behavior. In addition to identifying threats, it can adapt to new forms of malicious software. There are certain challenges in implementing artificial intelligence for detecting malicious software, as well as strategies for improving protection.

Keywords: Artificial Intelligence, Malware, Detection, Smart Cities.

Contact information:

Milica VARŠANDAN 1, MSc, Teaching Assistant
(Corresponding author)
1983
Dr Lazar Vrkatic Faculty of Law and Business Studies, Bulevar oslobođenja 76, 21102 Novi Sad, Serbia
milicamarjanovic89@gmail.com
https://orcid.org/0009-0002-6500-2464

Čaba VARŠANDAN 2, Quality Assurance Engineer
1987
HTEC Group, Bulevar Milutina Milankovića 7Đ, 11070 Belgrade, Serbia
varsandancaba@gmail.com
https://orcid.org/0009-0009-4321-9276

Smart Home Data Preprocessing Using Python

Ana ĐOKIĆ[1], Hana STEFANOVIĆ[2], Dragana DUDIĆ[3]

Abstract: Smart home systems generate large volumes of data from various sensors, such as temperature, humidity, motion, and energy consumption. Effective preprocessing is essential to enhance data quality, reduce noise, and enable accurate analysis. This paper examines Python-based data preprocessing techniques for smart home environments. The preprocessing workflow includes data cleaning, handling missing values, normalization, feature selection, and data transformation. Data cleaning addresses duplicate records, outliers, and inconsistencies, while missing values are imputed using statistical and machine learning approaches. Normalization techniques standardize sensor readings to ensure consistency across data points. Feature engineering and dimensionality reduction refine the dataset for improved predictive modeling. By enhancing data quality, preprocessing contributes to smarter home automation, efficient anomaly detection, and optimized energy management. This study underscores the critical role of preprocessing in smart home analytics, facilitating reliable and meaningful insights for decision-making. The proposed techniques enhance the integration of smart home data into machine learning models, driving advancements in intelligent home automation systems.

Keywords: Data Preprocessing, Python Programming Language, Smart Homes.

Contact information:

Ana ĐOKIĆ 1, MSc, Lecturer
1974
Information Technology School, Cara Dušana 34, Zemun, Serbia
ana.djokic@its.edu.rs
https://orcid.org/0009-0002-3469-586X

Hana STEFANOVIĆ 2, PhD, Senior Lecturer
1977
Academy of Technical and Art Applied Studies, School of Electrical and Computer Engineering, Vojvode Stepe 283, 11000 Belgrade, Serbia
hanas@viser.edu.rs
https://orcid.org/0000-0003-0890-4410

Dragana DUDIĆ 3, PhD, Assistant Professor
1985
(Corresponding author)
Faculty of Computer Science and Informatics, University Union Nikola Tesla, Cara Dušana 62-64, 11000 Belgrade, Serbia
ddudic@unionnikolatesla.edu.rs
https://orcid.org/0000-0001-8513-6529

Integration of Drones for Intelligent Crowd Counting in the Safe City Concept

Nikola GLIGORIJEVIĆ[1], Danilo STRUGAREVIĆ[2], Vladimir ČABRIĆ[3], Marko RAČIĆ[4]

Abstract: Rapid urbanization and increasing population density in urban areas pose a significant challenge to maintaining security and effective crowd management during mass gatherings, such as public events, protests and emergencies. The "safe city" concept relies on modern technologies, including drones and artificial intelligence, to improve security, optimize resource allocation and reduce the risks associated with mass gatherings. This paper explores the use of drones, equipped with advanced cameras and object detection algorithms like YOLO and Fast R-CNN, to count people in crowds and analyze their movements in real time. By combining multi-criteria analysis, the algorithms were evaluated according to key criteria, including accuracy, processing speed, robustness to noise, segmentation efficiency and energy efficiency. The results show that the YOLO algorithm is superior in applications that require fast real-time processing, while Fast R-CNN provides higher accuracy in complex scenarios. Integrating drones with these algorithms enables accurate crowd counting and tracking, which contributes to better security and management in modern urban environments.

Keywords: Safe City, Drones, Artificial Intelligence, YOLO, Fast R-CNN, Crowd Counting, Multi-criteria Analysis.

Contact information:

Nikola GLIGORIJEVIĆ 1, MSc in Information Tehnology Engineering
(Corresponding author)
1991
University of Criminal Investigation and Police Studies, 11000 Belgrade, Serbia
nikola.gligorijevic@nfinnova.com
https://orcid.org/0009-0001-1307-0839

Danilo STRUGAREVIĆ 2, MSc in Information Tehnology Engineering
1981
The Academy of Applied Preschool Teaching and Health Studies, Balkanska 18, 37000 Kruševac, Serbia
strugarevic@avmss.edu.rs
https://orcid.org/0009-0008-8602-7349

Vladimir Čabrić 3, Graduate Engineer of Traffic
1984
Faculty of Transport and Traffic Engineering, University of Belgrade, 11000 Belgrade, Serbia
vcabric@gmail.com
https://orcid.org/0009-0001-6005-9368

Marko RAČIĆ 4, MSc of Economics
1986
Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
marko.m.racic@gmail.com

The Model of a Smart Education System: Gamification of Teaching Through Digital Dialogue

Momčilo RANĐELOVIĆ[1], Radoje JEVTIĆ[2], Jovan NIČKOVIĆ[3], Dragan VUČKOVIĆ[4]

Abstract: The two starting points of this research are the Socratic dialogue method and the "forgetting curve." Hermann Ebbinghaus. On the other hand, it is known that it is Socrates' dialogue is a method of philosophical inquiry and interaction that he employed to encourage his interlocutors to think more deeply and analyze their beliefs. This method is based on asking questions that lead to the discovery of truth, relying on logical and critical discussions. The second starting point is Hermann Ebbinghaus's Forgetting Curve, which emphasizes that resumption of material is most important in the first few minutes after learning, because then the speed of forgetting is the highest. Without repetition, as much as 50–70% of information can be forgotten in the first hour. Early restoration slows down this process and allows for longer-lasting memory. This paper is part of a more extensive research, in search of a teaching concept that would realize the ideal of Socratic dialogue and ensure the highest level of retention of the exhibited material, in accordance with the recommendations Hermann Ebbinghaus with the help of modern digital technologies. At the same time, the application of gamification in teaching increases the motivation and interest of students for active learning in the teaching process.

