Information Systems and Artificial Intelligence Integration Challenges

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Abstract: *The synergy between IS and AI deals with challenges and emphasizes the importance of research, innovation, and governance for effective integration. A key challenge is to improve practices with integrated solutions. Developing artifacts, methods, processes, tools, and educational projects is essential for professionals and researchers in the IS community. Innovative IS research in Brazil calls for investment in training specialists, creating accessible tools, and combining IS with AI technology.*

Palavras-chave*: artificial intelligence, information systems.*

1. What is your idea, vision, or reflection on the challenge in IS in Brazil for the next 10 years?

The Information Systems (IS) research area has grown in complexity, diversity, and plurality, demanding increased community knowledge to advance research on global organizational problems. With the advancement of data and computer processing, IS have incorporated Artificial Intelligence (AI) as a tool in diverse life cycle stages. However, the use of AI poses new challenges for the IS area.

Recent work with a topic-based ontology explores key IS research topics through articles from the Brazilian Symposium on IS (Simpósio Brasileiro de Sistemas de Informação - SBSI) [Santos et al. 2025]. Analyzing SBSI publication data reveals trends, patterns, and gaps in research areas from 2018-2023, particularly in AI and IS. Based on the topic-based ontology, there are consolidated key research topics, showing areas of

constant interest to researchers in the IS community and remaining highly relevant in a rapidly evolving scenario. The persistence of these areas suggests that they continue to address fundamental IS challenges, receiving updates and innovations as new technologies emerge.

- **Data Mining** - emerged as a critical tool for exploring and analyzing large data volumes as data availability grows exponentially.
- **Database Design and Models** - essential for structuring and organizing data efficiently, with research on various database design and modeling aspects.
- **Information Integration/Interoperability** - makes combining data from various sources possible, providing a more comprehensive and neat view in a scenario where data distribution has become increasingly evident.
- **Decision Support Systems** - essential to help make informed decisions, integrating data from different sources and advanced analysis.
- **Collaborative and Social Computing Systems and Tools** - reflect the growing importance of collaboration and social networks in information exchange and teamwork.
- **Enterprise IS** - vital for integrating and managing complex IS in organizations, a central issue for digital transformation.

The authors in [Santos et al. 2025] analyze emerging and declining keywords in article titles to identify research trends. They observe that emerging keywords are increasing while declining keywords are dropping or disappearing in new publications. This analysis tracks how interests in the scientific community evolve and suggests new research directions. Emerging keywords were more common in 2022-2023, and declining keywords saw reduced use after 2020.

Trends over the years show keywords that have gained relevance more recently but already have great potential for impact. The fact that these keywords have appeared consistently in recent years signals that they are moving away from experimental niches to becoming key in the field.

- **Blockchain** – application in data security and traceability areas.
- **Ontology** – gained prominence as a tool for semantic representation, facilitating the interoperability of systems in enterprise IS and information integration.
- **Machine learning** – appeared in 2019 with deep learning techniques spread, aroused the community's interest with research boost (2022 & 2023).
- **Sentiment analysis** – emerges in valuing qualitative data, such as analysis of opinions on social media, great interest to the community (2020 & 2022).

2. Why is it critical that the community direct efforts to overcome it?

The analysis presented in Section 1 suggests that the IS community focuses on established issues and new technologies to meet today's organizational needs. However, the

coexistence of well-established and new technologies is not static. For example, collaborative computing may adopt practices like blockchain, while data mining includes qualitative analysis and deep learning. Integrating new technologies like AI is a significant challenge for the IS community.

Focusing on AI technologies that present challenges to the development of intelligent IS, we list non-exhaustive:

- **Large Language Model (LLM)** [Naveed et al. 2024] — a machine learning/deep learning model that demonstrated remarkable capabilities in Natural Language Processing (NLP) tasks, including translating, summarization, information retrieval, information extraction, sentiment analysis, classifying, generating text, conversational interactions, and identifying data patterns to improve diverse topics such as architectural innovations, better training strategies, facilitating communication and self-expression for humans and IS interaction.
- **Intelligent IS and AI ethics** [Hauer 2022] – Intelligent IS and AI platforms evolving through self-learning from data currently raise several thorny ethical and legal issues that impact society.
- **Promoting EDI (equity, diversity, inclusion) in AI** is vital for ethical development and accessibility. A lack of diversity can uphold biases, affecting marginalized groups. Inclusion initiatives help demonstrate AI's positive potential when used responsibly. EDI principles enhance innovation and relevance in AI.
- **Digital Twins (DT) with AI** [Kreuzer et al. 2024] – DT is a virtual model of physical assets. AI analyzes data from these models to predict future outcomes, optimize performance, detect potential failures, automate processes, and improve efficiency in real-time business operations.
- **Ontology** [Husáková and Bureš 2020] – a formal representation of a domain conceptualization to provide a structured framework for representing knowledge, facilitating knowledge sharing, integration, and reasoning within a particular domain or across different domains in intelligent IS.
- **Multi-Agent Systems (MAS)** [Vizuete et al. 2024, Ahmed Abbas 2015, van der Hoek and Wooldridge 2008] – a distributed system with multiple interacting intelligent agents that work collectively to perform tasks on behalf of a user or another system, aiming to achieve goals related to real-world organizational problems.

2. **What are the risks if we do not move forward in resolving it?**
   AI technology is crucial in daily life and the future of the IS area. The IS community has shown interest in integrating AI into key research topics, such as enterprise IS for digital transformation, decision support systems using big data and data mining, and information integration with deep learning techniques. The risk, if the IS community does not advance in integrating AI technology, is

becoming outdated in decision support challenges, considering the growing strength of globalized organizations.

3. What other problems, areas, knowledge, actions, initiatives, technologies, does the challenge relate to?

Moreover, the connection between IS and AI addresses some IS challenges from 2016-2026 [Boscarioli et al. 2017]:

- **Systems-of-Information Systems**: interoperability of complex systems with robust architectures and diverse components, e.g., legacy systems and new AI-based technologies.
- **IS in the Open World**: focuses on using data from various real-time sources, with AI improving decision-making in changing environments.
- **The complexity of IS development**: requires knowledge in areas like machine learning, data science, and software engineering with agile methods.
- **Socio-technical Vision of IS**: considers social and ethical impacts, ensuring fairness in AI, avoiding biases, and respecting user privacy and rights.

The synergy between IS and AI deals with challenges and emphasizes the importance of research, innovation, and governance for effective integration. A key challenge is to improve practices with integrated solutions. Developing artifacts, methods, processes, tools, and educational projects is essential for professionals and researchers in the IS community. Innovative IS research in Brazil calls for investment in training specialists, creating accessible tools, and combining IS with AI technology.

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