

1st European Symposium on Information Systems Engineering (ESISE)

Editors: Prof. Dr. Gilbert Fridgen & Prof. Dr. Robert Keller

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Introduction

Due to their inherent socio-technical nature, the engineering of information systems creates quite distinctive challenges. Addressing them requires not only a deep understanding of technical capabilities, but also of the respective application area, and the behavior of the intended users. Being interdisciplinary by design, the Information Systems field provides a broad tool-set to address these challenges.

We are thus delighted to present the proceedings of the **1st European Symposium on Information Systems Engineering (ESISE)**, held from September 11 to 13, 2024, at the Kempten University of Applied Sciences in Kempten, Germany. This symposium brought together researchers and thought leaders to explore the latest advancements and challenges in the field of information systems engineering.

With the ESISE we would like to create a platform for interdisciplinary collaboration among academics in information systems engineering from multiple universities in Europe. In our presentations, researchers were able to disseminate cutting-edge research findings and practical experiences to advance the field. In subsequent discussions, we identified emerging challenges and opportunities in information systems engineering, particularly in the context of rapidly evolving technologies.

Key Themes

The papers presented at this symposium covered a diverse range of topics, reflecting the multifaceted nature of information systems engineering. The key themes included:

- **Artificial Intelligence and Machine Learning:** Exploration of hybrid intelligence systems, applications of large language models (LLMs) in various domains such as ticketing systems and smart meter data gap filling.
- **Blockchain and Decentralization:** Analyses of digital infrastructures, security risks associated with blockchain technologies, and the economic impacts of missing NFT images.
- **Energy Systems and Sustainability:** Studies on energy literacy, flexibility provision, dynamic tariffs, and the integration of renewable energy sources into existing infrastructures.
- **Privacy and Security:** Investigations into privacy concerns in central bank digital

currencies, threat modeling in time series data analysis, and security awareness training efficacy.

- **Tourism and Visitor Management:** Research on visitor behavior analysis, crowding perceptions, and the use of technology to enhance tourism experiences.
- **Design Science Research:** Application of design science methodologies to enhance ESG trust and develop evaluation approaches in the energy domain.

We believe that the insights and innovations shared during the symposium will significantly contribute to the advancement of information systems engineering. We extend our sincere gratitude to all authors, reviewers, and participants who made this event a success.

We hope that these proceedings will serve as a valuable resource for researchers and practitioners, inspiring future work and collaboration in this dynamic field.

Acknowledgments

The success of the **1st European Symposium on Information Systems Engineering (ESISE)** is the result of the collective efforts of many individuals and organizations. We would like to express our heartfelt appreciation to:

- **The Authors:** For their high-quality submissions and contributions, which form the backbone of this symposium.
- **The Organizing Committee:** For their dedication and hard work in planning and executing the symposium.
- **University of Applied Sciences Kempten and SnT - University of Luxembourg:** For their support and collaboration in hosting this event.
- **Participants:** For their active engagement, stimulating discussions, and contributions to the success of the symposium.

We also acknowledge the invaluable assistance of the administrative staff and volunteers who worked tirelessly behind the scenes to ensure a seamless experience for all attendees.

Thank you all for your commitment and support.

Cite This Work

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Academic Chairs and Organization

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Hybrid Intelligence

Author: Igor TCHAPPI

Institution: SnT - University of Luxembourg

Abstract:

Hybrid intelligence systems combine machine and human intelligence to overcome the limitations of current AI systems. This paper introduces the concept of hybrid intelligence, outlining its potential to enhance AI capabilities. The paper also explores the role of humans as collaborators in AI processes, highlighting the importance of understanding human contributions in depth. By identifying key gaps and opportunities in existing methodologies, the paper sets the stage for future advancements in the field. The paper concludes with a discussion of short-term and long-term research directions, aimed at improving the effectiveness and efficiency of hybrid intelligence systems.