Keywords: Digital Dialogue, Gamification in Teaching, Interactive Teaching, Hybrid Learning.

Contact information:

Momčilo RANĐELOVIĆ 1, PhD
(Corresponding author)
1964
University Business Academy in Novi Sad, 21000 Novi Sad, Serbia / Faculty of Social Sciences, 11000 Belgrade, Serbia
mocaprof@gmail.com
https://orcid.org/0009-0006-3908-1815

Radoje JEVTIĆ 2, PhD
1973
Electrical Engineering Technician School „Nikola Tesla “, Aleksandra Medvedeva 18, 18000 Niš, Serbia
milan.jvtc@gmail.com
https://orcid.org/0000-0002-0179-1321

Jovan NIČKOVIĆ 3, MSc
1974
Electrical Engineering Technician School „Nikola Tesla “, Aleksandra Medvedeva 18, 18000 Niš, Serbia
jovan@etstesla.ni.ac.rs
https://orcid.org/0009-0008-3285-4808

Dragan VUČKOVIĆ 4, PhD, Assistant Professor
1974
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
dragan.vuckovic@alfa.edu.rs
https://orcid.org/0009-0001-8699-9374

Using Machine Learning Techniques for Age Prediction Based on PPG Signal Analysis

Mirjana TOMIC[1], Stevan JOKIC[2], Nenad GLIGORIĆ[3], Ana KOVAČEVIĆ[4], Branislav GERAZOV[5]

Abstract: This paper explores the application of machine learning and neural networks for age prediction based on PPG signals (photoplethysmographic signals), which provide a non-invasive and cost-effective method for assessing patient health, particularly in the field of cardiovascular diseases. PPG signals, recorded using light sources and photodetectors, enable the assessment of changes in blood volume in the microvasculature, which is closely related to the condition of blood vessels. In this study, a machine learning model based on neural networks has been developed, using PPG signals as input data to predict patient age. Various neural network architectures were tested, including models with one hidden layer and models with multiple layers, to investigate how the number of layers affects prediction accuracy. Additionally, different activation functions, such as tanh and ReLU, as well as various data preprocessing techniques, such as normalizing PPG signals, were considered. The model evaluation was carried out using MAE (Mean Absolute Error) and MSE (Mean Squared Error) as key statistical indicators measuring prediction accuracy. The results show that models with a greater number of hidden layers achieve better performance in age prediction, with a 30% reduction in errors compared to models with one hidden layer. Errors were primarily caused by data imbalance and specific signal characteristics that were not correctly identified by the model. The causes of larger prediction errors were also analyzed, revealing that certain PPG signals exhibited features resembling those of older or younger age groups, which influenced the model's errors. Further optimization of the model and data processing can significantly improve prediction accuracy, potentially making this approach an effective tool for real-time medical prediction. Keywords: PPG signals, machine learning, neural networks, age prediction, data processing, cardiovascular health.

Keywords: PPG Signals, Machine Learning, Neural Networks, Age Prediction, Data Processing, Cardiovascular Health.

Contact information:

Mirjana TOMIĆ 1, MSc
(Corresponding author)
1973
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
tomicmirjana3@gmail.com
https://orcid.org/0009-0008-1152-1596

Stevan JOKIĆ 2, PhD, Assistant Professor
1983
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
stevan.jokic@alfa.edu.rs
https://orcid.org/0000-0003-4432-0172

Nenad GLIGORIĆ 3, PhD
1984
Zentrix Lab OÜ, Harju maakond, Tallinn, Kesklinna linnaosa, Narva mnt 7-652, 10117, Estonia
nenad@zentrix.io
https://orcid.org/0000-0002-9054-2799

Ana KOVAČEVIĆ 4, PhD Candidate
1993
Zentrix Lab OÜ, Harju maakond, Tallinn, Kesklinna linnaosa, Narva mnt 7-652, 10117, Estonia
ana.kovacevic@zentrixlab.com
https://orcid.org/0000-0003-4928-9848

Branislav GERAZOV 5, PhD, Professor
1982
FEEIT, UCMS, Skopje, Macedonia
gerazov@feit.ukim.edu.mk
https://orcid.org/0000-0003-2498-6831

Development of Educational Information Systems in Smart Cities with the Application of Artificial intelligence

Ana BAŠIĆ[1], Dejan VIDUKA[2], Ana-Marija VUKIĆ[3]

Abstract: The development of educational information systems in the context of the fourth industrial revolution and smart cities is transforming traditional approaches to education through the integration of artificial intelligence (AI), IoT and cloud computing. These advanced systems enable personalization of learning, automation of knowledge assessment and efficient management of resources, thus supporting the principles of Education 4.0. The focus is on adaptive technologies that meet the individual needs of students, improve the quality of teaching and increase user engagement. This paper analyzes the key technologies, methods and tools which are enabling the application of AI in education, identifying challenges such as privacy protection, ethical dilemmas, the digital divide and the integration of new technologies into existing educational practices. Special attention is given to the application of AI in the personalization of learning, the automation of knowledge assessment and the optimization of resource management in educational institutions. The results of the analysis highlight the significant potential of these systems for improving the educational experience, while proposing a strategic framework for their implementation in smart cities.

Keywords: Artificial Intelligence, Educational Information Systems, IoT, Personalization of Learning, Resource Management, Smart Cities.

Contact information:

Ana BAŠIĆ 1, PhD, Senior Lecturer
(Corresponding author)
1981
Information Technology School - ITS, 11000 Belgrade, Serbia
ana.basic@its.edu.rs
https://orcid.org/0009-0009-4137-3296

Dejan VIDUKA 2, PhD, Full Professor
1980
Faculty of Mathematics and Computer Science, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
dejan.viduka@alfa.edu.rs
https://orcid.org/0000-0001-9147-8103

Ana-Marija VUKIĆ 3, MSc, Student
2001
Technical faculty "Mihajlo Pupin", University of Novi Sad, Djure Djakovica bb, 23000 Zrenjanin, Serbia
anamvukic@gmail.com
https://orcid.org/0009-0006-8515-6419

ALFA BK UNIVERSITY
FACULTY OF INFORMATION TECHNOLOGIES
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
ALFATECH
Book of Abstracts

Implementing Network Policies in Kubernetes

Sava STANISIĆ[1], Vladimir MLADENOVIĆ[2]

Abstract: Managing network traffic and ensuring security has become critical for maintaining robust Kubernetes environments. This paper aims to investigate the implementation of Kubernetes Network Policies to enhance network security and operational efficacy. The objectives of these research include exploring the configuration of NetworkPolicy resources, employing label selectors, and managing namespaces. The methodology presented in this paper involves leveraging advanced tools like Flannel and Calico to enforce network policies effectively. The results indicate significant improvements in traffic control and workload security, offering a comprehensive guide for optimizing Kubernetes clusters with refined network policy management techniques.

