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Databases and Information Systems: Contributions from ADBIS 2023 Workshops and Doctoral Consortium

Adam Przybyłek¹[0000-0002-8231-709X], Aleksandra
Karpus¹[0000-0001-6198-1234], Allel Hadjali²[0000-0002-4452-1647], Anton
Dignös³[0000-0002-7621-967X], Carmem S. Hara⁴[0000-0002-0674-9229], Danae
Pla Karidi⁵[0000-0002-3154-6212], Ester Zumpano⁶[0000-0003-1129-3737], Fabio
Persia⁷[0000-0002-1798-0215], Geneveva Vargas-Solar⁸[0000-0001-9545-1821],
George Papastefanatos⁵[0000-0002-9273-9843], Giancarlo
Sperli⁹[0000-0003-4033-3777], Giorgos Giannopoulos⁵[0000-0002-8252-9869], Ivan
Luković¹⁰[0000-0003-1319-488X], Julien Aligon¹¹[0000-0002-1954-8733], Manolis
Terrovitis⁵[0000-0003-0784-8402], Marek Grzegorowski¹²[0000-0003-4740-0725],
Mariella Bonomo¹³[0000-0002-1536-0872], Mirian Halfeld
Ferrari¹⁴[0000-0003-2601-3224], Nicolas Labroche¹⁵[0000-0002-2794-2124], Paul
Monsarrat¹⁶[], Richard Chbeir¹⁷[0000-0003-4112-1426], Sana
Sellami¹⁸[0000-0001-8302-3053], Seshu Tirupathi¹⁹[0000-0003-2998-0826], Simona
E. Rombo¹³[0000-0003-3833-835X], Slavica Kordić²⁰[0000-0002-3992-0096], Sonja
Ristić²⁰[0000-0003-0059-6062], Tommaso Di Noia²¹[0000-0002-0939-5462], Torben
Bach Pedersen²²[0000-0002-1615-777X], and Vincenzo
Moscatto⁹[0000-0002-0754-7696]

¹ Gdańsk University of Technology, Faculty of Electronics, Telecommunications and Informatics, Poland

adam.przybylek@gmail.com, alekarpu@pg.edu.pl

² LIAS - ISAE-ENSMA/University of Poitiers, France

allel.hadjali@ensma.fr

³ Free University of Bozen-Bolzano, Bozen-Bolzano, Italy

anton.dignoes@unibz.it

⁴ Universidade Federal do Paraná, Curitiba, Brazil

carmemhara@ufpr.br

⁵ Athena Research Center, Greece

danae@athenarc.gr, mter@athenarc.gr, giann@athenarc.gr, gpapas@athenarc.gr

⁶ DIMES, University of Calabria, Italy

e.zumpano@dimes.unical.it

⁷ University of L'Aquila, Italy

fabio.persia@univaq.it

⁸ CNRS, Univ Lyon, INSA Lyon UCBL, LIRIS UMR5205, Lyon, France

geneveva.vargas-solar@cnrs.fr

⁹ University of Naples "Federico II", Italy

vmoscatto@unina.it, giancarlo.sperli@unina.it

¹⁰ University of Belgrade, Faculty of Organizational Sciences, Serbia

ivan.lukovic@fon.bg.ac.rs

¹¹ Université de Toulouse-Capitole, IRIT, (CNRS/UMR 5505), Toulouse, France

julien.aligon@irit.fr

¹² University of Warsaw, Poland

m.grzegorowski@mimuw.edu.pl
¹³ University of Palermo, Italy
mariella.bonomo@community.unipa.it, simona.rombo@unipa.it
¹⁴ Université d'Orléans, LIFO, INSA CVL, Orléans, France
mirian@univ-orleans.fr
¹⁵ University of Tours, France
nicolas.labroche@univ-tours.fr,
¹⁶ RESTORE, France
paul.monsarrat@univ-tlse3.fr
¹⁷ Univ Pau & Pays Adour, E2S-UPPA, LIUPPA, EA3000, Anglet, France
richard.chbeir@univ-pau.fr
¹⁸ Aix Marseille Univ, Université de Toulon, CNRS, LIS, Marseille, France
sana.sellmi@univ-amu.fr
¹⁹ IBM Research Europe, Ireland
SESHUTIR@ie.ibm.com
²⁰ University of Novi Sad, Faculty of Technical Sciences, Serbia
slavica@uns.ac.rs, sdristic@uns.ac.rs
²¹ Polytechnic University of Bari, Italy
tommaso.dinoia@poliba.it
²² Aalborg University, Denmark
tbp@cs.aau.dk

1 Introduction

The 27th European Conference on Advances in Databases and Information Systems (ADBIS) aims at providing a forum where researchers and practitioners in the fields of databases and information systems can interact, exchange ideas and disseminate their accomplishments and visions. ADBIS originally included communities from Central and Eastern Europe, however, throughout its lifetime it has spread and grown to include participants from many other countries throughout the world. The ADBIS conferences provide an international platform for the presentation of research on database theory, development of advanced DBMS technologies, and their advanced applications. The ADBIS series of conferences aims at providing a forum for the presentation and dissemination of research on database theory, development of advanced DBMS technologies, and their advanced applications. ADBIS 2023 in Barcelona continues after Turin (2022), Tartu (2021), Lyon (2020), Bled (2019), Budapest (2018), Nicosia (2017), Prague (2016), Poitiers (2015), Ohrid (2014), Genoa (2013), Poznan (2012), Vienna (2011), Novi Sad (2010), Riga (2009), Pori (2008), Varna (2007), Thessaloniki (2006), Tallinn (2005), Budapest (2004), Dresden (2003), Bratislava (2002), Vilnius (2001), Prague (2000), Maribor (1999), Poznan (1998), and St. Petersburg (1997).