LLMs for the ticketing systems

Author: Qianbo ZANG

Institution: SnT - University of Luxembourg

Abstract:

The Reasoning & Action (ReAct) is a technique for prompting Large Language Models (LLMs), which extends the Chain-of-thought (CoT) technique to enable LLMs to generate actions. The ReAct is a loop structure where LLMs generate Thought, Action, and Observation. The LLMs can use Observation for the next iteration generation (Thought, Action, Observation). The ReAct has strong explainability, extensibility, and generalizability. It gradually replaces few-shot learning methods and becomes the State of the Arts. Because the ReAct addresses the drawback of few-shot learning methods. If few-shot prompts are not relevant to the target tasks, the accuracy of LLMs will decrease. Helpdesk ticketing systems help communication among clients, company employees, and company managers for IT support. Because ticketing systems involve many IT applications with limited and unbalanced datasets, traditional machine learning or database methods cannot accurately classify the target requirements. We propose a new helpdesk ticketing system using LLMs.

LLMs for Gap Filling in Smart Meter Data

Author: Amir SARTIPI

Institution: SnT - University of Luxembourg

Abstract:

One of the main pillars of the energy transition is the shift towards smart grids, enabled by the deployment of advanced actuators and sensors such as smart meters. However, smart meter data often encounters missing values due to sensor failures, transmission errors, and other disruptions, such as communication loss. These missing values can lead to biased consumption analyses and unreliable predictions, resulting in technical and economic setbacks. Recent advancements in machine learning offer promising new methods for addressing these data gaps more effectively than traditional statistical techniques, which often rely on interpolation and regression. This research investigates the potential of large language models (LLMs) for time series gap filling in smart meter data and compares their performance with both traditional and other machine learning approaches. We conduct experiments using a publicly available smart meter dataset, where we artificially introduce missing values of varying lengths to evaluate the performance of these models.

Balancing centralization and decentralization in cross-organizational digital infrastructures

Authors: Eduard HARTWICH & Alexandra HOESS

Institution: SnT - University of Luxembourg

Abstract:

Balancing centralization and decentralization in the architecture and governance of cross-organizational digital infrastructures can be difficult. Sometimes, it may not be possible to follow best practices such as archetypical decentralization trajectories and architecture governance mirroring. To explore how digital infrastructure managers navigate these atypical cases, we study the complex evolution of two blockchain infrastructures for the delivery of public services. We find that both infrastructures employed what we term composite decentralization strategies. These strategies combine temporary departures from archetypical decentralization trajectories (trajectory compromises) and architecture governance mirroring (mirroring compromises). They appear to be especially effective in the early stages of a digital infrastructure but require careful management. We consolidate our insights in a process model for implementing composite decentralization strategies. Our work contributes a ‘strategic compromise’ perspective to the decentralization debate of digital infrastructures.

The value of quantitative research: A guide to its practical industry applications

Author: Marija TATOMIR

Institution: SnT - University of Luxembourg

Abstract:

Quantitative research offers invaluable contributions across various fields due to its systematic approach to data collection and analysis. By employing statistical methods, researchers can derive objective, measurable, and generalizable conclusions from large datasets, which is crucial for establishing trends and correlations. This form of research is particularly beneficial when exploring phenomena that require precise measurement and comparison, making it a cornerstone in fields like economics, medicine, social sciences and fintech. For instance, in fintech, quantitative research can quantify the impact of specific interventions on large populations, providing evidence-based guidance for policy decisions. Additionally, its reliance on numerical data allows for replication and verification, enhancing the reliability of findings. Practical applications of quantitative research are vast. In business, it helps companies understand market trends, customer preferences, and the effectiveness of marketing strategies through surveys and data analytics. In education, it supports the evaluation of teaching methods and learning outcomes by analyzing test scores and other measurable indicators. Moreover, in technology development, quantitative research can optimize processes and product designs by analyzing user data and feedback. The structured nature of quantitative research, combined with its ability to handle vast amounts of data, makes it indispensable for decision-making processes. By translating complex realities into numerical data, it provides a clear, concise foundation upon which strategies and policies can be built, ensuring they are both effective and efficient.