Keywords: Egress Traffic, Ingress Traffic, Kubernetes, Network Policies, Security.

Contact information:

Sava STANISIĆ 1, MSc
(Corresponding author)
2000
Faculty of Technical Sciences Čačak, University of Kragujevac, Svetog Save 65, 32000 Čačak, Serbia
sava.stanisic@vs.rs
https://orcid.org/0009-0002-3118-0537

Vladimir MLADENOVIĆ 2, PhD, Full Professor
1975
Faculty of Technical Sciences Čačak, University of Kragujevac, Svetog Save 65, 32000 Čačak, Serbia
vladimir.mladenovic@ftn.kg.ac.rs
https://orcid.org/0000-0001-8530-2312

Syntactic and Morphological Data-base and Algorithms for NLP of the Serbian Language

Mirjana TOMIC[1], Dejan DJUKIC[2]

Abstract: In this work, a method for automated generating grammatically correct sentences in Serbian language has been presented. This work presented a significant challenge, as the Serbian language is a highly inflected language, with complex word morphology, noun and adjective genders and declinations, verbal conjugations and concordance rules. The word components, such as word roots and their inflectional and morphological particles have been stored in JSON structures. The word components have been combined using custom produced software in Python programming language. The main software functions are the access to JSON data base of linguistic data, and the execution of algorithms for combining word parts into grammatically correct words, and words into syntactically and semantically correct sentences. The principal features of the software include morphological formation of verbs, nouns and adjectives, and combining these words with prepositions in a way to form sentences that appear to belong to the natural language use in Serbian language. The examples of generated sentences by this method show that such sentences, albeit somewhat simple, can be successfully generated by using this approach. The applications of the method presented here are numerous: from educational use, e.g. in language training, to more general research tools in the domain of natural language processing (NLP), not only for the Serbian language, but for a wider family of languages following complex grammatical rules, such as highly inflected, and morphologically complex languages.

Keywords: Natural Language Processing, NLP, Automated Natural Language Generation, NLG, Serbian Language, Data-base Design, Language and Text Synthesis, Education, Programming Methodology.

Contact information:

Mirjana TOMIC 1, MSc
(Corresponding author)
1973
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
tomicmirjana3@gmail.com
https://orcid.org/0009-0008-1152-1596

Dejan DJUKIC 2, PhD, Assistant Professor
1965
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
dejan.djukic@alfa.edu.rs
https://orcid.org/0000-0001-7581-148X

Ethical and Innovative Smartphone-Based Blood Vessel Assessment: Privacy and Data Protection in the 'ECG for Everybody' App for Smart Cities

Stevan JOKIĆ[1], Ivan JOKIĆ[2], Branislav GERAZOV[3], Nenad GLIGORIĆ[4], Ana KOVAČEVIĆ[5]

Abstract: The growing emphasis on personalized healthcare within the paradigm of smart cities highlights the need for innovative, accessible solutions that enable early detection and continuous monitoring of cardiovascular health. In this study, we propose an advanced methodology for assessing blood vessel elasticity, expressed as the vascular "biological age," through the analysis of Photoplethysmography (PPG) signals acquired via the widely adopted mobile application "ECG for Everybody," which boasts over 150,000 downloads and a database of nearly 3 million recordings. Our approach introduces the concept of a dominant PPG beat, derived by averaging PPG signals across the entire recording. This averaged waveform serves as a robust representation of vascular characteristics, enabling precise assessment of blood vessel elasticity. By analyzing the shape and temporal dynamics of this dominant beat, we estimate vascular health parameters and determine the biological age of blood vessels. The analysis leverages a deep neural network trained on a diverse dataset collected from real-world users of the "ECG for Everybody" application, as well as multiple signal processing techniques. This neural model correlates the morphological features of the averaged PPG beat with vascular elasticity, providing an innovative and non-invasive method for assessing cardiovascular health. Initial experimental results validate the efficacy of the proposed approach in accurately estimating vascular biological age. By integrating advanced PPG signal processing and machine learning techniques within a user-friendly mobile application, this work represents a significant step toward accessible, real-time healthcare solutions tailored for smart city environments.

Keywords: Photoplethysmography (PPG) Analysis, Vascular Elasticity, Biological Age, Neural Networks, Healthcare Technology, Smart Cities.

Contact information:

Stevan JOKIĆ 1, PhD, Assistant Professor
(Corresponding author)
1983
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
stevan.jokic@alfa.edu.rs
https://orcid.org/0000-0003-4432-0172

Ivan JOKIĆ 2, PhD, Assistant Professor
1980
Faculty of Economics and Engineering Management, University Business Academy in Novi Sad, Cvećarska 2, 21207 Novi Sad, Serbia
ivan.jokic@fimek.edu.rs
https://orcid.org/0009-0008-0083-7675

Branislav GERAZOV 3, PhD, Professor
1982
FEEIT, UCMS, Skopje, Macedonia
gerazov@feit.ukim.edu.mk
https://orcid.org/0000-0003-2498-6831

Nenad GLIGORIĆ 4, PhD
1984
Zentrix Lab OÜ, Harju maakond, Tallinn, Kesklinna linnaosa, Narva mnt 7-652, 10117, Estonia
nenad@zentrix.io
https://orcid.org/0000-0002-9054-2799

Ana KOVAČEVIĆ 5, PhD Candidate
1993
Zentrix Lab OÜ, Harju maakond, Tallinn, Kesklinna linnaosa, Narva mnt 7-652, 10117, Estonia
ana.kovacevic@zentrixlab.com
https://orcid.org/0000-0003-4928-9848

Software Architectures for Smart Water Utilities

Slavimir VESIĆ

Abstract: The scarcity of water at the global level, along with the trends of population growth on the planet and their concentration in cities, are putting increasing pressure on city waterworks. The infrastructure built several decades ago and maintained for almost as long, with occasional reconstructions, is finding it increasingly difficult to withstand large changes in the demand for drinking water. Water is a necessary resource for life, and most people take it for granted. Waterworks should provide drinking water 24/7 for all its citizens with appropriate parameters such as pressure and flow, as well as physical, chemical, biological, and microbiological quality. That is why the operation of city waterworks can be seen as a multifactor optimization problem. In this manuscript, we will analyse the issues that arise in the operation of city waterworks by looking at the core activities in their value chain and the challenges that exist in them. Traditional IS in water utilities like business, geographical and technical IS only to some extent can cope with the mentioned issues. There is a space where IoT, Cloud Computing, Big Data and AI can contribute significantly. We will present some software architectures that can help in solving these challenges.