This year, ADBIS, attracted five workshops and a doctoral consortium.

- *1st Workshop on Advanced AI Techniques for Data Management and Analytics (AIDMA)*, organized by Anton Dignös (Free University of Bozen-Bolzano, Italy), Vincenzo Moscato (University of Naples “Federico II”,

- Italy), Giancarlo Sperli (University of Naples “Federico II”, Italy), Fabio Persia (University of L’Aquila, Italy), Nicolas Labroche (University of Tours, France), Julien Aligon (Université de Toulouse-Capitole, IRIT, France), Danae Pla Karidi (Athena Research Center, Greece), Giorgos Giannopoulos (Athena Research Center, Greece), George Papastefanatos (Athena Research Center, Greece), Manolis Terrovitis (Athena Research Center, Greece), Paul Monsarrat (RESTORE, France), Seshu Tirupathi (IBM Research Europe, Ireland), Torben Bach Pedersen (Aalborg University, Denmark), Sana Selami (Aix Marseille University, France), Richard Chbeir (University Pau & Pays Adour, France) and Allel Hadjali (Engineer School ENSMA, France)
- *4th Workshop on Intelligent Data – from data to knowledge (DOING)*, organized by Mirian Halfeld Ferrari (Université d’Orléans, INSA CVL, LIFO EA, France) and Carmem S. Hara (Universidade Federal do Paraná, Curitiba, Brazil).
 - *2nd Workshop on Knowledge Graphs Analysis on a Large Scale (K-Gals)*, organized by Mariella Bonomo (University of Palermo, Italy) and Simona E. Rombo (University of Palermo, Italy).
 - *5th Workshop on Modern Approaches in Data Engineering and Information System Design (MADEISD)*, organized by Ivan Luković (University of Belgrade, Faculty of Organizational Sciences, Serbia), Slavica Kordić (University of Novi Sad, Faculty of Technical Sciences, Serbia), and Sonja Ristić (University of Novi Sad, Faculty of Technical Sciences, Serbia).
 - *2nd Workshop on Personalization and Recommender Systems (PeRS)*, organized by Marek Grzegorowski (University of Warsaw, Poland), Aleksandra Karpus (Gdańsk University of Technology, Poland), Tommaso Di Noia (Politechnic University of Bari, Italy), and Adam Przybyłek (Gdańsk University of Technology, Poland).
 - The *ADBIS Doctoral Consortium*, organized by Genoveva Vargas Solar (LIRIS, French Council of Scientific Research, France) and Ester Zumpano (DIMES, Università della Calabria, Italy).

The ADBIS satellite events had its own international program committee, whose members served as the reviewers of papers included in this volume. This volume contains papers on the contributions of all workshops and the doctoral consortium of ADBIS 2023. In the following, for each event, we present its main motivations and topics of interest and we briefly outline the papers selected for presentations. The selected papers will then be included in the remainder of this volume. Some acknowledgements from the organizers are finally provided

2 AIDMA 2023: 1st Workshop on Advanced AI Techniques for Data Management and Analytics

2.1 Description

Artificial Intelligence (AI) methods are now well-established and have been fully integrated by the data management and analytics (DMA) community as an innovative way to address some of its challenges. For example, and without being

exhaustive, one may cite the personalization of queries on databases, the management of time series big data streams, the recommendation of dashboards in business intelligence, the indexing of large amounts of data possibly in distributed systems based on ML-based optimization methods, the guided exploration of novel data or the explanation of the provenance of data in queries. The AIDMA workshop fully embraces this new trend in data management and analytics. It aims at gathering researchers from both AI, data management and analytics to address the new challenges of the domain. These challenges are now of prime importance for several reasons.

Data are increasingly complex and, most of the time, are not simple tabular data. For example, one may consider multivariate temporal relationships between observations as time series, possibly with no synchronicity between observations. Others may view more general relations as graphs, such as in social networks, that carry multi-modal information such as text, sound, videos and user-related information with different links between them. Indeed, multimedia data allow fast and effective communication and sharing of information about peoples' lives, their behaviors, work, and interests, but they are also the digital testimony of facts, objects, and locations. In such a context, Social Media Networks (SMNs) actually represent a natural environment where users can create and share multimedia content such as text, images, video, audio, and so on. Within these "interest-based" networks, each user interacts with the others through multimedia content (text, image, video, audio) and such interactions create "social links" that well characterize the behaviors of the users. Here, in addition to social information (e.g., tags, opinions, insights, evaluations, perspectives, ratings, and user profiles) multimedia data can play a "key-role" especially from the perspective of Social Network Analysis (SNA): representing and understanding multimedia characteristics and user-to-item interaction mechanisms can be useful to predict user behavior, model the evolution of multimedia content and social graphs, design human-centric multimedia applications and services, just to make a few examples. AIDMA workshop aims to address these critical challenges by bringing together scientists, engineers, practitioners, and students in an interdisciplinary forum where they can share experiences and ideas, discuss the results of their research on models, methodologies and algorithms, and forge new collaborations that will lead to the development of new applications and tools to transform information extracted from SMNs into actionable intelligence.