Ghosts in the Blockchain: Predictive Analysis and Economic Impact of Missing NFT Images

Author: Orestis Papageorgiou

Institution: SnT - University of Luxembourg

Abstract:

In this study, we analyze a comprehensive dataset of 55 million non-fungible tokens (NFTs) to investigate the persistence of their associated images and predict potential value loss due to missing images. We identify key characteristics and trends within the dataset, including the distribution of image availability across various NFT platforms, file types, and hosting services. Our analysis reveals significant factors influencing image retention, such as hosting platform reliability, NFT age, and metadata integrity. Additionally, we develop a predictive model to ascertain the likelihood of image availability for NFTs in the future, leveraging machine learning techniques to incorporate variables such as hosting service, image type, and historical uptime. Furthermore, we create a model to estimate the economic impact of missing NFT images. By analyzing market data and correlating image availability with NFT prices, we quantify the potential value loss, highlighting the financial risks associated with image disappearance. This research offers valuable insights for NFT creators, collectors, and platforms, emphasizing the importance of reliable image hosting and proactive measures to ensure long-term accessibility.

Day-Trip vs. Overnight: Analyzing the Digital Divide in Tourist Information Gathering

Authors: Diana CHVIROVA & Franka MENKE

Institution: University of Kempten

Abstract:

The tourism industry has undergone significant transformations due to advancements in digital technology. The increasing reliance on digital platforms has reshaped how tourists seek information, altering traditional models of tourist information and behavior. This shift necessitates a comprehensive understanding of evolving information-seeking behaviors, especially among Western European tourists, to enhance visitor experiences and manage tourism more effectively. Studies show a growing preference for online and digital sources for gathering travel information. This research focuses on identifying changes in tourist information behavior, including the sources tourists use, their motivations, and the impact of demographic factors such as generational differences. It proposes to analyze data from questionnaires to identify patterns in information-seeking behavior. Specifically, it will explore the difference in behavior between day-trip tourists and overnight tourists. The study aims to refine existing models of tourist information behavior to reflect these digital advancements. It will provide practical insights for tourism managers on leveraging digital platforms, understanding crowd perception, and offering personalized guidance to improve tourist satisfaction. The findings will contribute to developing more effective tourism management strategies, providing both theoretical and practical insights into the modern tourist's behavior.

Are You Flexible Enough? The Impact of Energy Literacy and Environmental Values on Flexibility Provision

Authors: Muriel-Larissa FRANK & Hanna MARXEN

Institution: SnT - University of Luxembourg

Abstract:

Users are essential to the sustainable energy transition. By accepting direct load control, households can provide flexibility and contribute to stable energy systems with balanced supply and demand. Initial studies suggest that when users are energy-literate—understanding energy use and its relation to daily technologies—their willingness to provide this flexibility increases. However, empirical evidence is still limited. To address this, the current study surveyed 435 grid users in Luxembourg, exploring their understanding of energy use and motivations for providing flexibility in smart heating and electric vehicle charging. The findings show that energy literacy and environmental motivations are key predictors of flexibility.

Understanding Visitor Behavior: Causal Analysis of Touristic Time-Series Data Using Configurational Comparative Methods

Author: Dominik REBHOLZ

Institution: University of Kempten

Abstract:

Crowding poses significant challenges for managing popular tourist destinations. Nevertheless, the patterns at which crowding happens are often inadequately understood, posing challenges for effective crowd management. Traditional machine learning (ML) algorithms, while capable of predicting visitor numbers with reasonable accuracy, suffer from limitations such as high data requirements, overfitting, and a lack of transferability to different points of interest. Moreover, the complexity and black-box nature of these models necessitate the application of explainable AI methods to enhance interpretability and often require continuous computational resources. This study addresses these challenges by exploring the applicability of Configurational Comparative Methods (CCM), specifically Coincidence Analysis (CNA) and Qualitative Comparative Analysis (QCA), on time-series data to predict crowding. Unlike ML algorithms, CCM are adept at discerning causal relationships and do not solely rely on correlation-based analysis. Employing a dataset derived from camera sensors that track the number of people, bicycles, cars, and other vehicles at a lakeside touristic spot, we aim to develop a causal model that identifies the relevant feature combinations (e.g., high temperature and day of the week) contributing to crowding. Our findings demonstrate that CCM can successfully be applied to time-series data, revealing actionable insights into the interaction of various conditions leading to crowding. This causal model offers an interpretable and transferable framework for managing visitor behavior at diverse touristic sites, thus providing a robust alternative to traditional ML approaches.

Enhancing ESG trust through Design Science Research

Authors: Egor ERMOLAEV & Evgenia Yvonna TSELONI

Institution: SnT - University of Luxembourg

Abstract:

Companies must publicly disclose Environmental, Social, and Governance (ESG) key performance indicators (KPIs) to demonstrate their dedication to green practices. The existing structure for annual reports may not include all the needed information from a legal standpoint and could fail to appeal to investors who prioritize sustainability. Many businesses, including life insurance companies, aspire to improve their ESG KPI reporting processes. Life insurance businesses can incorporate ESG-focused tactics into their client engagement to avoid accusations of greenwashing and appeal to environmentally conscious clients. This enhances competitiveness and fosters long-term trust among institutions. This research suggests the establishment of a reporting system architecture backed by Distributed Ledger Technology (DLT) for compliant, transparent, reliable, and standardized ESG reporting. This would assist these businesses in dealing with the challenges associated with ESG KPI reporting.

The Imminent (and Avoidable) Security Risk of Bitcoin Halving

Authors: Johannes SEDLMEIR & Yunxiu ZHOU

Institution: SnT - University of Luxembourg

Abstract:

Bitcoin anticipates its next halving on April 20, 2024. This quadrennial reduction in the growth rate of total supply is designed for digital scarcity, one of the cryptocurrency's key value propositions. The issuance of new Bitcoins in the form of block subsidies represents the predominant incentive for mining and, thus, ensures the proper functioning of the network and protects it against various attacks. In this paper, we argue that the discontinuity in block rewards created by the halving poses a thus far disregarded threat to Bitcoin's security. Through theoretical analysis and simulations, we demonstrate that halvings can introduce instability in mining profitability by precipitating substantial system shocks and, therefore, significantly lower the instantaneous cost of a 51% attack. We examine the effect of various exogenous (e.g., Bitcoin price, electricity prices, and mining hardware distribution) and endogenous (e.g., maximum change of difficulty levels and relative timing of halving and difficulty adjustments) parameters on these results. We illustrate that a certain level of inertia in mining decisions could be a short-term mitigation to help the system regain stability. As a long-term solution, we propose a more steady block subsidy reduction schedule. Our paper contributes to the economic security analysis and design theory of proof-of-work blockchains.

Trading Electric Vehicle Charging Flexibility in Spot Markets

Authors: Raviteja CHEMUDUPATY & Timothée HORNEK

Institution: SnT - University of Luxembourg

Abstract:

Decarbonizing private mobility requires a significant increase in the use of electric vehicles. This shift poses a challenge for energy suppliers, who must manage the unpredictable charging behaviors of electric vehicle users, leading to less precise demand forecasts and increased financial risks due to potential power imbalances. In Europe, suppliers can trade these imbalances in short-term electricity markets, such as the continuous intraday market, where controlled electric vehicle charging can be strategically timed to lower costs. However, the financial benefits of such trading are uncertain, largely due to fluctuating continuous intraday prices and the unpredictable nature of electric vehicle user behavior. This study develops and evaluates strategies for managing electric vehicles in various short-term markets, focusing on the day-ahead auction and continuous intraday market. By employing initial and updated forecasts of electric vehicle charging flexibility, we empirically show that trading in the continuous intraday market can reduce overall power procurement costs. Our findings indicate that energy suppliers can significantly mitigate financial risks through continuous trading strategies that leverage arbitrage opportunities in the continuous intraday market, even amidst high flexibility forecast errors.

On the relationship of energy literacy and energy technology adoption

Author: Boris ORTEGA MORENO

Institution: SnT - University of Luxembourg

Abstract:

To address climate change, societies must increasingly embrace renewable energy and innovative energy technologies. This paper investigates the factors that drive the adoption of these technologies, focusing on the role of energy literacy—an individual’s understanding of energy concepts and technologies—in the uptake of Electric Vehicles (EVs), Photovoltaic (PV) systems, and Home Energy Monitoring (HEM) systems. Analyzing household-level survey data, the study finds that higher energy literacy significantly boosts the likelihood of adopting these technologies. A one-point increase in energy literacy yields a 22.5% higher probability of adopting any of the three technologies. The impact varies across technologies, with a notable 32.9% increase in EV adoption, while PV adoption shows no significant effect. These findings highlight the crucial role of targeted energy education and suggest that tailored informational campaigns could be more effective in encouraging the adoption of EVs and HEM systems.

Driving Personal Sustainable Mobility - Improving Customer Satisfaction at Large-Scale Fast Charging Hubs by Reducing the Expectation-Performance Gap

Authors: Jessica BOLLENBACH & Robert KELLER

Institution: University of Kempten

Abstract:

The transport sector is the second-largest emitter of greenhouse gases, necessitating a rapid transition to sustainable personal mobility. This multidimensional task requires the implementation of comprehensive decarbonization strategies and a holistic approach to address the full spectrum of personal mobility needs. One strategy for achieving sustainability is the technological advancement and transition from internal combustion vehicles to battery electric vehicles (BEVs). For a BEV to satisfy the entire range of mobility needs associated with a private vehicle, access to fast-charging infrastructure with high available power is essential to enable long-distance travel. However, charging park operators cannot always meet customer expectations of maximum charging power due to economic and technical restrictions. According to the expectation-disconfirmation theory, the resulting expectation-performance gap increases the dissatisfaction of vehicle drivers regarding the servicing time in a non-linear manner. Therefore, I present one paper of my doctoral thesis including an optimization model with a utilitarian welfare function, anchored in social choice theory, aiming to enhance customer satisfaction at charging parks. For evaluation, we carry out a case study including a current real-world case and four future cases regarding (technical) developments of electric mobility. Compared to a uniform power allocation, our results display a reduced absolute average gap of up to 4 min (i.e., 13.3%) between expected and actual servicing time in the real-world case, enhancing welfare by 22.9%. Further, the future cases with an increased average gap reduction of up to 5.2 min indicate the increasing importance of an information system addressing the expectations of BEV drivers.

Towards the sociotechnical design of BEMS for public sector buildings

Authors: Renan LIMA BAIMA & Lorenzo Matthias BURCHERI

Institution: SnT - University of Luxembourg

Abstract:

Recent sustainable energy policies from the European Union (EU), such as the Energy Efficiency Directive 2023/1791 and the Renewable Energy Directive 2023/2413, aim to boost energy efficiency, especially in public buildings like schools, universities, hospitals, and city halls. Building Energy Management Systems (BEMS) can support this objective by monitoring and controlling the building's energy needs. However, traditionally, the potential of occupant behavior is insufficiently considered in the initial design phase of BEMS. Recognizing this gap, our work introduces Design Principles (DP) advocating for BEMS that balance technological and behavioral elements, emphasizing their complementary nature and the importance of both human and non-human actors in a building's energy system. Following Möller's method for Design Principles development, we apply the Abstraction Hierarchy to map system requirements identified from an integrative literature review. Based on this, we formulate five DPs, concerning user engagement, information standards, contextualization, flexibility, and efficiency. They guide system designers in creating BEMS blueprints, maintaining contextualization while emphasizing architectural requirements, and prioritizing technical efficiency and synergistic effects between technical infrastructure and occupant behavior. Additionally, this paper demonstrates how such conceptual architecture can be derived from the design principles in practice, and how these principles can be used to evaluate BEMS use cases to identify potential system improvements. Lastly, the DPs are evaluated in workshops using Iivari's Minimum Reusability Framework.

A general theory of residential flexibility supply

Author: Joachim GESKE

Institution: SnT - University of Luxembourg

Abstract:

The shift towards electrifying both the mobility and heating (including cooling) sectors is a key part of global efforts to reduce carbon emissions. However, this increased demand for electricity puts additional pressure on existing infrastructure, especially since much of the future electricity supply will come from renewable sources, which are often intermittent and decentralized. To keep adaptation costs manageable, it's crucial that the demand for electricity—whether for charging vehicles or heating and cooling buildings—becomes more flexible, adjusting more closely to when renewable electricity is available. Currently, our understanding of how electricity demand responds to flexible pricing is limited. This is because each type of appliance or device comes with its own unique challenges when it comes to shifting usage times. To enhance our understanding of this flexibility, we've developed a short-term decision model for economic electricity demand. In its simplest form, this model focuses on a single substitution cost parameter, which is applicable across all energy sectors, including industry. This parameter provides a standardized measure of potential flexibility. This approach allows us to calculate the economic feasibility of supplying flexibility and to compare its effectiveness. Moreover, it offers a straightforward way to communicate preferences for supplying flexibility, which is essential for automating the process and enabling overall system flexibility.

Visitor perception versus visitor counting: A comparative study on subjective and objective crowding in urban and rural tourism destinations considering the use cases Füssen and Lake Hopfensee in Allgäu

Author: Marina BERGLER

Institution: University of Kempten

Abstract:

The terms crowding, overcrowding and overtourism have been playing an ongoing role in tourism for years and in more and more destinations, such as Venice or Barcelona, the carrying capacity limits are at the limit or have already been exceeded. Threshold limits are clearer and easier to define in closed environments such as cinemas or concert halls with a fixed number of seats than in public and open spaces such as city centers or hiking trails. Here, limits and capacities are strongly dependent on the subjective perception of the crowding volume or, for example, the kind of individual (local resident, day visitor, retailer). To ensure efficient and targeted visitor management measures, this master thesis examines the correlation between the subjective crowding perception of visitors and the actual/objectively measured number of visitors. It aims to identify possible differences in subjective crowding in urban and rural areas as well as correlations between objective measurement and subjective perception in both use cases. This investigation is carried out with the help of image-based methods from people counting cameras and user-friendly feedback terminals with rating buttons. The procedure is implemented for the two touristically relevant locations of Füssen and Hopfensee in Allgäu and also takes into account which external factors (e.g. events, weather, temperature, etc.) influence perception. The results are intended to contribute to the efficient design and implementation of data-driven visitor management measures based on empirically proven carrying capacity limits.

Managing Congestion in European Electricity Networks: The Role of Aggregators and Local Flexibility Markets

Author: Rawan AKKOUCH

Institution: SnT - University of Luxembourg

Abstract:

As renewable energy integration increases and existing infrastructure faces limitations, power grid congestion management is experiencing a crucial transition that requires innovative solutions to ensure system reliability. To address this challenge, the power sector is adopting new solutions such as flexibility provision by various market participants, including aggregators and local flexibility markets. These solutions offer congestion management services without significant infrastructure investments. Our literature review begins with a search across academic data bases which formulates a research string and clarifies the focus and keywords needed for our literature review. To ensure a rigorous process we started by removing duplicates, filtering relevant papers by titles and abstracts. The selected articles were assessed for eligibility and quality, and finally we employed snowballing techniques to ensure thorough coverage. Through a systematic literature review, we found a lack of common understanding regarding the interlink between congestion management services, local flexibility markets, and aggregators. Our paper aims to clarify the interlinks between CM services, aggregators, and LFMs, thereby improving knowledge of their collective roles within the energy sector. This contribution will help clarify the conceptual differences and similarities and support the development of future market designs.

A Threat Modeling Approach to Privacy-Utility Trade-off in Time Series Data Analysis

Authors: Iván ABELLÁN ÁLVAREZ & Joaquin DELGADO FERNANDEZ

Institution: SnT - University of Luxembourg

Abstract:

The necessity for precise predictions in time series data analysis is frequently driven by the utilization of granular data inputs, which raises significant privacy concerns. This paper presents a comprehensive approach to address the inherent privacy-utility trade-off in clustering protocols. We adhere to a threat modeling approach to accommodate system design assumptions and privacy threats to establish privacy requirements. We introduce a privacy-preserving clustering model according to the derived privacy requirements. The model has access to a private version of data, thus ensuring data confidentiality while maintaining prediction accuracy. Furthermore, we illustrate the model behavior in a specific context based on household load profiles. Our approach offers guidance towards privacy-first system design solutions, and discusses the privacy-utility trade-off in time series data analysis, enabling accurate predictions while safeguarding individual privacy in an increasingly data-driven environment. This work contributes to the ongoing discourse on privacy and data utility, offering practical solutions for preserving privacy in time series data analysis.

Privacy in Central Bank Digital Currency Ecosystems

Authors: Martin BRENNECKE & Nadia POCHER

Institution: SnT - University of Luxembourg

Abstract:

As cash usage declines across the globe in favor of digital means of payments, central banks are increasingly interested in bringing central bank money to the digital realm. They do so by exploring retail central bank digital currencies (CBDCs) and investigating related overarching design choices. In this context, the need to ensure end-user privacy while mitigating financial integrity risks has emerged as a key aspect. Despite a wide array of CBDC projects already in development and piloting stages, different stakeholders (including central banks, commercial banks, governments, citizens, and researchers) bring widely different perspectives on the central concept of privacy, leading to misunderstandings. From an academic perspective, this results in some form of isolation in disciplinary silos, with researchers from different academic fields publishing in domain-specific outlets and limited discussions on CBDCs in information systems (IS) outlets. To mitigate the risk of parallel and disconnected discussions and research, we conceptualize retail CBDCs as hybrid ecosystems and investigate them through a socio-technical systems lens. This enables us to first discuss the interlinkages between the social and the technical subsystems. In a second step, we dive deeper into an analysis of privacy-transparency trade-offs in retail CBDC ecosystems, as well as a granular conceptualization of privacy within the ecosystems themselves. In a third step, we hope to inspire fellow IS researchers to take a socio-technical approach to (retail) CBDC ecosystems in future analysis and thereby contribute to the discourse, design, and development of what could be a central means of payment in the future.

Security Awareness Training and the Efficacy of Generative AI

Author: Ayah THARWAT

Institution: SnT - University of Luxembourg

Abstract:

In the contemporary digital era, organizations continually encounter cyber threats, primarily due to human error and insufficient security awareness among individuals and organizations. This study aims to: 1) assess the role of security training in strengthening individual defenses, 2) explore how generative AI can aid in creating effective security training programs, and 3) evaluate participants' ability to detect misinformation generated by ChatGPT. We utilized a mixed-methods approach: qualitative data provided insights into participants' demographics and security backgrounds, while quantitative data measured the impact of security awareness training on improving cybersecurity knowledge and participants' identification of misinformation. This involved administering two surveys—one before and one after a security training session—each with seven Likert-scale questions and two to four open-ended questions to 50 randomly selected CS and IT students. Results from the Student's t-test indicated significant improvements in participants' understanding of the five critical cybersecurity topics administered with all p-values being less than 0.05. However, a notable challenge remains: participants frequently misidentify misinformation generated by ChatGPT as accurate, attributed to overconfidence in information security, a lack of security education, training, and awareness (SETA), and excessive trust in generative AI. While ChatGPT can provide a foundational framework, it is crucial for humans to meticulously review and refine the content, ensuring accuracy and strengthening the training's effectiveness. Individuals often overestimate their cybersecurity knowledge, leaving them vulnerable to cyber threats. The current version of ChatGPT-4 requires human objectivity in developing robust security training programs.

EU Policies meet Global Practices: eIDAS2.0 and the Discourse on Qualified Website Authentication Certificates

Authors: Pratyush DIKSHIT & Pol HÖLZMER

Institution: SnT - University of Luxembourg

Abstract:

The controversy surrounding Qualified Web Authentication Certificates (QWACs) holds substantial implications for digital security and trust within the EU's digital market. This research seeks to explore the origins and justifications of this debate, concentrating on the trust model and the perspectives of diverse stakeholders. Utilising a mixed-methods approach, the study will analyse regulatory documents and conduct interviews to provide a comprehensive understanding of the QWAC controversy. The findings reveal significant advocacy efforts and differing viewpoints, where a contained issue is projected as having a total loss of web security. It demonstrates the EU's efforts to find a balanced compromise among stakeholders, addressing complex narratives presented in media coverage. These insights enhance trust frameworks and inform policy recommendations to strengthen digital security and trust.

Industrial electrification: opportunities and challenges

Author: Estibalitz RUIZ IRUSTA

Institution: SnT - University of Luxembourg

Abstract:

Decarbonizing Europe's industrial sector is a critical but challenging task, particularly in energy-intensive industries like plastic manufacturing. This study evaluates the impact of electrifying steam production in a European plastic manufacturing facility by analyzing its energy consumption patterns. Our findings show that full electrification would increase energy costs by 56.3% and peak power demand by 142.58%. Additionally, we assessed a scenario in which the company utilizes cross-sectoral flexibility, resulting in a modest 0.44% reduction in energy costs. However, the overall use of electricity in this scenario remains minimal, highlighting the complexities of achieving meaningful decarbonization through electrification alone.

Insights from a Multi-Step Literature Review on Load Forecasting Using Large-Scale Smart Meter Data

Authors: Quoc Viet NGUYEN & Sergio POTENCIANO MENCI

Institution: SnT - University of Luxembourg

Abstract:

The widespread deployment of smart meters has significantly transformed the collection of high-resolution energy consumption data, essential for supporting energy suppliers. Despite their benefits, converting extensive smart meter data into precise short-term load forecasting models remains a complex challenge. This research addresses this challenge by conducting a multi-step literature review to examine the current state of load forecasting methodologies, data characteristics, and model evaluation strategies, which can help energy suppliers or academics navigate the complexities. Our literature review begins with a scope literature review, which generates a research string and clarifies the focus and keywords for the subsequent semi-systematic literature review. Following best practices, the semi-systematic review filters and selects relevant papers for detailed content analysis. In the content analysis, we explore big data topics such as the 4Vs (volume, velocity, variety, and veracity), storage computation, and forecasting approaches in the academic literature. The output of our research is twofold. First, it provides a brief description and classification framework for current forecasting approaches, offering a clear snapshot of the state of the art in load forecasting. Second, it delivers valuable insights that can assist academics and practitioners in developing their literature reviews. These insights are not limited to highlighting the intricate nature of merging domains, the iterative process of refining research strings and focus through scope reviews, and the implications of filter stringency in systematic reviews.

Design of an evaluation approach using design science research and experiences from the energy domain

Author: Christine VAN STIPHOUDT

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Abstract:

As digitalisation and energy market services expand in power systems, communication interfaces, and information exchanges increase significantly. Many of these interfaces and exchanges require automated information exchange and processing, which in turn necessitates consensus on the models and information to be exchanged. Therefore, the growing number of communication interfaces and information exchanges underscores the need to previously evaluate the data and information models that IT systems will use to ensure reliability and proper task execution. Our contribution focuses on developing an evaluation approach for these models using design science research, specifically targeting power system market communication exchanges across services. We present the design process, incorporating experiences from a data and information model design in the energy sector.

Real-time gap filling in power systems time series using AI methods

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Abstract:

This paper investigates AI-based gap-filling methods for effectively handling missing data during transient power system disturbances. Utilizing neural networks, the proposed method efficiently processes multivariate datasets, significantly improving the accuracy and operational reliability of grid performance during disturbances. It was tested under three different missing data patterns across various missing data ratios. A thorough comparative analysis with traditional imputation methods was performed using the IEEE 39-bus New England system, focusing on voltage magnitudes and angles as inputs. Results show that this method excels in maintaining data integrity and ensuring system stability, reducing Mean Absolute Error (MAE) by 5% to 25% in most cases. However, it slightly underperformed in conditions with a high missing data ratio of 0.9. The method's robustness was evident through its high imputation accuracy and fast performance, making it suitable for real-time applications in smart grid monitoring due to its parallel data processing capability.

Closing Remarks

As we conclude the **1st European Symposium on Information Systems Engineering (ESISE)**, we reflect on the enriching experiences and knowledge shared over the past three days. The symposium has been a convergence point for innovative ideas, rigorous research, and collaborative discussions that are pivotal to advancing the field of information systems engineering.

The diversity of topics and the depth of research presented highlight the dynamic and interdisciplinary nature of our field. From the exploration of cutting-edge artificial intelligence applications to the critical examination of energy systems and sustainability, the symposium has showcased the breadth of challenges and opportunities we face.

We are particularly encouraged by the collaborative spirit demonstrated by participants from various institutions and countries. This synergy is essential as we tackle complex global issues such as climate change, data privacy, and the ethical implications of emerging technologies.

We hope that the connections made and the ideas exchanged during this symposium will lead to fruitful collaborations and advancements in information systems engineering. We look forward to witnessing the future contributions that will stem from the foundations laid during this event.

Thank you once again to all who participated and contributed to making ESISE a resounding success. We anticipate your continued involvement in future symposia.