Keywords: Smart City, Smart Water Utility, Software Architecture, Industry 4.0.

Contact information:

Slavimir VESIĆ, PhD, Head of software development
(Corresponding author)
1984
PUC "Belgrade Waterworks and Sewerage", Kneza Miloša Street 27, 11000 Belgrade, Serbia
vesic.slavimir@gmail.com
https://orcid.org/0000-0003-2020-8418

Analysis of Security-Intelligence Data Obtained by Osint Techniques Using the Apache Hadoop Big Data Platform

Nikola PETROVIĆ[1], Vojkan NIKOLIĆ[2]

Abstract: Apache Hadoop is a platform for storing, processing and analyzing large amounts of data. Some of the capabilities of this platform include storing data in HDFS (Hadoop Distributed File System) and setting complex HiveQL queries. In addition to Apache Hadoop, which is used in this work to process and analyze the collected data, convolutional neural networks were also used for photo analysis. Data was collected using various OSINTA (Open-source intelligence) techniques, including finding, selecting and collecting information from publicly available sources.

Keywords: Big Data, Apache Hadoop, OSINT.

Contact information:

Nikola PETROVIĆ 1, Police Lieutenant
2000
Ministry of Interior of the Republic of Serbia, Kneza Milosa 101, 11000 Belgrade, Serbia
nikola.spetrovic@mup.gov.rs
https://orcid.org/0009-0004-2325-2822

Vojkan NIKOLIĆ 2, PhD, Associate Professor
(Corresponding author)
1971
University of Criminal Investigation and Police Studies, Cara Dusana 196, 11080 Belgrade, Serbia
vojkan.nikolic@kpu.edu.rs
https://orcid.org/0000-0002-9230-7549

ALFA BK UNIVERSITY
FACULTY OF INFORMATION TECHNOLOGIES
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE
ALFATECH
Book of Abstracts

Contemporary Machine Learning in Smart Cities: A Review of Quality, Measurability, Explainability, Privacy, and Security

Anja DELIĆ[1], Jelena KOVAČ[2], Nevena GLIGOROV[3], Branislav S. RISTIĆ[4], Marko GORDIĆ[5], Radovan TUROVIĆ[6], Dinu DRAGAN[7], Dušan B. GAJIĆ[8], Veljko B. PETROVIĆ[9]

Abstract: This review paper examines current research on machine learning applications in smart cities, with a specific focus on quality, measurability, explainability, privacy, and security. By synthesizing findings from recent studies, we uncover new trends, methods, and ways to measure performance that are key for the development and deployment of these systems. We discuss how challenges related to data privacy and system security intertwine with the technical requirements of quality assurance and explainability, and we propose future research directions that could foster more reliable and accountable machine learning solutions in urban environments. This review aims to provide researchers and practitioners with an overview of the current landscape, facilitating a multidisciplinary dialogue on enhancing trust and efficacy in smart city technologies.

Keywords: Smart City, Internet of Things, Artificial Intelligence, Machine Learning, Smart Energy, Smart Transport, Smart Logistics, Smart Health, Smart Building, Smart Home, Smart Security.

Contact information:

Contact information:

Anja DELIĆ 1, MSc, Teaching Assistant
2000
Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia
delic.anja@uns.ac.rs
https://orcid.org/0009-0003-7506-3268

Jelena KOVAČ 2, BSc, Teaching Assistant
2001
Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia
kovac.e214.2024@uns.ac.rs
https://orcid.org/0009-0005-0287-4662

Nevena GLIGOROV 3, BSc, Teaching Assistant
2001
Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia
gligorov.e27.2024@uns.ac.rs
https://orcid.org/0009-0002-4366-060X

Branislav S. RISTIĆ 4, MSc, Teaching Assistant
2000
Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia
branislav.ristic@uns.ac.rs
https://orcid.org/0009-0004-1438-142X

Marko GORDIĆ 5, Student
2004
Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia
marko@gordic.rs
https://orcid.org/0009-0003-6306-4511

Radovan Turović 6 , MSc, Teaching Assistant
(Corresponding author)
1992
Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia
radovan.turovic@uns.ac.rs
https://orcid.org/0000-0003-2853-4875

Dinu DRAGAN 7, PhD, Associate Professor
1979
Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia
dinud@uns.ac.rs

https://orcid.org/0000-0001-8623-1923

Dušan GAJIĆ 8, PhD, Associate Professor
1982
Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia
dusan.gajic@uns.ac.rs
https://orcid.org/0000-0003-0495-8788

Veljko B. PETROVIĆ 9, PhD, Assistant Professor
(Corresponding author)
1986
Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia
pveljko@uns.ac.rs
https://orcid.org/0000-0001-8662-1366

Use of Covariance Matrix in Automatic Speaker Recognition

Ivan JOKIĆ[1], Stevan JOKIĆ[2], Duško BOGDANIĆ[3]

Abstract: One procedure for automatic speaker recognition based on use of 21 mel-frequency cepstral coefficients as speaker features and covariance matrix as speaker model is tested in this paper. Tests are conducted on the Solo part of the CHAINS speech database which contains 37 recordings for each of 36 speakers. Each speech recording is represented by appropriate matrix of feature vectors. Modeling of recording of speaker is done by covariance matrix of matrix of feature vectors. Results of recognition accuracy are compared for two cases, when on elements of speaker model is applied sigmoid function and when it is not. Tests are done in five stages. Application of sigmoid function on elements of covariance matrices results in most of tests in significantly increasing of recognition accuracy. Achieved mean recognition accuracy for all done tests when sigmoid function is not applied is 87,84% and when sigmoid function is applied is 94,64%.

Keywords: Automatic Speaker Recognition, Mel-Frequency Cepstral Coefficients, Covariance matrix.