The remarkable achievements of AI and DMA in the past and present have spurred a growing demand from high-stake domains such as Renewable Energy Systems for comprehensive data management and analysis solutions. To address these issues, AIDMA invites paper submissions in any field connected to AI tools and applications. Regarding the RES sector, the workshop focuses on complex and developing areas in data management, machine learning, and artificial intelligence techniques and applications, providing a thorough grasp of the various machine-learning methods and equipment that may be applied to the design, upkeep, and improvement of renewable energy systems, such as wind and solar parks. One of the workshop's main focuses will be the most recent develop-

ments in machine learning and how they apply to renewable energy systems, giving attendees a chance to learn about the various models and their efficacy in improving the performance of renewable energy systems. Such domains need efficient approaches that can be trusted by field experts, as the outcome of the analysis may directly impact the quality of life of millions of people worldwide.

Another direction for AIDMA workshop concerns medicine and healthcare management systems that now heavily rely on the recent progress of machine and deep learning to support complex decision tasks. Complex data acquisition, pre-processing and then analysis pipelines are set up to answer questions related to patients' medical situation or in a prospective way to learn more about diseases, healthcare paths, treatments, and physiological, chemical or biological processes involved in medicine and healthcare. As such, these decision systems delegate to end-to-end data-driven systems with no or little regulation, decisions that generally have a crucial impact on the life of patients.

These new approaches must consider the user as a first-class citizen in the data management and analysis process. This relates to the ability of the user to inflect the process and to understand the rationale of a data analysis, which is addressed in the explainability domain. Finally, interacting with users implies being able to manage efficiently the uncertainty attached to data as well as in any artificial intelligence process. Uncertainty needs to be managed at various levels of the data management process: data collection, data querying, machine learning and data analytics. For instance, the presence of uncertainty can be the source of semantics errors during query evaluation. Moreover, traditional machine learning and deep learning models do not consider uncertainty in data and predictions, while they are noise-prone. Then, quantifying uncertainty is a critical challenge for most machine learning techniques.

2.2 Keynote Speaker

The AIDMA workshop welcomes Michele Linardi (PhD in Computer Science), who is an assistant professor at Cergy Paris University (CYU - ETIS laboratory, France). His research interests span the areas of time series analytics and databases, with a great interest in machine learning for temporal data.

Multivariate time series analysis (MTS), such as classification, forecasting, and anomaly detection, are omnipresent problems in many scientific domains. In this context, several state-of-the-art solutions rely on deep learning (DL) architectures such as CNN (Convolutional Neural Network), LSTM (Long Short-Term Memory Network), and attention-based architecture like Transformer.

Despite their effectiveness and usage, DL models remain uninterpretable black boxes, where the user feeds an input and obtains an output without understanding the motivations behind that decision. In countless real-world domains, from legislation and law enforcement to healthcare and precision agriculture, diagnosing what aspects of a model's input drive its output is essential to ensure that decisions get driven by appropriate insights in the context of its use. In this sense, explainable machine learning techniques (xAI) aim to provide a

solid descriptive approach to DL models, and it is at the cusp of becoming a compulsory requirement in all use cases.

In this talk, we introduce and present the main state-of-the-art xAI methods adopted in the MTS DL models. Among several technical and fundamental aspects, we will show how xAI solutions become effective when they can leverage the causal relationships (between target and predictors) occurring over MTS variables. We will also present how xAI solutions can be effective in DL Domain Adaptation which is an omnipresent problem in various scientific fields, including Healthcare.

2.3 Selected Papers

The paper *“Data exploration based on local attribution explanation: a medical use case”* [11] presents a new approach that considers the explanation description space as a first-class citizen for data exploration. This approach is of particular interest as it combines the determination of a model in the data space, and then benefits from the explanations of the complex relationships extracted by this model as a basis for unsupervised study of the data. The underlying research question relates to the informative and discriminating power of the influence explanation space, which generally embodies only the most distinctive features for a specific class and their importance attached to a specific value of the features.

The paper *“Explainability based on feature importance for better comprehension of machine learning in healthcare”* [10] presents a framework for analysis of features’ importance (FI) in the context of healthcare and specifically for Systemic Inflammatory Response Syndrome. The originality of the paper lies in the use of the FI based on the decision tree selection procedure as well as Shap, which means using both ante-hoc/post-hoc methods. Other problems addressed in the paper relate to the impact of the ML pipeline on explanation such as the classifier or the sampling to limit unbalancing of data.

The paper *“An empirical study on the robustness of active learning for biomedical image classification under model transfer scenarios”* [19] proposes a study of the effects of transferring an actively sampled training data set from an acquisition model to different successor models for biomedical image classification tasks. The research shows that training a successor model with an actively-acquired data set is most promising if the acquisition and successor models are of similar architecture.