Contact information:

Ivan JOKIĆ 1, PhD, Assistant Professor
(Corresponding author)
1980
Faculty of Economics and Engineering Management, University Business Academy in Novi Sad, Cvećarska 2, 21207 Novi Sad, Serbia
ivan.jokic@fimek.edu.rs
https://orcid.org/0009-0008-0083-7675

Stevan JOKIĆ 2, PhD, Assistant Professor
1983
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
stevan.jokic@alfa.edu.rs
https://orcid.org/0000-0003-4432-0172

Duško BOGDANIĆ 3, PhD, Associate Professor
1981
Faculty of Mathematics And Computer Science, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
dusko.bogdanic@alfa.edu.rs
https://orcid.org/0000-0002-6511-7475

Blockchain Applications in the Development of Smart Cities

Nikola VUKIĆ[1], Sara POPARIĆ[2], Helena ANIŠIĆ[3], Dane MILIŠIĆ[4], Aleksa ĐUKIĆ[5], Nebojša HORVAT[6], Dušan B. GAJIĆ[7], Veljko B. PETROVIĆ[8], Dinu DRAGAN[9]

Abstract: Blockchain technology, with its decentralized nature, immutability, and transparency, has emerged as a promising tool to address challenges in smart city development. This review paper examines the applications of blockchain across multiple sectors, including waste management, finance, voting, real estate, and energy management. Drawing from current research, the paper demonstrates how blockchain can enhance conventional approaches to improve efficiency, transparency, and security. While blockchain holds significant promise, this paper also explores the constraints hindering its mass adoption, such as scalability, energy consumption, and regulatory challenges. By incorporating perspectives from both industry and academia, it provides a balanced analysis of the opportunities and challenges associated with blockchain adoption in smart cities. Ultimately, this paper aims to offer valuable insights to policymakers, researchers, and stakeholders, helping them better understand how blockchain can be strategically leveraged to create more sustainable, secure, and efficient urban systems.

Keywords: Blockchain, Smart City, Distributed Ledger Technology, Ethereum, Energy Trading, Waste Management, Finance, Voting, Real Estate.

Contact information:

Nikola Vukić 1, Teaching Assistant
2000
Faculty of Technical Sciences, University of Novi Sad, 21000 Novi Sad, Serbia
nikola.vukic@uns.ac.rs
https://orcid.org/0009-0007-6576-8669

Sara POPARIĆ 2, Teaching Assistant
1999
Faculty of Technical Sciences, University of Novi Sad, 21000 Novi Sad, Serbia
poparic.sara@uns.ac.rs
https://orcid.org/0000-0001-6388-7081

Helena ANIŠIĆ 3, Teaching Associate
1998
Faculty of Technical Sciences, University of Novi Sad, 21000 Novi Sad, Serbia
hanisic@uns.ac.rs
https://orcid.org/0000-0001-6388-7081

Dane MILIŠIĆ 4, Teaching Assistant
2000
Faculty of Technical Sciences, University of Novi Sad, 21000 Novi Sad, Serbia
milisic@uns.ac.rs
https://orcid.org/0009-0003-7173-6832

Aleksa ĐUKIĆ 5, Teaching Assistant
2001
Faculty of Technical Sciences, University of Novi Sad, 21000 Novi Sad, Serbia
djukic.e284.2024@uns.ac.rs
https://orcid.org/0009-0008-0906-7865

Nebojša HORVAT 6, Teaching Associate
1995
Faculty of Technical Sciences, University of Novi Sad, 21000 Novi Sad, Serbia
horva.n@uns.ac.rs
https://orcid.org/0000-0001-9321-6940

Dušan B. Gajić 7, PhD, Associate Professor
(Corresponding author)
1982
Faculty of Technical Sciences, University of Novi Sad, 21000 Novi Sad, Serbia
dusan.gajic@uns.ac.rs
https://orcid.org/0000-0003-0495-8788

Veljko B. PETROVIĆ 8, PhD, Assistant Professor
1986
Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia
pveljko@uns.ac.rs
https://orcid.org/0000-0001-8662-1366

Dinu DRAGAN 8, PhD, Associate Professor
1979
Faculty of Technical Sciences, University of Novi Sad, 21000 Novi Sad, Serbia
dinud@uns.ac.rs
https://orcid.org/0000-0001-8623-1923

PPG Signal Analysis And Wavelet Selection For Feature Extraction

Zlatko RADOVANOVIĆ[1], Branislav GERAZOV[2], Ana KOVAČEVIĆ[3], Nenad GLIGORIĆ[4]

Abstract: Biomedical signals or biosignals are spatial, temporal or spatio-temporal records of a biological phenomenon. Biosignals contain information that is of great importance for understanding the specific physiological mechanisms of biological phenomena or the systems from which they originate. Signals provide important information about the internal state of organs, response to external stimuli, general state, general state of health and the state of various other parameters and are an indispensable part of modern medical diagnostic practice. The signal that arises as a result of the device's action on the organism, the subject of this paper, is the signal obtained by the photoplethysmography (PPG) method. Certain artificial intelligence methods were used to analyze the PPG signal. In this paper, analysis using wavelet transformation will be used, and a special focus will be on the selection of wavelets (wavelets) that will be used for the purpose of machine learning.

Keywords: Characteristic Parameters, Diastolic Peak, Photoplethysmography (PPG), Pulse Width, Machine Learning, Systolic Peak, Wavelet Transform.

Contact information:

Zlatko RADOVANOVIĆ 1, MSc
(Corresponding author)
1974
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
zlajo@pobox.sk
https://orcid.org/0009-0002-3829-2128

Branislav GERAZOV 2, PhD, Professor
1982
FEEIT, UCMS, Skopje, Macedonia
gerazov@feit.ukim.edu.mk
https://orcid.org/0000-0003-2498-6831

Ana KOVAČEVIĆ 3, PhD Candidate
1993
Zentrix Lab OÜ, Harju maakond, Tallinn, Kesklinna linnaosa, Narva mnt 7-652, 10117, Estonia
ana.kovacevic@zentrixlab.com
https://orcid.org/0000-0003-4928-9848

Nenad GLIGORIĆ 4, PhD
1984
Zentrix Lab OÜ, Harju maakond, Tallinn, Kesklinna linnaosa, Narva mnt 7-652, 10117, Estonia
nenad@zentrix.io
https://orcid.org/0000-0002-9054-2799

The Role of Organizational Culture in the Onboarding Process in Four Small IT Companies: A Qualitative Study

Maja GABOROV[1], Željko STOJANOV[2], Mila KAVALIĆ[3], Verica GLUVAKOV[4], Igor VECŠTEJN[5]

Abstract: In the context of onboarding, which is the process of introducing new employees to the organization, organizational culture plays a key role because new employees first come into contact with specific values, norms, and behaviors that shape the working environment in the company. Onboarding is a process that allows new employees to understand its goals and culture, and successfully perform their tasks. This study examines the role of organizational culture in the onboarding process in small IT companies. Through qualitative interviews with four IT experts working in different companies, the research presents a thematic analysis of how onboarding is aligned with organizational culture. The research results show the role of organizational culture in the onboarding process in small IT companies. Participants pointed out that onboarding is crucial for introducing new employees to the organization and company culture. Communication is recognized as a central element that helps define and maintain culture, while HR (Human Resource) departments and mentors are identified as key factors in the integration of new employees. Also, challenges such as mismatch with organizational culture and lack of a formal culture framework in small companies were recognized as potential barriers to successful onboarding.

Keywords: Organizational Culture, Onboarding Process, Small IT Companies, Qualitative Study.

Contact information:

Maja GABOROV 1, MSc, Teaching Assistant
(Corresponding author)
1995
Technical faculty "Mihajlo Pupin", University of Novi Sad, Djure Djakovica bb, 23000 Zrenjanin, Serbia
maja.gaborov@uns.ac.rs
https://orcid.org/0000-0002-3810-6156

Željko STOJANOV 2, PhD, Full Professor
1971
Technical faculty "Mihajlo Pupin", University of Novi Sad, Djure Djakovica bb, 23000 Zrenjanin, Serbia
zeljko.stojanov@uns.ac.rs
https://orcid.org/0000-0001-6930-5337

Mila KAVALIĆ 3, Phd, Assistant Professor
1989
Technical faculty "Mihajlo Pupin", University of Novi Sad, Djure Djakovica bb, 23000 Zrenjanin, Serbia
mila.kavalic@uns.ac.rs
https://orcid.org/0000-0001-7053-2334

Verica GLUVAKOV 4, MSc, Teaching Assistant
1997
Technical faculty "Mihajlo Pupin", University of Novi Sad, Djure Djakovica bb, 23000 Zrenjanin, Serbia
verica.gluvakov@uns.ac.rs
https://orcid.org/0000-0003-1083-0203

Igor VECŠTEJN 5, MSc, Teaching Assistant
1995
Technical faculty "Mihajlo Pupin", University of Novi Sad, Djure Djakovica bb, 23000 Zrenjanin, Serbia
igor.vecstejn@uns.ac.rs
https://orcid.org/0009-0009-9940-4411

Simulation of Evacuation as a Consequence of Industry 4.0

Radoje JEVTIĆ[1], Dragan VUČKOVIĆ[2], Momčilo RANĐELOVIĆ[3], Ivana JANKOVIĆ[4], Jelena LUKIĆ[5], Jovan NIČKOVIĆ[6]

Abstract: Evacuation presents very important, complex and always open and actual task and problem. Experience showed that even well calculated evacuation plans can have errors, mistakes and oversights. As an example, it is almost impossible to predict humans` behavior in stress and panic situations what can extremely endanger evacuation and cause many new victims. As a standard evacuation procedure, during construction of some object, it is necessary to calculate evacuation time needed for evacuation. But, even with a proper calculation, suppresses and unpredictable events are frequent. So, it is the best way to predict as many possible evacuation scenarios. One of the best ways for that purpose is the use of simulation software. The simulation software, as a consequence of Industry 4.0, enables many benefits in the sense of precision, prediction, calculation of evacuation times, determining of evacuation routes and their optimizations. In the future, this software will be consolidated with artificial intelligence with optimized results. In this paper, several typical evacuation examples were presented with use of simulation software Pathfinder (version 2023), for high residential buildings as a particularly complex and hard objects for evacuation.

Keywords: Simulation, Industry 4.0, Human, Safety, Prediction, Evacuation.

Contact information:

Radoje JEVTIĆ 1, PhD
(Corresponding author)
1973
Electrical Engineering Technician School „Nikola Tesla “, Aleksandra Medvedeva 18, 18000 Niš, Serbia
milan.jvtc@gmail.com
https://orcid.org/0000-0002-0179-1321

Dragan VUČKOVIĆ 2, PhD, Assistant Professor
1974
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
dragan.vuckovic@alfa.edu.rs
https://orcid.org/0009-0001-8699-9374

Momčilo RANĐELOVIĆ 3, PhD
1964
University Business Academy in Novi Sad, 21000 Novi Sad, Serbia / Faculty of Social Sciences, 11000 Belgrade, Serbia
mocaprof@gmail.com
https://orcid.org/0009-0006-3908-1815

Ivana JANKOVIĆ 4, MSc
1977
Electrical Engineering Technician School „Nikola Tesla “, Aleksandra Medvedeva 18, 18000 Niš, Serbia
ivana.etstesla@gmail.com
https://orcid.org/0009-0009-7718-4702

Jelena Lukić 5, MSc
1995
Electrical Engineering Technician School „Nikola Tesla “, Aleksandra Medvedeva 18, 18000 Niš, Serbia
jelenadlukic7@gmail.com
https://orcid.org/0009-0005-0158-5172

Jovan NIČKOVIĆ 6, MSc
1974
Electrical Engineering Technician School „Nikola Tesla “, Aleksandra Medvedeva 18, 18000 Niš, Serbia
jovan@etstesla.ni.ac.rs
https://orcid.org/0009-0008-3285-4808

Intelligent Connectivity for Smart City Development

Vladan PANTOVIĆ[1], Dragorad MILOVANOVIĆ[2], Filip JOVANOVIĆ[3]

Abstract: The paper presents an overview of the progress of modern information and communication technologies, which are necessary for the development of smart cities. A special review was given to the explanation of the concept of Intelligent Connectivity (ICon) that includes the convergence of key technological trends: mobile networks of the fifth generation (5G), Internet-connected objects (IoT - Internet of Things), Artificial Intelligence systems (AI) and Cloud Computing (CC). The 5G network, with high data transfer rates, is expected to enable the integration of AIoT = AI+IoT Artificial Intelligence and the Internet of Connected Objects by supporting continuous connectivity and low latency connections and becomes a key prerequisite for a successful Smart City infrastructure. The network architecture for IoT-based Smart Cities should enable the integration of technologies with sensor networking, information processing and real-time control to efficiently utilize public resources.