In the paper *“Holistic Analytics of Sensor Data From Renewable Energy Sources: A Vision Paper”* [20] the authors present their vision for a next-generation time series management system that efficiently can manage vast amounts of time series across edge, cloud, and client.

The paper *“Evaluating the Robustness of ML Models To Out-of-Distribution Data Through Similarity Analysis”* [26] addresses the perception accuracy problem from a data out-of-distribution (OOD) point-of-view and proposes a method for analyzing datasets from a use-case scenario perspective, detecting and quantifying OOD data on the dataset level.

3 DOING 2023: 4th Workshop on Intelligent Data – from Data to Knowledge

3.1 Description

The DOING Workshop focuses on transforming data into information and then into knowledge. It gathers researchers from natural language processing, databases, and artificial intelligence. DOING 2023 received 9 submissions, out of which 3 were accepted as full papers and 2 as short papers, resulting in an acceptance rate of 50%. Each paper received three reviews from members of the program committee. The final program featured works in the areas of information extraction from textual data, data classification, and quantum technology applied to natural language processing and classification.

This workshop is an event sponsored by the French network MADICS²³. More specifically, it is an event of the action DOING²⁴ in MADICS and of the DOING working group in the regional French network DIAMS²⁵.

The workshop is the result of the collective effort of a large community, which we gratefully acknowledge. We thank the ADBIS conference chairs, who worked hard to support the workshop organization. We are also grateful to the members of the program committee, who did an outstanding job, providing timely and thoughtful reviews. Finally, we are grateful to the authors who submitted their work to DOING 2023.

3.2 Selected Papers

Three full papers were presented at DOING 2023. The first one, entitled “*Labeling Portuguese Man-of-War Posts Collected from Instagram*” [33], details the process of choosing labels for classifying posts from Instagram as legitimate occurrences of the cnidarian Portuguese Man-of-War on the Brazilian coast. It is shown that labels for manual labeling may not always be adequate for training a machine-learning classification model. The article reports on the need for analyzing the labeling process in order to adapt it and generate an adequate dataset for training a classification model. Experimental analysis are presented to show the effect of this process on the quality of the resulting model.

The second paper, entitled “*Semantic Business Trajectories Modeling and Analysis*” [2] presents a method for constructing business trajectories based on online news data. Methods for topic modelling and named entity recognition are used to extract information from the news and semantically enrich the trajectory data. The goal of the study is to provide spatial, temporal and contextual views of businesses over time, which can also be used to understand their impacts on the environment, such as noise pollution and carbon emissions.

The third paper, “*A Text Mining Pipeline for Mining the Quantum Cascade Laser Properties*” [21], tackles the problem of extracting information on quantum

²³ <https://www.madics.fr/>

²⁴ <https://www.madics.fr/actions/doing/>

²⁵ <https://www.univ-orleans.fr/lifo/evenements/RTR-DIAMS/>

cascade laser properties from scientific literature, such as working temperature, optical power, lasing frequency, material design and barrier thickness. The proposed method is based on an extension of the ChemDataExtractor pipeline with parsing rules to manage special characters and formats that are specific to the application. Experimental analysis shows that the proposed rules improve the performance of the extracted information.

Two short papers completed the program of DOING 2023. Both are in an exciting area of research of quantum computing. The paper *“Ensemble Learning based Quantum Text Classifiers”* [6], relates quantum computing with natural language processing. It describes a comparative evaluation of text classification using different models in the Lambeq Quantum NLP toolkit. Finally, *“Exploring the Capabilities and Limitations of VQC and QSVC for Sentiment Analysis on Real-World and Synthetic Datasets”* [4], evaluates the performance of two quantum classifiers for sentiment analysis applications. The evaluation is based on implementing a quantum version of a Support Vector Classifier and a Variational Quantum Classifier for running experiments over a synthetic dataset and IMDB.

4 K-Gals 2023: 2nd Workshop on Knowledge Graphs Analysis on a Large Scale

4.1 Description

Knowledge Graphs are powerful models to represent networks of real-world entities, such as objects, events, situations, and concepts, by illustrating the relationships between them. Information encoded by knowledge graphs is usually stored in graph databases, and visualized as graph structures. Although these models have been introduced in the Semantic Web context, they have recently found successful applications also in other contexts, e.g., the analysis of financial, social, geospatial and biomedical data.

Knowledge Graphs often integrate datasets from various sources, which frequently differ in their structure. This, together with the increasing volumes of structured and unstructured data stored in a distributed manner, bring to light new problems related to data/knowledge representation and integration, data querying, business analysis and knowledge discovery.

The ultimate goal of K-GALS is to provide participants with the opportunity to introduce and discuss new methods, theoretical approaches, algorithms, and software tools that are relevant to the Knowledge Graphs-based research, especially when it is focused on a large scale. In this regard, interesting open issues include how Knowledge Graphs may be used to represent knowledge, how systems managing Knowledge Graphs work, and which applications may be provided on top of a Knowledge Graph, in the distributed.

4.2 Selected Papers

The 2023 edition of K-GALS includes five papers, all accepted as research full papers after a very selective peer review process, which are published in this volume. Research reported in the accepted papers spans from the most theoretical foundations [37], to notions related to software development [34], and applications in contexts such as sustainability [18,16] and biomedicine [5].

In the manuscript “*P2KG: Declarative Construction and Quality Evaluation of Knowledge Graph from Polystores*” [37] the authors provide a systematic way to build and evaluate Knowledge Graphs from diverse data sources. The approach proposes a new generic language to specify the mapping rules to guide users to translate data from relational and graph sources into a meaningful Knowledge Graph. The mapping language specifies how elements of the Knowledge Graph are defined as views over one or more data sources. The authors define three types of constraints, derived from source data, user specifications, and common rules of a good Knowledge Graph, and translate them into unified expressions in the form of graph functional dependencies and extended graph dependencies to evaluate the quality, correctness, and consistency, given the mapping rules applied to construct the Knowledge Graph.

The manuscript “*An ArchiMate-Based Thematic Knowledge Graph for Low-Code Software Development Domain*” [34] illustrates how ArchiMate modelling language can be applied at the ontology level of a Knowledge Graph for representing knowledge that concerns an enterprise. In particular, the ArchiMate-based Knowledge Graph is proposed for representing knowledge about low-code software development, with the purpose to make this knowledge available for enterprise management. Navigating the Knowledge Graph enables stakeholders to exploit knowledge about different aspects of lowcode development and promote the use of the low-code development approach in their enterprises.

The authors of the paper “*Using Knowledge Graphs to Model Green Investment Opportunities*” [18] discuss how Knowledge Graphs can be used to represent investment opportunities for the green transition, and they refer to a case study investment for the green transition targeting African regions. The described project aims to develop a system that automatically detects and analyzes green investment opportunities. In the Knowledge Graph, each funding initiative has been described as a subgraph itself, with nodes and relationships used to encode relevant facts, such as the type of investment or the provided budget.

The authors of the paper “*Knowledge Graphs Embeddings for Link Prediction in the Context of Sustainability*” [16] propose a framework for building a collaborative platform that can support the System Dynamics experts in identifying new partnerships and innovative solutions. The approach uses a Knowledge Graph that can track the links among stakeholders and store their metadata. It is in charge of leveraging machine learning methodologies and models for data analysis, as well as the prediction of connections among stakeholders and potential work tables to facilitate the achievement of the Sustainability Development Goals (SDGs) in specific contexts.

Finally, the manuscript “*A Knowledge Graph to Analyze Clinical Patient Data*” [5] describes how Knowledge Graphs can be used to represent patient data coming from clinical folders information. The main aim is to provide suitable classifications of patients, in order to allow a deeper understanding of possible (side) effects that the same treatment may cause on different patients. The Knowledge Graph building and related software services for its analysis are implemented upon the Neo4J NoSQL database.

5 MADEISD 2023: 5th Workshop on Modern Approaches in Data Engineering and Information System Design

5.1 Description

For decades, there has been an open issue of how to support the information management process to produce useful knowledge and tangible business values from the data being collected. One of the hot questions in practice is still how to effectively transform large amounts of daily collected operational data into useful knowledge from the perspective of declared company goals, and how to set up the information design process aimed at the production of effective software services. Nowadays, we have great theoretical potential for applying new and more effective approaches in data engineering and information system design. However, it is more likely that the actual deployment of such approaches in industry practice is far behind their theoretical potential.

The main goal of the Modern Approaches in Data Engineering and Information System Design (MADEISD) workshop is to address open questions and real potentials for various applications of modern approaches and technologies in data engineering and information system design to develop and implement effective software services in a support of information management in various organization systems. The intention was to address the interdisciplinary character of a set of theories, methodologies, processes, architectures, and technologies in disciplines such as Data Engineering, Information System Design, Big Data, NoSQL Systems, Data Streams, Internet of Things, Cloud Systems, and Model Driven Approaches in development of effective software services. In this issue, from 14 submissions, after a rigorous selection process, we accepted 7 papers for publication at ADBIS 2023.

5.2 Selected Papers

This edition of MADEISD workshop includes the following 7 papers, where the first 3 of them have been accepted as full papers and the rest 4 as short papers.

In the paper “*Towards Automatic Conceptual Database Design based on Heterogeneous Source Artifacts*” [3], the authors present an early prototype of the tool named DBomnina. It is the first online web-based tool enabling the automatic derivation of conceptual database models from heterogeneous source artifacts, including business process models and textual specifications. DBomnina employs

other pre-existing tools to derive conceptual models from sources of the same type and then integrates those models, whereby the main challenge is related to the integration of conceptual models that are automatically generated and can be considered unreliable. The authors come to the initial results showing that the implemented tool derives models that are more precise and complete compared to the models derived from sources of the same type.

The authors of the paper “*Lightweight Aspect-Oriented Software Product Lines with Automated Product Derivation*” [32] advocate that applications of the aspect-oriented software product lines are facing two obstacles: establishing software product lines is challenging and aspect-oriented programming is not that widely accepted. To address the obstacles, the authors propose an approach to establishing lightweight aspect-oriented software product lines with automated product derivation. The authors evaluate the approach as simple and accessible since developers decide about variation points directly in the code without any assumption on the development process and applied management. Also, the proposed approach allows for variability management by making the code readable, configurable, and adaptable mainly to scripts and code fragments in a modular and concise way, while the use of annotations helps in preserving feature models in code. The authors present the practical usability of the approach on a battleship game and the data preprocessing pipeline product lines.

The authors of the paper “*Comparison of selected neural network models used for automatic liver tumor segmentation*” [24] consider the problem of automatic and accurate segmentation of liver tumors, as crucial for diagnosing and treating hepatocellular carcinoma or metastases. The authors present a study focusing on tumor segmentation as a more critical aspect from a medical perspective, compared to liver parenchyma segmentation, which is the focus of most authors in publications. The authors trained four state-of-the-art models and used them to compare with UNet in terms of accuracy. Based on polar coordinates and Visual Image Transformer (ViT), two of them have been adopted for the specified task. Experiments on a selected public dataset have demonstrated that the proposed ViT-based network can accurately segment liver tumors from CT images end-to-end, outperforming many existing methods. The authors state that the obtained results seem to be clinically relevant.

Index tuning in databases is a critical task that significantly impacts database performance. However, manually configuring indexes is often time-consuming and, as a rule, inefficient. In the paper “*Intelligent index tuning using reinforcement learning*” [27], the authors consider using the reinforcement learning approach to create database indexes. The authors developed an agent that can learn to make optimal decisions for configuring indexes in a chosen database. They also proposed an evaluation method to measure database performance regarding the loading, querying, and processing power of multiple query streams simultaneously. It is to be used in the proposed reinforcement learning algorithm.

The following paper also addresses the problem of index recommendation in databases. The authors of the paper “*Automatic Indexing for MongoDB*” [12] present a new method for automated index suggestions for MongoDB, based

solely on the queries, called aggregation pipelines, without requiring data or usage information. The solution handles complex aggregations and is suitable for cloud and standalone databases. The authors validated the algorithm and showed that all suggested indexes were used. The authors state that this is MongoDB’s first query-based solution for automated indexing.

The paper “*From High-Level Language to Abstract Machine Code: An Interactive Compiler and Emulation Tool for Teaching Structural Operational Semantics*” [35] is devoted to the development of an abstract machine compiler specifically for the Structural Operational Semantics (SOS) framework. This compiler serves as a formal framework for programming language specification and analysis. The authors put focus on the development process, such as translating high-level language constructs into low-level machine instructions and implementing memory models. Their ultimate objective is to provide valuable insights into the design and implementation of an abstract machine compiler and emulator with potential applications in language design and verification. The tools developed can also be applied in educational settings to aid the teaching process.

The author of the paper “*Decentralised Solutions for Preserving Privacy in Group Recommender Systems*” [31] states that privacy in Group Recommender Systems (GRS) has always been a core issue since most recommendation algorithms rely on user behavior signals and contextual information that may contain sensitive information. Existing works in this domain mostly distribute data processing tasks without addressing privacy, and the solutions that address privacy for GRS, e.g., k-anonymization and local differential privacy, remain centralized. In the paper, the author identifies and analyzes privacy concerns in GRS and provides guidelines on how decentralized techniques can address privacy problems.

6 PeRS 2023: 2nd Workshop on Personalization and Recommender Systems

6.1 Description

Recommender systems play an essential role in our daily lives, whether we read news, use social media, or make online purchases. As a result, this field has garnered increasing attention from academics and industry professionals. User Modelling is intricately intertwined with Recommender Systems as it enables personalization, a crucial aspect of developing innovative recommendation techniques. However, User Modelling encompasses a broader scope, encompassing areas such as user representation, personalized search, adaptive educational systems, and intelligent user interfaces.

In 2022, Aleksandra Karpus and Adam Przybyłek established the workshop on Personalization and Recommender Systems (PeRS) as part of the FedC-SIS multiconference, aiming to provide a platform for academics and industry practitioners to connect, collaborate, and learn from one another. In 2023, PeRS (<https://pers.lasd.pl>) joined ADBIS, further expanding its reach and opportunities for advancing the field of User Modelling and Recommender Systems.

6.2 Selected Papers

PeRS'23 attracted 14 submissions. After a rigorous review, two full and five short papers were accepted.

The paper titled “*Overcoming the Cold-Start Problem in Recommendation Systems with Ontologies and Knowledge Graphs*” [23] presents a solution to the cold-start problem in recommendation systems by leveraging Ontologies and Knowledge Graphs. The authors propose incorporating a semantic layer into text-based methods. The implicit and explicit characteristics of item text attributes are captured by generating a knowledge graph using ontologies, enriching the item profile with semantically related keywords. The proposed approach is evaluated against state-of-the-art text feature extraction techniques, demonstrating improved recommendation performance in scenarios with limited user data and interactions. Overall, this research enhances recommendation systems by providing a novel method combining ontologies and knowledge graphs with text-based approaches.

Frikha et al. [14] propose a personalized service recommendation framework in the paper titled “*A Recommendation System for Personalized Daily Life Services to Promote Frailty Prevention*”. The framework aims to assist senior citizens in selecting appropriate services to prevent frailty and improve autonomy. It uses a multidimensional evaluation of the elderly person, considering both user’s status information and service-related data, and defines a four-step recommendation process using knowledge-based and rule-based approaches to generate personalized recommendations that align with the individual’s needs. The proposal’s effectiveness is evaluated using different representative scenarios, and an example is described in detail to demonstrate the developed recommendation process, algorithms, and relevant rules.

The paper entitled “*Design-focused Development of a Course Recommender System for Digital Study Planning*” [30] identifies important factors to consider when creating a course recommender system (CRS) for higher education. The researchers analyzed and summarized students’ selection criteria and processes to establish the requirements for the system. They then developed a design prototype and evaluated it through think-aloud user tests. The paper’s main contribution is identifying six guidelines for designing an effective CRS.

In the paper titled “*Systematic Literature Review on Click Through Rate Prediction*” [25], the authors present the findings of a comprehensive literature review that will assist researchers in getting a head start on developing new solutions. The most prevalent models were variants of the state-of-the-art DeepFM model.

The paper titled “*Neural Graph Collaborative Filtering: analysis of possibilities on diverse datasets*” by Kobiela et al. [22] focuses on assessing the possibilities of the NGCF (Neural Graph Collaborative Filtering) technique on diverse datasets. The main contribution of this work involves replicating the research conducted by Wang et al. [36] and expanding it to encompass numerous new and diverse datasets. Additionally, the paper prepares the groundwork for achieving

reproducible results by providing Python scripts available in the GitHub repository.

Galka et al. [15] in their paper “*Performance and reproducibility of BERT4Rec*” aim to assess the BERT4Rec’s reproducibility on MovieLens1M and measure its performance on Netflix Prize dataset in comparison to other recommender systems. Overall findings suggest that while using a proper implementation, BERT4Rec can still be called a state-of-the-art solution, however, additional work is needed to increase reproducibility of the original model.

The paper entitled “*Recommender Chatbot as a Tool for Collaborative Business Intelligence in Tourism Domain*” [8] introduces a framework for a virtual assistant that incorporates the following crucial elements: a conversational unit, a task identification, data exploration component, and a recommendation model. Tourists often search for information from different sources and compare found facts, leading to spending significant amounts of time comparing descriptions and photos across different platforms before deciding. To overcome this challenge, virtual assistants have become increasingly common.

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7 DC 2023: ADBIS Doctoral Consortium

7.1 Description

The ADBIS 2023 Doctoral Consortium (DC) is a forum for PhD students to present their research projects to the scientific community. DC papers describe the status of PhD student’s research, a comparison with relevant related work, their results, and plans on how to experiment, validate and consolidate their contribution. Through the DC, the PhD Consortium allows PhD students to establish international collaborations with members and participants of the ADBIS community.

The ADBIS 2023 DC received 22 submitted papers evaluated through a selective peer-review process by an international program committee. After a thorough evaluation, ten papers were selected for presentation, seven of which are included in this volume, giving an overall acceptance rate of 45%.

The ADBIS 2023 DC program also included a panel titled “Being productive and developing relevant research vs achieving well-being and a well-balanced

life. How to have everything and survive without leaving your skin on the line?”. Accomplished professionals in academia, industry, and entrepreneurship did the panel discussion. Finally, recognizing the importance of Diversity and Inclusion (D&I) according to the initiative promoted by the conference, the DC organized a data-driven activity to create inclusion awareness in research together with the D&I conference program.

7.2 Selected Papers

The program of this DC edition included eighth oral presentations with sessions where PhD students received feedback from a selected group of mentors about the opportunities and perspectives they perceive and suggest to pursue their work. The following papers composed the DC program:

The article *“Towards a researcher-in-the-loop driven curation approach for quantitative and qualitative research methods”* by Alejandro Adorjan [1], describes challenges and initial results concerning the modelling researcher in-the-loop curation for qualitative research methodologies.

The article *“Tackling the RecSys Side Effects via Deep Learning Approaches”* by Erica Coppolillo [9] presents research activities aimed at analyzing and mitigating the impact of Recommender Systems in changing users’ preferences and affecting niche items.

In the article *“Deep learning techniques for television broadcast recognition”* [7] Federico Candela proposes several deep-learning techniques and the advancement of research in this area for TV program classification on long-form video.

The article *“Intelligent Technologies for Urban Progress: Exploring the Role of AI and Advanced Telecommunications in Smart City Evolution”*, by Enea Vincenzo Napolitano [28], contributes to the understanding of how AI and advanced telecommunications can drive urban progress and foster the sustainable evolution of smart cities.

In the article *“Process Mining solutions for public administration”* [13], Simona Fioretto, shows the current AI application for public administration (PA), and presents process discovery techniques that could practically improve PA effectiveness.

In the article *“Automatic Discovery of Zones of Interests with Maritime Trajectory Mining”* [17], Omar Ghannou describes a method and an algorithm for trajectory mining to identify specific trajectory points called zones of interest (ZOI).

In the article *“Towards reliable machine learning”* [29], Simona Nisticò focuses on the Explainable Artificial Intelligence topic giving an overview of some of the open problems and describing some methodologies proposed to face them.

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We, Genoveva Vargas Solar and Ester Zumpano, doctoral consortium co-chairs, hope readers will enjoy reading the DC papers and follow their evolution in other publications!

References

1. Adorjan, A.: Toward a researcher-in-the loop driver curation approach for quantitative and qualitative research methods. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
2. Arslan, M., Cruz, C.: Semantic business trajectories modeling and analysis. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
3. Banjac, G., Brdjanin, D., Banjac, D.: Towards automatic conceptual database design based on heterogeneous source artifacts. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
4. Belhadef, H., Benchiheb, H., Lebdjiri, L.: Exploring the capabilities and limitations of vqc and qsvc for sentiment analysis on real-world and synthetic datasets. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
5. Bonomo, M., Ippolito, F., Morfea, S.: A knowledge graph to analyze clinical patient data. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
6. Bouakba, Y., Belhadef, H.: Ensemble learning based quantum text classifiers. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
7. Candela, F.: Deep learning techniques for television broadcast recognition. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
8. Cherednichenko, O., Muhammad, F.: Recommender chatbot as a tool for collaborative business intelligence in tourism domain. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
9. Coppolillo, E.: Tackling the recsys side effects via deep learning approaches. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)

10. Das, P.P., Wiese, L.: Explainability based on feature importance for better comprehension of machine learning in healthcare. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
11. Escriva, E., Doumard, E., Excoffier, J.B., Aligon, J., Monsarrat, P., Soulé-Dupuy, C.: Data exploration based on local attribution explanation: a medical use case. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
12. de Espona Pernas, L., Vichalkovski, A., Steingartner, W., Pustulka, E.: Automatic indexing for mongodb. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
13. Fioretto, S.: Process mining solutions for public administration. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
14. Frikha, G., Lorca, X., Pingaud, H., Taweel, A., Bortolaso, C., Borgiel, K., Lamine, E.: A recommendation system for personalized daily life services to promote frailty prevention. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
15. Galka, A., Grubba, J., Walentukiewicz, K.: Performance and reproducibility of bert4rec. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
16. Galluzzo, Y., Gennusa, F.: Knowledge graphs embeddings for link prediction in the context of sustainability. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
17. Ghannou, O.: Automatic discovery of zones of interests with maritime trajectory mining. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
18. Grani, G., Di Rocco, L., Ferraro Petrillo, U.: Using knowledge graphs to model green investment opportunities. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
19. Janusko, T., Gonsior, J., Thiele, M.: An empirical study on the robustness of active learning for biomedical image classification under model transfer scenarios. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
20. Jensen, S.K., Thomsen, C.: Holistic analytics of sensor data from renewable energy sources: A vision paper. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DO-*

- ING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
21. Kerre, D., Laurent, A., Maussang, K., Owuor, D.: A text mining pipeline for mining the quantum cascade laser properties. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings. Barcelona, Spain (2023)
 22. Kobiela, D., Groth, J., Sieczyński, M., Wolniak, R., Pastuszak, K.: Neural graph collaborative filtering: analysis of possibilities on diverse datasets. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
 23. Kuznetsov, S., Kordik, P.: Overcoming the cold-start problem in recommendation systems with ontologies and knowledge graphs. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
 24. Kwiatkowski, D., Dziubich, T.: Comparison of selected neural network models used for automatic liver tumor segmentation. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
 25. Leszczelowska, P., Bollin, M., Grabski, M.: Systematic literature review on click through rate prediction. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
 26. Lindén, J., Forsberg, H., Daneshtalab, M., Söderquist, I.: Evaluating the robustness of ml models to out-of-distribution data through similarity analysis. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
 27. Matczak, M., Czocharński, T.: Intelligent index tuning using reinforcement learning. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
 28. Napolitano, E.V.: Intelligent technologies for urban progress: Exploring the role of ai and advanced telecommunications in smart city evolution. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
 29. Nistico', S.: Towards reliable machine learning. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)
 30. Ochs, M., Hirmer, T., Past, K., Henrich, A.: Design-focused development of a course recommender system for digital study planning. In: New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)

31. Paldauf, M.: Decentralised solutions for preserving privacy in group recommender systems. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
32. Perdek, J., Vranić, V.: Lightweight aspect-oriented software product lines with automated product derivation. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
33. Rocha, H.F., Nascimento, L.S., Camargo, L., Noernberg, M., Hara, C.S.: Labeling portuguese man-of-war posts collected from instagram. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
34. Rokis, K., Kirikova, M.: An archimate-based thematic knowledge graph for low-code software development domain. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
35. Steingartner, W., Sivý, I.: From high-level language to abstract machine code: An interactive compiler and emulation tool for teaching structural operational semantics. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*
36. Wang, X., He, X., Wang, M., Feng, F., Chua, T.S.: Neural graph collaborative filtering. In: *Proceedings of the 42nd International ACM SIGIR Conference on Research and Development in Information Retrieval*. p. 165–174. SIGIR'19, Association for Computing Machinery, New York, NY, USA (2019). <https://doi.org/10.1145/3331184.3331267>
37. Zheng, X., Dasgupta, S., Gupta, A.: P2kg: Declarative construction and quality evaluation of knowledge graph from polystores. In: *New Trends in Database and Information Systems - ADBIS 2023 Short Papers, Doctoral Consortium and Workshops: AIDMA, DOING, K-Gals, MADEISD, PeRS, Barcelona, Spain, September 4-7, 2023, Proceedings (2023)*