Keywords: Smart City, Intelligent Connectivity, 5G, IoT, Artificial Intelligence.

Contact information:

Vladan PANTOVIĆ 1, PhD, Associate Professor
(Corresponding author)
1961
Faculty of Project and Innovation Management, Bože Jankovića 14, 11000 Belgrade, Serbia,
vladan@pantovic.rs
https://orcid.org/0009-0001-6319-8822

Dragorad MILOVANOVIĆ 2, MScEE, Lecturer
1962
School of Computing (RAF), Kneza Mihaila 6/VI, 11000 Belgrade, Serbia
dragoam@gmail.com
https://orcid.org/0000-0001-6430-7421

Filip JOVANOVIĆ 3, PhD, Assistant Professor
1985
Faculty of Project and Innovation Management, Bože Jankovića 14, 11000 Belgrade, Serbia
filip.jovanovic@pmc.edu.rs
https://orcid.org/0000-0002-4891-7219

Optimization of Urban Mobility Using Combinatorial Algorithms and Artificial Intelligence

Sonja DJUKIC POPOVIC[1], Stefan POPOVIC[2], Dejan DJUKIC[3]

Abstract: Growing urbanization and increasing traffic demands impose the need for innovative solutions in the management of urban mobility. This paper investigates the application of combinatorial algorithms and artificial intelligence (AI) in the optimization of urban traffic systems. Special focus is on the use of metaheuristic approaches, such as genetic algorithms, swarm intelligence and tabu search, in solving problems of dynamic vehicle routing, traffic flow management and public transport planning. The methods of machine learning and deep neural networks in predicting traffic jams and optimizing transport resources are analyzed. The research relies on simulation models and real urban data to evaluate the effectiveness of the proposed algorithms. The contribution of the work is reflected in the review of the most significant achievements in this area, the presentation of already implemented solutions, as well as in indicating the inevitability of applying mathematical models and integrating optimization algorithms and artificial intelligence in urban mobility, with the aim of improving sustainability and quality of life in modern cities.

Keywords: Combinatorial Optimization, Urban Mobility, Artificial Intelligence, Machine Learning, Smart Cities, Algorithms.

Contact information:

Sonja DJUKIC POPOVIC 1, Teaching Assistant
(Corresponding author)
1984
Faculty of Mathematics - University of Belgrade, Studentski trg 13, Belgrade, Serbia
sonjica27@yahoo.com
https://orcid.org/0000-0001-8169-8866

Stefan POPOVIC 2, Lecturer
1983
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, Belgrade, Serbia
stefan.popovic@alfa.edu.rs
https://orcid.org/0000-0002-5288-4560

Dejan DJUKIC 2, Assistant Professor
1965
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, Belgrade, Serbia
dejan.djukic@alfa.edu.rs
https://orcid.org/0000-0001-7581-148X

Technical and Economic Analysis of Photovoltaic Plant Investment at Maribor District Heating Facility

Matija MEDEN[1], Filip KOKALJ[2]

Abstract: The research analyses the technological and economic dimensions of developing a modular solar power plant at Maribor district heating facility, including rooftops and parking lots. The main goal is to enhance the company's energy self-sufficiency, reduce power expenses, and facilitate the shift to renewable energy sources. The research project seeks to enhance energy production by the application of solar photovoltaic technology, ensuring both cost-effectiveness and long-term sustainability. Multiple design and implementation alternatives have been examined utilising the PV*Sol software package, which facilitates comprehensive simulations and performance assessments of solar power systems. The study concentrated on determining the most economically viable configuration, including variables such as energy output, capital expenditures, and operational efficacy. A comparison of various modular system designs was conducted to identify the most effective strategy for scalability and optimal performance. The legal and regulatory frameworks pertinent to the planning and construction of a solar power plant were examined, including adherence to national and EU energy policies, grid connection stipulations, and accessible financial incentives. The research has evaluated the long-term economic viability of the project, identified potential risks and problems, and provided the most profitable and sustainable implementation strategy.

Keywords: Photovoltaic Solar Modules, Renewable Energy Sources, Energy Self-Sufficiency, Investment Economic Evaluation.

Contact information:

Matija MEDEN 1, mag. inž. stroj.

Energetika Maribor, Jadranska cesta 28, SI-2000 Maribor, Slovenia
matija.meden@energetika-mb.si

Filip KOKALJ 2, prof. dr., univ. dipl. inž. stroj.
(Corresponding author)
1973
Faculty of Mechanical Engineering, University of Maribor, Smetanova 17, SI-2000 Maribor, Slovenia
filip.kokalj@um.si
https://orcid.org/0000-0001-9234-7834

Smart Highways

Luka BOJIĆ[1], David MAKA[2]

Abstract: Smart highways use advanced technologies, sensors, and artificial intelligence to improve traffic safety, efficiency, and environmental sustainability. The integration of traffic management systems, dynamic signage, and vehicle-to-infrastructure communication helps reduce congestion and the number of accidents. The benefits of smart highways are numerous. The integration of traffic sensors and real-time data analysis enables the prediction of congestion, which significantly reduces travel time. The use of renewable energy sources, such as solar panels embedded in roads, contributes to energy efficiency and environmental sustainability. Additionally, advanced systems like wireless charging for electric vehicles help reduce dependence on fossil fuels. Smart highways are crucial for the future of transportation because they improve how people and goods move, reduce traffic accidents, and optimize the use of infrastructure. Examples of these technologies can be seen in the Netherlands, the USA, China, and the UK, where smart systems for signaling, road maintenance, and adaptive lighting are being implemented. As technology continues to evolve, smart highways will play an increasingly important role in creating safer, more efficient, and environmentally friendly transportation systems.

Keywords: Smart Highways, Artificial Intelligence, Traffic Safety, Wireless Charging, Dynamic Signage.

Contact information:

Luka BOJIĆ 1, Student
(Corresponding author)
1989
Faculty of Information Technologies, Alfa BK University, Palmira Toljatija 3, 11000 Belgrade, Serbia
bojicbojicluka@gmail.com
https://orcid.org/0009-0007-4002-3644

David MAKA 2, QA engineer
1992
DQ Automotive, Prague, Czech Republic
david.maka16@gmail.com

Leadership in Smart Cities: Emotional Intelligence as a Driver of Smart City Ecosystem Transformation

Jelena VUKONJANSKI SRDIĆ[1], Bojana MILIČIĆ[2], Katarina PAVLOVIĆ[3]

Abstract: This paper aims to examine the role of organizational leaders in the process of transforming urban areas into smart cities, with a detailed analysis of the key challenges they face. The introduction of the smart city concept requires the modernization of leadership styles, organizational strategies, and resources, as well as increased agility and adaptability to new internal and external business conditions. Current research indicates that emotional intelligence plays a key role in the efficient and effective management of these changes. Therefore, the aim of this research is to examine the impact of emotional intelligence on the leadership and economic performance of organizations in Serbia. Quantitative analysis showed that emotional intelligence statistically significantly contributes to the quality of leadership. Additionally, it was found that it acts as a moderating factor in the relationship between leadership and economic performance of organizations. Research findings indicate a positive correlation between a higher level of emotional intelligence of leaders and improved economic indicators of organizations. The obtained results show that the development of emotional intelligence in leaders is a key factor for successfully managing processes within the Smart City ecosystem. Accordingly, the findings of this research provide important guidelines for the strategic selection and development of leaders who will lead organizations in smart cities in Serbia.

Keywords: Leadership, Smart Cities, Emotional Intelligence, Economic Performance, Smart City Ecosystem.

Contact information:

Jelena VUKONJANSKI SRDIĆ 1, PhD, Associate Professor
1979
Alfa BK Univeristy, Faculty of Finance, Banking and Auditing, Palmira Toljatija 3, 11070 Novi Beograd, Serbia
jelena.vukonjanski@alfa.edu.rs
https://orcid.org/0000-0003-3742-9639

Bojana MILIČIĆ 2, MSc in Construction Engineering, PhD Student
(Corresponding author)
1987
Alfa BK Univeristy, Faculty of Finance, Banking and Auditing, Palmira Toljatija 3, 11070 Novi Beograd, Republic of Serbia
bojana.milicic@bktesla.rs
https://orcid.org/0009-0002-3202-910X

Katarina PAVLOVIĆ 3, PhD, Associate Profesor
1976
Faculty of Project and Innovation Management, EDUCONS University, 21208 Sremska Kamenica, Serbia
katarina.pavlovic@pmc.edu.rs
https://orcid.org/0000-0002-2220-2418

Person Detection and Re-Identification In Open-World Settings of Retail Stores and Public Spaces

Branko BRKLJAČ[1], Milan BRKLJAČ[2]

Abstract: Practical applications of computer vision in smart cities usually assume system integration and operation in challenging open-world environments. In the case of person re-identification task the main goal is to retrieve information whether the specific person has appeared in another place at a different time instance of the same video, or over multiple camera feeds. This typically assumes collecting raw data from video surveillance cameras in different places and under varying illumination conditions. In the considered open-world setting it also requires detection and localization of the person inside the analyzed video frame before the main re-identification step. With multi-person and multi-camera setups the system complexity becomes higher, requiring sophisticated tracking solutions and re-identification models. In this work we will discuss existing challenges in system design architectures, consider possible solutions based on different computer vision techniques, and describe applications of such systems in retail stores and public spaces for improved marketing analytics. In order to analyse sensitivity of person re-identification task under different open-world environments, a performance of one close to real-time solution will be demonstrated over several video captures and live camera feeds. Finally, based on conducted experiments we will indicate further research directions and possible system improvements.

Keywords: Person Re-Identification, Computer Vision, Retail Stores, Public Spaces, Marketing Analytics.

Contact information:

Branko BRKLJAČ 1, PhD, Associate Professor
1986
Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, 21000 Novi Sad,Serbia
brkljacb@uns.ac.rs
https://orcid.org/0000-0001-7932-6676

Milan BRKLJAČ 2, PhD
(Corresponding author)
1988
Faculty of Finance, Banking and Auditing, Alfa BK Univeristy, Palmira Toljatija 3, 11070 Novi Beograd, Serbia
milan.brkljac@alfa.edu.rs
https://orcid.org/0000-0002-0617-973X

Mapping of Heat Underground Infrastructrue in Smart Cities – Resource Control

Dejan BLAGOJEVIC[1], Filip KOKALJ[2], Ljubo GERMIC[3], Milan PROTIC[4]

Abstract: This paper explores the role of mapping underground installations in smart cities, focusing on resource control through the monitoring of heat networks in urban areas. The study highlights the importance of using advanced technologies such as drones, thermal cameras, and interactive maps for detecting energy losses, leaks, and system inefficiencies. A key case study is presented from some Serbian and Slovenian districts, where thermal monitoring of underground heat networks has been implemented to assess the current infrastructure's performance. The interactive map developed for this project incorporates georeferencing of elements, allowing real-time data and visualizations to be mapped accurately onto the urban landscape. This geospatial approach enables more efficient decision-making and resource management. The results demonstrate how continuous monitoring can help optimize resource usage, reduce maintenance costs, and contribute to sustainable urban planning. Through this analysis, the paper underscores the potential of smart cities to leverage innovative technologies for improved energy efficiency, enhanced safety, and reduced environmental impact, with a particular emphasis on optimizing district heating systems.

Keywords: Georeferencing, Interactive Map, Smart Cities, Underground Infrastructure, Resource Management, Thermal Mapping.

Contact information:

Dejan BLAGOJEVIC 1, Prof. Appl. Studies
1970
Academy of Applied Technical and Preschool Teacher Studies, Aleksandra Medvedeva 20, 18000 Nis, Serbia
Dejan.blagojevic@akademijanis.edu.rs
https://orcid.org/0000-0002-9086-4392

Filip KOKALJ 2, Associate Professor
1973
Faculty of Mechanical Engineering University Maribor, Smetanova 17, 2000 Maribor, Slovenia
filip.kokalj@um.si
https://orcid.org/0000-0001-9234-7834

Ljubo GERMIC 3, Spec. Advisor

Energetika Maribor, Jadranska cesta 28, 2000 Maribor, Slovenia
ljubo.germic@energetika-mb.si

Milan PROTIC 4, Prof. Appl. Studies
1981
Academy of Applied Technical and Preschool Teacher Studies, Aleksandra Medvedeva 20, 18000 Nis, Serbia
milan.protic@akademijanis.edu.rs

ISBN: 978-86-6461-085-8
DOI: