Journal of Education for Humanities

A peer-reviewed quarterly scientific journal issued by College of Education for Humanities / University of Mosul

Decision Support in Artificial Intelligence and Its Use in Objective Data

Ali Hussein Khalaf AL-Sammarraie

Ministry of Education, Iraq Directorate General of Education Diyala Baquba, Iraq

Article information

Accepted: 4/2/2025

Published 31/7/2025

Keywords

Decision Support, Artificial Intelligence, Objective Data

Correspondence:

Ali Hussein Khalaf

sahk383@yahoo.com

Abstract

Decision support systems (DSS) are extremely useful tools for problem solving and decision making under uncertainty. These systems help to better understand the complexity of problems addressed, allowing incremental and consistent integration of the knowledge on it. Artificial intelligence (AI) can be used as a means to provide the DSS with the flexibility required to process the knowledge on a specific area (Objective Data). The main objective of this work is to show that DSS can be created using methods and techniques of AI for the elaboration of court decisions, which are part of an objective and regulated data environment, specifically the Mercosur Common Nomenclature. The results presented demonstrate large-scale creation of court decisions that use influence diagrams based on objectives to guide the litigation process, evidencing the effectiveness of the AI used in a DSS and reducing the ambiguity, an inherent problem in the formulation of judicial decisions.

DOI: *********,,

دعم القرار في الذكاء الاصطناعي واستخدامه في البيانات الموضوعية

علي حسين خلف السامرائي

وزارة التربية – تربية ديالى بعقوبة – العراق

معلومات الارشفة

تاريخ القبول : ٢٠٢٥/٢/٤

تاريخ النشر : ٢٠٢٥/٧/٣١

الكلمات المفتاحية :

دعم القرار، الذكاء الاصطناعي، البيانات الموضوعية.

معلومات الاتصال

علي حسين خلف السامرائي

sahk383@yahoo.com

الملخص

تعتبر انظمة دعم القرار اداة مفيدة للغاية لحل المشكلات واتخاذ القرارات. تساعد هذه الانظمة على فهم مدى تعقيد المشكلات التي تتم معالجتها بشكل أفضل، مما يسمح بالتكامل المتزايد والمتناسق للمعرفة المتعلقة بها. يمكن استخدام الذكاء الصناعي كوسيلة لتزويد نظام دعم القرار بالمرونة المطلوبة لمعالجة المعرفة في منطقة معينة (البيانات الموضوعية). الهدف الرئيسي من هذا البحث هو أنه يمكن إنشاء نظام دعم القرار باستخدام اساليب وتقنيات الذكاء الصناعي لإعداد قرارات محكمة، والتي تعد جزاء" من بيئة بيانات موضوعية ومنظمة، وتحديدا التسميات المشتركة ل Mercosur. توضح النتائج المقدمة انه تم اتخاذ قرارات جيدة او محكمة على نطاق واسع والتي تستخدم مخططات التأثير بناء" على الأهداف لتوجيه عملية الغموض والتقاضي مما يدل على فعالية اتخاذ القرار نظام امن والحد من الغموض، وهذه هي بحد ذاتها مشكلة متأصلة في صياغة القرارات والتي استطعنا التغلب على هذه المشكلة.

DOI: *********,,

1. Introduction to Artificial Intelligence in Decision Support Systems

Artificial intelligence technologies (AI) and decision support (DS) play a significant role in the modern business world. AI supports DS by executing the operation of decision-making in an intelligent and efficient way. A wide range of various models facilitates making decisions and solving problems (Gupta et al., 2021). The models aim to analyze the situation, identify potential needs of the decision-maker, identify goals and preferences, identify alternatives, and thus support the decision-maker in choosing the most convenient alternative. The decision-maker gets a recommendation that forces them to further evaluate the benefits and costs of the recommendations and make a decision based on the discussed information. AI, as a modern technology of computers, is especially useful as a model of the supplier and as a model of the client. In economics

and business, AI-DS systems can be mostly profitable in cases of properly defined decisional issues and direct collaboration of the human with the machine (Cao, 2023).

The general meaning of AI is that computer programs possess real intelligence, that is, the ability to respond reasonably to statements and situations that are presented in natural language and natural situations. There is no need for any special calculational form from the AI program, and this is a crucial difference between traditional computer programs and AI programs. The AI program operates with the natural form of its data, that is, real-life information (Alqahtani et al., 2023). AI is a response to the needs of people who do not want to change the format of their problems to satisfy the specific requirements of the particular programs. Market researchers emphasize the need for solutions without a priori conditions. The typically considered representational deficiency in traditional programs is the perception-problem-solving dichotomy. Deductive and deductive-probabilistic mathematics are the most recognized ways of solving this dichotomy (Fomin et al., 2020). ***Figure 1*** shows the details of the topic.

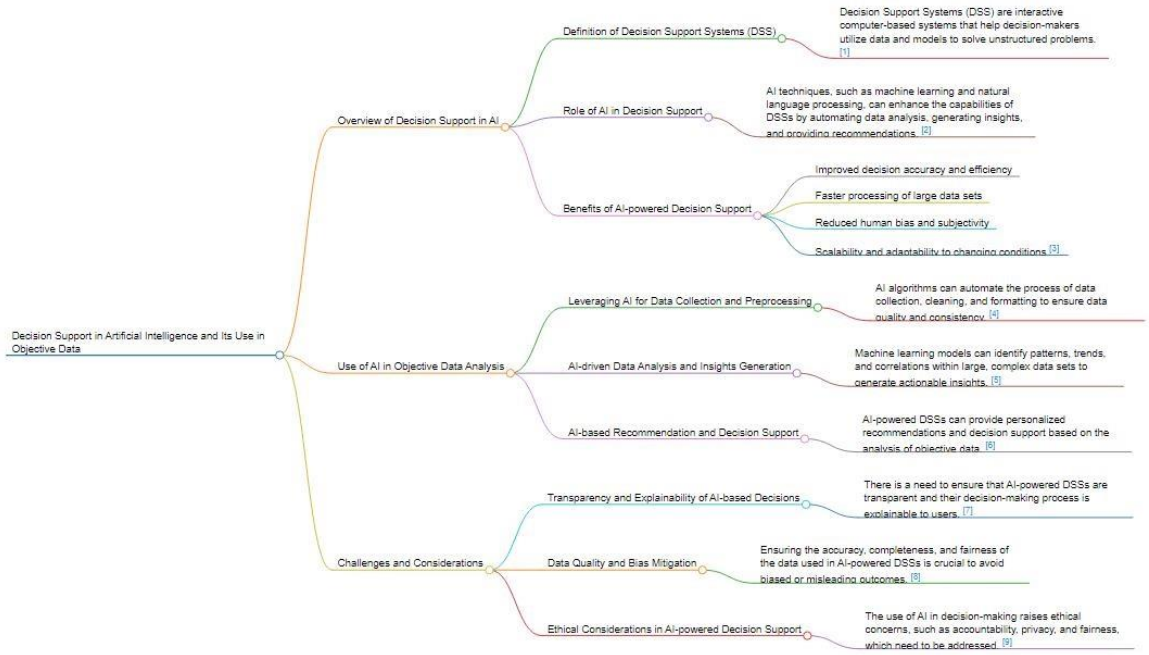


Figure 1 Details of Decision Support in Artificial Intelligence and Its Use in Objective Data

2. Fundamentals of Decision Support Systems

A decision support system (DSS) is an information system that uses data and user queries in combination with decision models to generate specific recommendations with which decision makers may evaluate alternative courses of action and choose the one that is expected to best achieve the organization's goals (Hamid et al., 2020). A modern extension to this definition is provided in, where a decision support system is defined as a computer-based information system that combines models and data in an attempt to solve semi-structured and some unstructured problems with user involvement (Hovorushchenko et al., 2021) (Kruse & Ehrbar, 2020). In this work, we will present several decision support approaches as applied in artificial intelligence, shown in the fields of expert systems, logic programming, discrete mathematics, and the combination of these areas, which are believed to generate successful decision support proposed here and applied to urban environmental management.

we need to combine efforts from many sections to construct explicit computer tools that involve a combination of specialized mathematically formalized models and interactive features that facilitate the user's participation in the skilled judgments obtained. These definitions express the consensus that a DSS must embody a specific model to process inputs supplied by the user of the system. Although some kind of decision model is a necessity for any system that we would like to consider a legitimate decision support system, should a DSS include any software that is able to represent and work with a decision model (Aversa et al., 2018) (Wong-Parodi et al., 2020).

2.1. Components and Architecture

Decision support is often implemented in data discovery systems based on the concept of general artificial intelligence, relying on the calculation of multidimensional space and its hierarchies. Decision support is a partial AI system designed to assist decision-making in uncertain environments, making more informed decisions based on an analysis of data. In the context of the decision-making process, semi-AI as an instrument is integrating the use of objective data for making more balanced decisions. To facilitate the work of managers working in rapidly changing conditions (in almost all industries), balanced decisions are essential. The deep learning techniques, machine learning, and data mining are required to make complex structures transparent to the

consumer, which has become a strategic task for statistical recognition of the consumer. (Jahani & Rayegani, 2020) (Bleher & Braun, 2022).

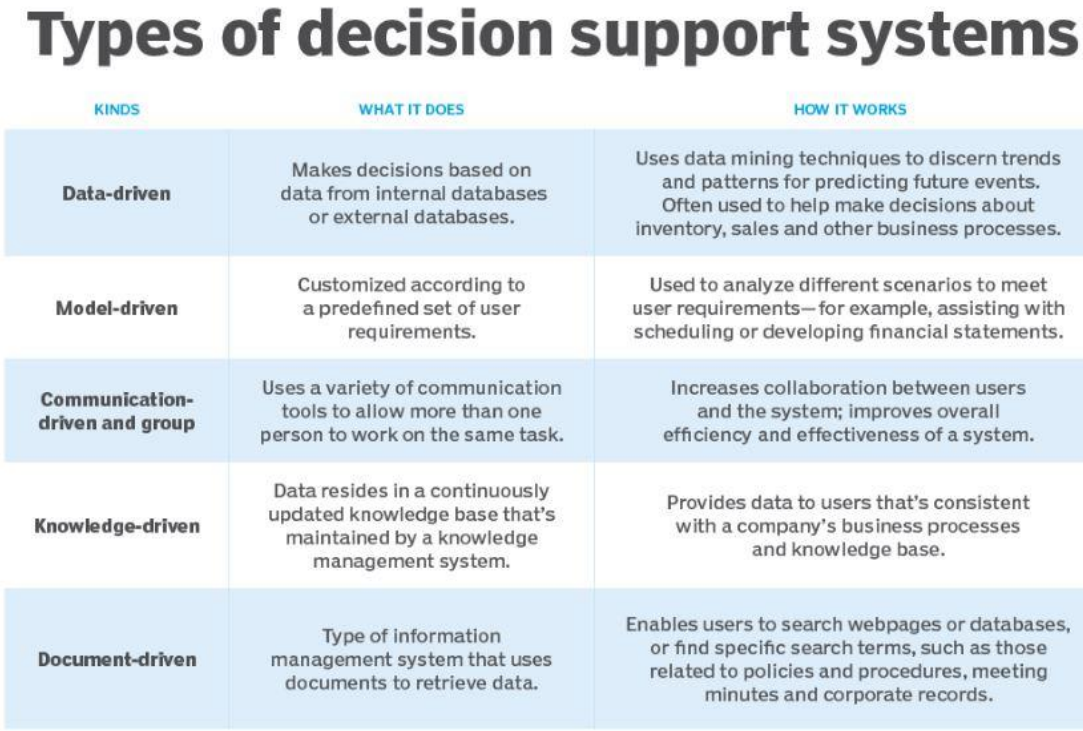
The combination of modern statistics discussed earlier statistical recognition as a science with the transparency of achieving statistical decisions as an art is fundamentally different and has not been performed to date. The practical implementation of complex decisions has not yet received a satisfactory answer and is being constantly developed (Tekouabou et al., 2021). The described system is the link in relation to statistical recognition of a single area. The depth of its consideration is due to the needs of the data economy. Moreover, the final task is a more accurate description of the area rather than describing individual objects of this area. The statistical machine of recognition on these data is motivated integrally treating data, hypotheses, and conclusions about these data. There are no alternatives to a holistic approach if the most informed decisions in the system take them (Shyshatskyi, 2020).

2.2. Types of Decision Support Systems

Decision support systems help decision makers to compile information and models and make judgments in the practical world (Schoonderwoerd et al., 2021). Thanks to computer software, it has evolved from the early reliance on improved management information to support toward the current involvement in unstructured tasks and the decision-making process (Giordano et al., 2021). As shown in the figure, decision support systems were classified as administrative systems, management support systems, and decision support systems in earlier research. Later studies further break down decision support systems and consider these as part of knowledge management, competitive intelligence, and executive information systems. In particular, executive information systems are considered an integral part of the Knowledge Management Systems at the managerial level (Shyshatskyi, 2020).

Decision support systems are also categorized in various ways: based on the recipient of the support, on the type of management task for which support is to be given, and on the type of stress situation in which decision support is to be given (Zuiev P et al., 2020). These groups create special challenges in the development and implementation of decision support. There is disagreement about whether expert systems should be classified as decision support systems because these were conceived as tools that included decision support components (Bleher & Braun, 2022). These computer-based systems are designed to generate decision-quality support, minimize personal bias, guard against judgments posed by emotional states, simply clarify decision-making,

offer a broad perspective, and provide a justification of actions (Jahani & Rayegani, 2020) (Shyshatskyi, 2020). **Figure 2** shows the Types of Decision Support Systems.



Types of decision support systems

KINDS	WHAT IT DOES	HOW IT WORKS
Data-driven	Makes decisions based on data from internal databases or external databases.	Uses data mining techniques to discern trends and patterns for predicting future events. Often used to help make decisions about inventory, sales and other business processes.
Model-driven	Customized according to a predefined set of user requirements.	Used to analyze different scenarios to meet user requirements—for example, assisting with scheduling or developing financial statements.
Communication-driven and group	Uses a variety of communication tools to allow more than one person to work on the same task.	Increases collaboration between users and the system; improves overall efficiency and effectiveness of a system.
Knowledge-driven	Data resides in a continuously updated knowledge base that's maintained by a knowledge management system.	Provides data to users that's consistent with a company's business processes and knowledge base.
Document-driven	Type of information management system that uses documents to retrieve data.	Enables users to search webpages or databases, or find specific search terms, such as those related to policies and procedures, meeting minutes and corporate records.

Figure 2 Types of Decision Support Systems.

3. Artificial Intelligence Techniques in Decision Support Systems

In the field of artificial intelligence, we can find multiple tools of great utility to assist the management and analysis of the different sources of information. Among all these techniques, we can highlight the construction of systems to support decisions, which are a set of concepts and methodologies that combine the computer systems of information and artificial intelligence in order to help and optimize the decision-making of an individual or a group (Lee et al., 2021). Its application can be oriented to multiple hierarchical levels of management, that is, for revision support, intelligence, and decision control. Such tools were initially created in response to the general difficulty of treating uncertainty and complexity and refer directly to computer systems that help managers make decisions effectively and economically, assisting them in the

access, analysis, and utilization of the necessary sources of information, although these could contain high levels of uncertainty, complexity, and ubiquitous ramifications (Yamamoto, 2017). The Figure 3 shows the graph with the main techniques of Artificial Intelligence used on the development of Decision Support Systems. This metric counts only traditional Artificial Intelli-gence techniques, it does not consider new techniques developed by the authors.

To make such tools possible, a series of artificial intelligence and information technologies had to be used (Zhang & Lu, 2021). An extensive set of artificial intelligence technologies was used with the primary purpose of bringing more intelligence and effectiveness to its systems, highlighting the following fundamental techniques: case-based reasoning and its process, the use of decision trees, expert systems, intelligent agents, the method of analysis based on analogies, data mining, reasoning inference, and monitoring system behavior, and research on the use of computational tools for inference of prior information. On the other hand, within the scope of the information on techniques such as information retrieval, databases, spreadsheets, and text and data mining were applied, and tools for decision making and groupware technologies (D. Lee & Yoon, 2021).

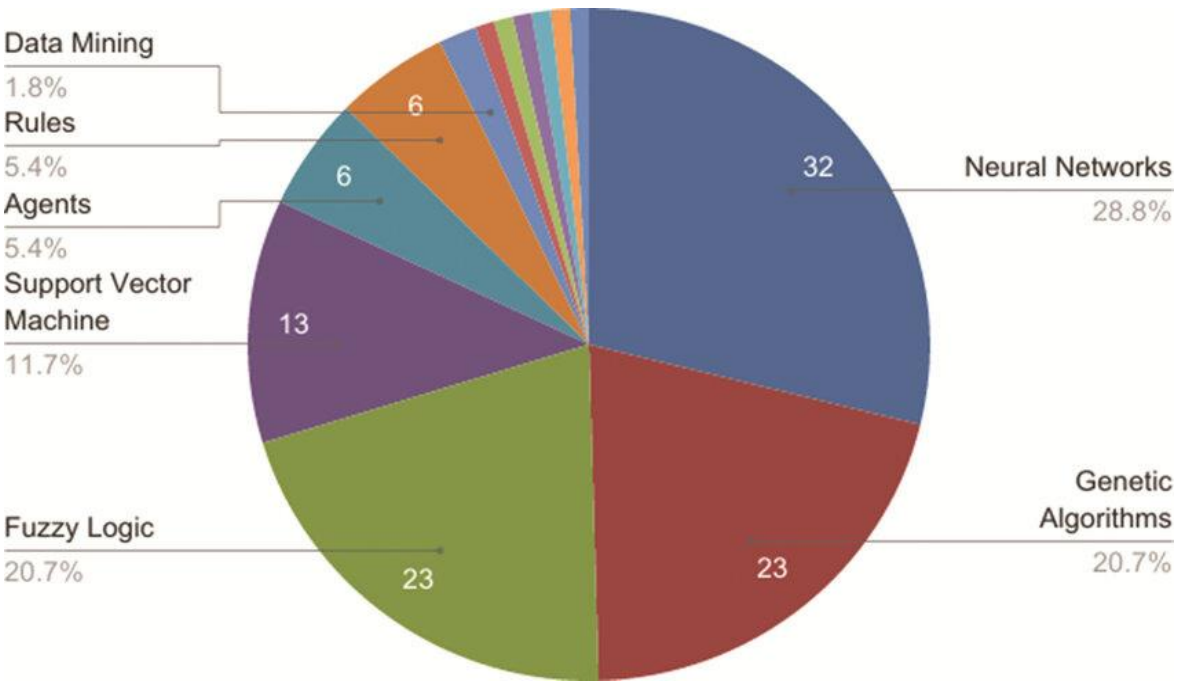


Figure 3 Artificial intelligence techniques used in decision support systems (Yamamoto, 2017).

3.1. Machine Learning Algorithms

The modeling process has common steps, such as iteration process. To create an environment for category transition, in which learning takes place, the following classification machine learning algorithms were utilized: Neural Network, Naive Bayes, K-Nearest Neighbor, Decision Tree, and Logistic Regression. In order to assess the models, given that the model must be able to make the correct type of decision/question, the confusion matrix of future responses from the model was calculated for each of the algorithms (Shen et al., 2020) (Chicco et al., 2021). The creation of the confusion matrix allowed observing the results of each one, their hits, and their errors, and estimating other indices used to evaluate the models, which can also be used to compare them, such as Support, Precision, Recall, and F1 score. The data models described were used in the current study independently of other variables for model interpretation and were intended to compare the techniques of confusion matrix and bootstrapping in machine learning (Itoo et al., 2020).

The dataset from the normally used algorithms KNN, Naive Bayes, Neural Network, Decision Tables, and Logistic Regression contains 4,615 examples with events and 100,000 examples without the event (ACE) classifying lending operations, as shown in the graph from the confusion matrix and above from the trained models using cross-validation with 10 folds (Roy et al., 2023). With this number of examples, the maximum depth of the tree of the Decision Tables algorithm using WEKA software was 8. All models tested had very similar results for the three confusion matrices. The production of data is usually governed by statistical principles. Design methods, data collection strategies, and statistical techniques allow us to handle measurements, understand information that is being manipulated, and summarize data patterns in a rigorous and coherent manner.

3.2. Natural Language Processing

There is plenty of objective information that seems to be hidden and cannot be immediately produced in digital format. Nowadays, there is plenty of text in several languages available as publicly accessible digital objective data. In such form, this data can be stored and processed by computers. (Gasparotto, 2024) There are several easy

procedures to encode text as a more formal and explicit machine-processible form, thus making it computable (List et al., 2022).

Natural language is a form of information that cannot be directly processed by computers. Codes and other objects need to be produced. Specific mathematical methods for the generation and recognition of natural expressions have been developed at the intersection of computer science, artificial intelligence, and linguistics. They can be implemented by techniques called natural language processing. With natural language processing, we can now transform natural language into a computable form that is easily available for artificial intelligence or other tools. Consequently, these steps provide access to information from a variety of text, codified in a transparent and objective form.

3.3. Expert Systems

Expert systems are a type of artificial intelligence system that are generally oriented to be used as decision support. These systems use expert knowledge about a particular domain to improve efficiency in the decision-making process. They have the capability of emulating an expert in specific knowledge and using extensive expert experience in a useful manner. Expert systems have been implemented for several medical diagnoses. These systems are composed of computer software that is able to imitate an expert in some particular fields and assist in performing tasks automatically. The development, design, and implementation of these systems are based on the knowledge of experts in complex areas, including mathematical algorithms, which are the most used methods to achieve inference and decision-making (Nishtar & Afzal, 2024) (Wu et al., 2024).

Using this kind of system, the expert can write rules that the system uses with a set of known data which correspond to a part of the entire knowledge of experts, and the remaining part is supplied by the users asking questions with a final processing to give advice. We can define expert systems as a subgroup that is part of the Artificial Intelligence area in which the knowledge is represented and interpreted to find adequate solutions to particular problems, i.e. (Li et al., 2022), a program capable of reasoning the system's conclusions. The expert system includes the rules that are known of how the final procedure is spread and maintains them in an orderly way. Through inference and the knowledge base, the knowledge about hardware and/or software is utilized to carry out reasoning. With the aid of an inference mechanism, the expert system

manipulates the knowledge to achieve a corresponding deductive procedure. Four types of knowledge are involved in an expert system.

4. Integration of AI and Decision Support Systems

This part is devoted to a separate type of Decision Support Systems, in which the role of feedback and, accordingly, the planning facility is most fully implemented as one of the levels of AI tools - expert systems. Indeed, the full-fledged functioning of expert systems is realized in the process of their constant interaction with the user. When the user receives decisions, the system records them. The user also asks questions, and the expert system, in turn, as if reflecting on their decisions, requests the user to clarify the information provided. Generally, special interactive programs are provided on the basis of AI, where expert systems and other AI tools can interact with the users. The internal intermediary also allows many of the direct problems solved by these systems in the areas of interest to us. In our studies, administrative personnel - administrators, heads of units, etc., were users of expert systems.

We will differentiate a special user - a client; in the departments they are called the chiefs of the sector who submitted a request and accepted the products received. By processing the results of their work with the frames corresponding to the problems, they formed new knowledge, in the course of their interaction with the consultant, and, analyzing their activities, the authors represented its model as a hierarchy of knowledge, which systematizes the accumulated experience and serves as an analogue of feedback, which compares the AI approaches used in decision support from two different angles. Initially, these are examples of the most interesting and meaningful AI tools, specialization data and knowledge bases.

5. Challenges and Ethical Considerations in AI-based Decision Support Systems

Ethical considerations of AI-based decision support mostly focus on general AI safety issues, including biased recommendations and the ethical implications when following conclusions. Developers may pay little or no attention to these consequences, which can cause substantial harm to the population, even when the system is addressing issues that require strict confidentiality.

Overfitting and associating statements with non-existent paths can lead to false conclusions that may go unnoticed during system development. It is difficult to prevent overfitting without hiding information, but the system can control its association with non-existent paths.

Biased weightings can also lead to biased conclusions and recommendations. It is easier to prevent biased conclusions in intelligent machines than those following non-existent paths. Biased recommendations and conclusions raise ethical issues, such as declining to offer valid and deserved recommendations and biasing towards what is most beneficial for the system.

Selective provision of education, health, and financial help based on prior knowledge of how recommendations will be acted upon can be seen as discriminatory. Therefore, biased recommendations should be considered highly unethical.

General failure to assist those suffering, withholding help and coverage based on classification feedback and biased weights inferred from the data, is also considered unethical. This not only causes inefficiencies but also affects societal behavior and undermines public health initiatives. An example of this was seen in the Brazil Felipe eradication campaign, where percentages drove the initial financing structure.

It is important to remember that even with only a small weight, large parts of society may be affected, and not all of the weight needs to be present to infer consequences. Helping biased decisions and those with good prospects, while precluding flawed morality and concealing inhuman and degrading treatment, argue that the health of both the decision maker and the decision maker's health system should be prioritized.

Overall, these ethical considerations highlight the need for a prepared and sustainable health system that takes into account the potential consequences of AI-based decision support.

6. Objective Data in Decision Making

Now, an attempt will be made to present the capability of expert-system technology to make use of "objective data" to support decision making, typically the unique domain of data-driven methods of analysis and synthesis such as "statistical" and "mathematical model." Alternative data-collection strategies such as interviews, observations, or questionnaires provide information from which the professional in a quadratic programs industry administrative investigate to know that similar relevant variables have similar values. This is the most direct way to provide sufficient "support" of critical decision-maker so they can confidently make provisional decisions.

The ideal approach is to develop a set of variables that will allow deciding on persons who get favorable decisions, while distinguishing between the benevolent cases and other futuristic contractors. The data collection problem is the most difficult part of a decision support advisory project tasks. The more structured the decision problem, the more structured ways one can design to collect the data. Define what kind of decision making a decision-support system is needed and what data related to the problem need to be collected even if it involves inferences regarding unknown facts. Then locate the required data and design ways to collect them. It's quite likely that decision support in many fields go through their development stages in the human-information-handling route. So far, relatively little attention has been directed toward making use of objective-data advantage in advisory expert systems. The issues of what can be gained versus what can be lost are empirical-librarian issues. Robotics research is continuing to progress at such important advances have been made areas as sensor, mobility, end-effectors, and the control of simple intelligent robots.

6.1. Definition and Importance

The decision support system plays a vital role in providing the user with data and conclusions obtained from these data, to make critical decisions in the right direction. Modern decision support systems, which have AI-based constructs and offer decision support services to the user, are among the applications that have become widespread and came to the fore with the increase in computer usage and software technology. The design of decision support systems has become one of the most popular areas of application of artificial intelligence in recent years. Expert systems also have the main function of generating knowledge in a specific field and providing this knowledge to users in the form of a decision support system. The basic aim of expert systems and decision support systems and decisions taken to assist people concerned to provide expertise in problem-solving in professional terms.

AI and expert systems provide support to systems in decision-making processes to be established in a very real sense. The quality of such intelligent decision support systems, which should help the decision-maker increase the level of rationalism, should be expressed in both satisfying the decision-maker's problem-solving capability and providing immediate assistance within the specified time constraint. In this context, the functional aspects discussed in conjunction with data-based decision support systems can be said to be valid for expert systems (artificial intelligence data-based systems). This decision support process is applied to systems that use programming-based

languages and are often employed to produce solutions that are characterized by large volumes of data, databases, and interactive data management systems and that can directly influence corporate information management policies. Furthermore, in the case of the resolve studies carried out in the enterprise information management chart, the tools of artificial intelligence and expert systems can often be used, in particular, to "teach" or assist the resolution-makers.

6.2. Sources of Objective Data

Three ways of finding these patients and interviewing them are suggested. One method is suggested as having potential in Spain, a second in the United Kingdom, and a third in Germany. The second empirical assumption calls for larger resources (Romay-Barja et al., 2021). These are needed to confirm the completeness of sampling and optimize the composition of the motivational mix in the treatment. Five aspects of this are examined: specific sequence of motivation sources, specific individuals performing the tasks, contiguity of the therapy schedule, seniority of individuals performing the tasks, and level of interaction within the therapeutic team. Then motivation issues are tackled, and some pointers are given to how the desired motivation levels may be achieved.

The final question placed several calls for decision support on the table. What decisions are made by treating psychiatrists, and what procedures guide these decisions? Is the decision-making situation the same for every patient during their treatment? What are the procedural barriers to the potential implementation of decision support in artificial intelligence and to the flow of objective data, and how can they be overcome.

7. Applications of AI in Objective Data Decision Support Systems

Decisions are made throughout the strategic management process to analyze, formulate, and successfully implement an effective business strategy. Decision aids or, more precisely, decision support systems need to support managers at critical stages of the strategy management process. Despite advancements made on strategic decision support systems (SDSS) over the past 30 years, the technology has hardly been adopted by the management community at large. Artificial intelligence technologies are currently being advanced and their abilities recognized, hence it has been suggested that they provide a more effective and viable solution. The purpose of this work is to identify the use of artificial intelligence as a decision aid in providing objective strategic data.

where AI has been used to offer various capabilities such as assistance with forward strategizing, the understanding of certain more complex qualitative data types, and the improvement in performance for some existing quantitative data analysis methods. The examples suggest that the use of AI can offer strategic managers more flexibility and more power than current traditional decision-making support systems and therefore contribute to a more effective objective data decision support environment. It is important to realize that the introduction of a decision support system comes with its own set of organizational and environmental challenges and that an organization must be correctly prepared for the insertion of a given AI-based decision-making system. However, it is the belief that while there are a number of drawbacks to be considered, the use of AI has the benefits that far outweigh these concerns.

7.1. Healthcare

Clinical decision support (CDS) systems are a key component in artificial intelligence and are of utmost importance when used in structures that are based on their intended requirements. These structures are not easily attainable and require expert knowledge and extensive testing. Our aim is to provide healthcare workers with up-to-date knowledge base support tools that balance the need for improved health and reduced costs. The best way for healthcare workers to follow treatment, therefore, is through artificial intelligence.

To develop an integrated CDS architecture applied to hospital infection control, an object-oriented model was designed. Then, a system made up of workstations and knowledge databases maintained by expert system shells was built. This special CDS contains several innovative ideas to improve interdisciplinary communication and performance.

Healthcare Management, Communication, and Evaluation of Functional Health Information Access is a concept encompassing the control, valuation, and communication of health data and management. Based on clinical practice, healthcare professionals encounter health information that may be used to drive their decision-making. However, health information has transformed considerably as data is used for ad hoc, transactional, tactical, as well as strategic and operational patient care. Functional health information reflects patients' overall health awareness by placing patients in the middle of their data. This patient information is documented in a structured form that allows users to measure adherent responses.

7.2. Finance

Decision support in finance includes a wide set of problems starting from pricing and ending with qualitative research of company activities. both about hedge funds, their strategies and all variants of decision support for analysis of applied models. This last problem is a relatively new and interesting in information systems. It is really an intelligent information system that firstly should not only obtain, store, transform and transfer data, but also understand the semantics of it up to some level. It applies methods of simple decision support, DSS, whose history begins from the mid-1960s when management used computers and tools like optimization to help them in discovering a preferred solution for semistructured and unstructured problems of decision-making.

However, in finance you can find peculiarities of DSS. One of them is a need for expert knowledge and PC issue, and the other one is measurement of effectiveness of decision support systems, because it normally includes subjective estimations or even knowledge assumed while the process of intelligent system operation. And this is one of the most used consulting domains. Corporate consulting, independent investment consulting, advice on how to bypass synthetic securities limitations - these are the most popular applications today. The big money industry has great opportunities not only due to its elite status, but also due to the confidential nature of work. Consulting is still occupying one of the leading positions in AI finance tools usage due to its systematic nature.

7.3. Marketing

We suggest an algorithm to extract valuable objective data from online services and facilitate sex discrimination in the real economy. The tool allows decision makers in marketing and HR to receive actual community feedback on products and strategies. This provides a quick response and creates an opportunity to influence an opinion. Artificial intelligence applications for different types of discrimination economically easily determine gender discrimination. Although corporate social responsibility is gradually becoming a "must have" digital brand, tools for influencing perception are needed. The ability to quickly analyze any reasonable set of socio-cultural truths, such as those provided by modern online platforms, creates a decision support system. Such algorithms are difficult to implement because of cultural, language, social, intellectual, and other subjective factors that are difficult to encode.

Keyword analysis is not a solution to the problem of understanding cultural content. To support decision-making in data environments with cultural context, we suggest an algorithm that allows objective features to be extracted and later fed into a classifier. The method is useful for web data mining and keyword ranking extraction algorithms. The problem of gender discrimination in the labor market ensures well-motivated job satisfaction and satisfaction. Minimizing the impact of discrimination is a positive practice that significantly increases social and economic development by efficiently using human capital. Discriminatory pay gaps are employees who have similar skills, experience, knowledge; perform work of similar value under similar conditions, but are the value to the employer and are considered purely because of their gender. The lack of wage equality is a reflection of inequality, gender inequality, and justice. Additionally, it is the reason why women's total income is lower over their lives.

8. Analyzing Case Studies and Successful Examples

These examples illustrate methods of using a diverse set of machine learning and reasoning strategies to address decision support problems. The ability to demonstrate value in this challenging area suggests that object-level decision support systems are increasingly feasible and economical. Based on the social impacts of our work in these areas, we also expect that they will be increasingly cost-effective and socioeconomically valuable. These emerging results suggest that the underlying science and engineering infrastructure to build decision support systems is an increasingly well-developed field, with established methods, tools, infrastructure, and expertise, and economies of scale and reuse across domains.

We conclude with a set of challenges for decision support research. These include both the development of enterprise-level systems and technologies, and fundamental research in AI, decision theory, human-computer interaction, and machine learning. With the right community investment and engagement, and perhaps some smart technology accelerants like those planted by some recent high-profile government and corporate investments in AI infrastructure, the challenges of decision support are ripe for real progress. Today, many automated systems work in tightly tied applications where a narrowly scoped expert in a specific problem area or a closely related area can identify an acceptable base algorithm or approach—solutions are being developed at a level that Edgar Codd might argue was a race to become a good aircraft mechanic rather than an aeronautics scientist. With respect to modern aircraft development, original design and ultimate innovation efforts are analytical, involve complex systems, and

typically address influential hot projects, rather than simple low-value devices that might achieve broader market acceptance but smaller practical impact. In many AI applications, we too often limit our collective aspirations to accommodate the classic time-constraints of available computation and the overabundance of often ambiguous data, rather than leveraging those tendencies as opportunities for subsequent improvements. In the process, we produce too many solutions that render experts useless, including methods for diagnosing and upgrading complex software systems or managing high-availability environments. We have the unique advantage of being able to investigate the added potential of advanced decision-support technologies, to advance the discipline of decision support, and to add significant value to related missions that address other fields of knowledge and expertise.

9. Future Trends and Innovations in AI Decision Support Systems

The outlook for the field of AI in healthcare has never been brighter. The role of observation and classification has been widely accepted, particularly as it pertains to "real narratives." In health services research, demonstrating best practices has been neglected. Objective data that demonstrate defined rational care are of subsequent greater value and have the potential to be generated by decision support. The incremental increase in the application of AI to assist with complex mental processing tasks suggests other unmet needs may become apparent. Cognitive tasks, particularly those involving abstraction, judgments of similarity, large knowledge bases, and translation may be further facilitated as speculated by Turing in his 1950 article 'Computing Machinery and Intelligence'.

Three highly influential and landmark AI conferences held in 1989, 1994 and 1999, provide persuasive milestones that have shaped advancements. A number of "tipping points" were suggested by the same author in 1990. These may be defined by individual known AI systems and projects. AI/ES has been successful in assisting outcomes from my own research. Other tipping points have been suggested due to expert knowledge development. Tools to articulate and transfer mental processes guided diagnostics of professionals on role and responsibility. 2003 saw the emergence of PC-based broad schemes of interoperability founded on XML. The concurrent lift in interest in the potential applications of the methodology in risk assessment and management indicate perhaps the first multi-industry watershed application of AI beyond the 1980s expert systems. AI decision support is being recognized as a valid response supertertiary government and regulator needs.

المصادر الأجنبية

- جوبتا، س.، مودجيل، س.، بهاتاشاريا، س.، وبوز، آي. (٢٠٢١). الذكاء الاصطناعي لأنظمة دعم القرار في مجال بحوث العمليات: مراجعة ونطاق البحث في المستقبل. حوليات بحوث العمليات، ٣٠٨(١-٢)، ٢١٥-٢٧٤ https://doi.org/10.1007/s10479-020-03856-6 .
- كاو، ل. (٢٠٢٣). الذكاء الاصطناعي عبر الأنظمة: الذكاء الاصطناعي التحويلي والعابر للتخصصات والترجمي وعلوم البيانات. المجلة الدولية لعلوم البيانات والتحليلات . https://doi.org/10.1007/s41060-023-00384-x
- القحطاني، ت.، بدر الدين، ح. أ.، الراشد، م.، الشايع، أ. ي.، الغامدي، س. س.، صالح، خ. ب.، العويس، س. أ.، الشايع، ع. أ.، رحمن، يامي، م. س. أ.، والبكيرى، أ. م. (٢٠٢٣). الدور الناشئ للذكاء الاصطناعي ومعالجة التعلم الطبيعي ونماذج اللغة الكبيرة في التعليم العالي والبحث العلمي. البحث في الصيدلة الاجتماعية والإدارية، ١٩(٨)، ١٢٣٦-١٢٤٢. https://doi.org/10.1016/j.sapharm.2023.05.016
- Fomin ،I. ،Kokarev ،K. ،Ananyev ،B. ،Neklyudov ،N. ،Bondik ،A. ،Glushkov ،P. ، Safina ،A. ،Stolyarova ،S. ،Tkach ،D. ،Vedernikova ،O. ،Yakovenko ،I. ، ،. سوشينتسوف، A ،Chekov ،D. ،Voronina ،E. ،Kuzina ،D. ،Kovaleva ،D. ،Korobkova أ.، ووهلفورث، دبليو (٢٠٢٠). الدراسات الدولية في عالم لا يمكن التنبؤ به: هل مازلت تتجنب المشاكل الصعبة؟ المجلة الأوروبية للعلاقات الدولية، ٢٧(١)، ٣-٢٨. https://doi.org/10.1177/1354066120948124
- Fomin ،I. ،Kokarev ،K. ،Ananyev ،B. ،Neklyudov ،N. ،Bondik ،A. ،Glushkov ،P. ، Safina ،A. ،Stolyarova ،S. ،Tkach ،D. ،Vedernikova ،O. ،Yakovenko ،I. ، ،. سوشينتسوف، A ،Chekov ،D. ،Voronina ،E. ،Kuzina ،D. ،Kovaleva ،D. ،Korobkova أ.، ووهلفورث، دبليو (٢٠٢٠). الدراسات الدولية في عالم لا يمكن التنبؤ به: هل مازلت تتجنب المشاكل الصعبة؟ المجلة الأوروبية للعلاقات الدولية، ٢٧(١)، ٣-٢٨. https://doi.org/10.1177/1354066120948124
- Hamid, M., Zeshan, F., Ahmad, A., Ahmad, F., Hamza, M. A., Khan, Z. A., Munawar, S., & Aljuaid, H) لإدارة فعالة IRDSS. (٢٠٢٠). نظام ذكي للموصي ودعم القرار IEEE Access١٤٠٧٥٢ ،٨، 140766-. المشاريع البرمجيات. https://doi.org/10.1109/access.2020.3010968

- Hovorushchenko, T., Hnatchuk, Y., Herts, A., & Onyshko, O (٢٠٢١). تكنولوجيا المعلومات الذكية لدعم اتخاذ القرار الطبي مع مراعاة الأساس القانوني. في : تقنيات IntelITSIS 2021 المعلومات الذكية وأنظمة أمن المعلومات ٢٠٢١ (ص ٧٢-٨٢). [RWTH Aachen]
- كروس، سي إس، وإيربار، إن. (٢٠٢٠). تأثيرات أنظمة دعم القرار المحوسبة على أداء الممارس ونتائج المرضى: مراجعة منهجية. مجلة المعلوماتية الطبية JMIR، ٨(8)، e17283. https://doi.org/10.2196/17283
- أفيرسا، ب.، وكابانتوس، ل.، وهافليجر، س. (٢٠١٨). عندما تفشل أنظمة دعم القرار: رؤى لأنظمة المعلومات الاستراتيجية من الفورمولا ١. مجلة أنظمة المعلومات الاستراتيجية، ٢٧(٣)، ٢٢١-٢٣٦. https://doi.org/10.1016/j.jsis.2018.03.002
- وونغ-بارودي، ج.، وماك، ك. ج.، وجاجاناثان، ك.، وسيوستروم، ك. د. (٢٠٢٠). رؤى لتطوير أدوات دعم القرار الفعالة للاستدامة البيئية. الرأي الحالي في الاستدامة البيئية، ٤٢، ٥٢-٥٩. https://doi.org/10.1016/j.cosust.2020.01.005
- جهاني، أ.، ورايجاني، ب. (٢٠٢٠). تقييم جودة المناظر الطبيعية للغابات باستخدام تقنيات الذكاء الاصطناعي كنظام لدعم القرار. البحث البيئي العشوائي وتقييم المخاطر، ٣٤(١٠)، ١٤٧٣-١٤٨٦. https://doi.org/10.1007/s00477-020-01832-x
- Bleher, H., & Braun, M. (٢٠٢٢). المسؤولية المنتشرة: إسناد المسؤولية في استخدام أنظمة دعم القرار السريري المعتمدة على الذكاء الاصطناعي. الذكاء الاصطناعي والأخلاق، ٢(٤)، ٧٤٧-٧٦١. https://doi.org/10.1007/s43681-022-00135-x
- Tekouabou, S. C. K., Diop, E. B., Azmi, R., Jaligot, R., & Chenal, J. (٢٠٢١). مراجعة تطبيق أساليب التعلم الآلي لنمذجة مؤشرات الشكل الحضري في أنظمة دعم القرار التخطيطي: الإمكانات والقضايا والتحديات. مجلة جامعة الملك سعود – علوم الحاسب والمعلومات، ٣٤(٨)، ٥٩٤٣-٥٩٦٧. https://doi.org/10.1016/j.jksuci.2021.08.007
- Shyshatskyi, A. (٢٠٢٠). طرق معقدة لمعالجة البيانات المختلفة في الأنظمة الفكرية لنظام دعم القرار. المجلة الدولية للاتجاهات المتقدمة في علوم الحاسب والهندسة، ٩(٤)، ٥٥٨٣-٥٥٩٠. https://doi.org/10.30534/ijatcse/2020/206942020
- شوندرورد، ت. أ.، وجوريتسما، و.، ونيرينكس، م. أ.، وفان دن بوش، ك. (٢٠٢١). الذكاء الاصطناعي المتمركز حول الإنسان: تطوير أنماط التصميم لشرح أنظمة دعم القرار السريري. المجلة الدولية لدراسات الإنسان والحاسوب، ١٥٤، ١٠٢٦٨٤

- جيوردانو، سي، بريتان، م، محمد، ب، رشيدي، ب، موداف، ف، وتيغي، ب. (٢٠٢١). الاستفادة من الذكاء الاصطناعي لاتخاذ القرارات السريرية. الحدود في الصحة الرقمية، ٣. https://doi.org/10.3389/fdgth.2021.645232
- زوبيف، ب.، زيفوتوفسكي، ر.، زفييريف، أو.، هاتسينكو، س.، آدامينكو، م.، كوبري، ف.، ناكونيتشني، أو.، شيشاتسكي، أ.، نيروزناك، ي.، وفيليتشكو، ف. (٢٠٢٠). تطوير منهجية معقدة لمعالجة البيانات غير المتجانسة في أنظمة دعم القرار الذكي. مجلة البحوث الطبية الأكاديمية، ٤ (٩-١٠٦)، ١٤-٢٣.
- لي، م.، كوان، و.، وباك، ك. (٢٠٢١). الذكاء الاصطناعي لتحليلات البيانات الضخمة في قطاع الضيافة: تطوير نموذج تنبؤ بمدى فائدة مراجعات المطاعم لدعم عملية اتخاذ القرار لدى العملاء. المجلة الدولية لإدارة الضيافة المعاصرة، ٣٣(٦)، ٢١١٧-٢١٣٦. https://doi.org/10.1108/ijchm-06-2020-0587
- ياماموتو، س. (٢٠١٧). وقائع المؤتمر الدولي التاسع عشر حول التفاعل بين الإنسان والحاسب الآلي الدولي ٢٠١٧، فانكوفر، كولومبيا البريطانية، كندا، ٩-١٤ يوليو ٢٠١٧، الجزء الثاني. سبرينغر.
- تشانغ، سي، ولو، واي (٢٠٢١). دراسة حول الذكاء الاصطناعي: أحدث التطورات والآفاق المستقبلية. مجلة تكامل المعلومات الصناعية، ٢٣، ١٠٠٢٢٤
- لي، د.، ويون، س. ن. (٢٠٢١). تطبيق تقنيات الذكاء الاصطناعي في قطاع الرعاية الصحية: الفرص والتحديات. المجلة الدولية للبحوث البيئية والصحة العامة، ١٨(١)، ٢٧١. https://doi.org/10.3390/ijerph18010271
- لي، د. ويون، س. ن. (٢٠٢١). تطبيق التقنيات القائمة على الذكاء الاصطناعي في صناعة الرعاية الصحية: الفرص والتحديات. المجلة الدولية للبحوث البيئية والصحة العامة، ١٨(١)، ٢٧١. https://doi.org/10.3390/ijerph18010271
- Shen, H., Jin, H., Cabrera, Á. A., Perer, A., Zhu, H., & Hong, J. I. (٢٠٢٠). تصميم تمثيلات بديلة للمصفوفات المشوشة لدعم فهم الجمهور غير المتخصص لأداء الخوارزمية. وقائع جمعية الحوسبة الأمريكية للتفاعل بين الإنسان والحاسوب، ٤(CSCW2)، ١-٢٢ . https://doi.org/10.1145/3415224
- Chicco, D., Tötsch, N., & Jurman, G. (٢٠٢١). معامل ارتباط ماثيوز (MCC) أكثر موثوقية من الدقة المتوازنة، ومعلومات صانع المراهنات، والوضوح في تقييم مصفوفة الارتباك ذات الفئتين. BioData Mining، ١٤(1). https://doi.org/10.1186/s13040-021-00244-z

- Itoo, F., Meenakshi, N., & Singh, S. (٢٠٢٠). مقارنة وتحليل الانحدار اللوجستي، خوارزميات التعلم الآلي Naïve Bayes وKNN للكشف عن الاحتيال في بطاقات الائتمان. المجلة الدولية لتكنولوجيا المعلومات، ١٣(٤)، ١٥٠٣-١٥١١. https://doi.org/10.1007/s41870-020-00430-y

- Roy, M., Das, S., Deb, N., Cortesi, A., Chaki, R., & Chaki, N. (٢٠٢٣). ربط السياقات وتضاربات NFR من سجلات الأحداث. Software & Systems Modeling، ٢٢(6)، ١٩٨٧-2010. https://doi.org/10.1007/s10270-023-01087-4

- Gasparotto, M. (٢٠٢٤). تعزيز العدالة اللغوية في المساحات الرقمية: استخدام الأساليب الأصلية في دراسة معالجة اللغة الطبيعية. Emerging Media. https://doi.org/10.1177/27523543241305814

- List, J., Forkel, R., Greenhill, S. J., Rzymski, C., Englisch, J., & Gray, R. D. (2022). Lexibank، مستودع عام لقوائم الكلمات الموحدة مع ميزات صوتية ومعجمية محوسبة. Scientific Data، ٩(1). https://doi.org/10.1038/s41597-022-01432-0

- نيشتار، ز.، وأفضال، ج. (٢٠٢٤). الجدولة الزمنية لليوم التالي بناءً على التسلسل إلى التسلسل لـ SCUC في أنظمة الطاقة المعزولة ذات التوليد المتقطع المحدود. مجلة محذوفة، ١(١)، ٤٣-٥٠. https://doi.org/10.48112/jestt.v1i1.683

- وو، م.، وما، ل.، وفان، ج. (٢٠٢٤). إطار عمل واسع النطاق لاتخاذ القرارات الجماعية يعتمد على مجموعات ضبابية ثنائية الأبعاد في اختيار البدائل المثلى للحد من انبعاثات الكربون. أنظمة الخبراء مع التطبيقات، ١٢٥٤٨٨. https://doi.org/10.1016/j.eswa.2024.125488

- لي، م.، هوانج، ز.، شان، كيو.، تشن، س.، تشانغ، ن.، هو، هـ.، ووانج، و. (٢٠٢٢). أداء ومقارنة الذكاء الاصطناعي والخبراء البشريين في الكشف عن وتصنيف السلائل القولونية. مجلة طب الجهاز الهضمي BMC، ٢٢(1). https://doi.org/10.1186/s12876-022-02605-2

- Romay-Barja, M., Iglesias-Rus, L., Boquete, T., Benito, A., & Blasco-Hernández, T. (٢٠٢١). المعرفة الأساسية المفقودة عن مرض شاغاس بين السكان المعرضين للخطر في إسبانيا والتي تؤثر على التشخيص والعلاج. الأمراض المعدية الناجمة عن الفقر، ١٠(١). https://doi.org/10.1186/s40249-021-00841-4

Bibliography of Arabic References (Translated to English)

- Gupta, S., Modgil, S., Bhattacharyya, S., & Bose, I. (2021). Artificial intelligence for decision support systems in the field of operations research: review and future scope of research. *Annals of Operations Research*, *308*(1–2), 215–274. https://doi.org/10.1007/s10479-020-03856-6
- Cao, L. (2023). Trans-AI/DS: transformative, transdisciplinary and translational artificial intelligence and data science. *International Journal of Data Science and Analytics*. https://doi.org/10.1007/s41060-023-00384-x
- Alqahtani, T., Badreldin, H. A., Alrashed, M., Alshaya, A. I., Alghamdi, S. S., Saleh, K. B., Alowais, S. A., Alshaya, O. A., Rahman, I., Yami, M. S. A., & Albekairy, A. M. (2023). The emergent role of artificial intelligence, natural learning processing, and large language models in higher education and research. *Research in Social and Administrative Pharmacy*, *19*(8), 1236–1242. https://doi.org/10.1016/j.sapharm.2023.05.016
- Fomin, I., Kokarev, K., Ananyev, B., Neklyudov, N., Bondik, A., Glushkov, P., Safina, A., Stolyarova, S., Tkach, D., Vedernikova, O., Yakovenko, I., Korobkova, D., Kovaleva, D., Kuzina, E., Voronina, D., Chekov, A., Sushentsov, A., & Wohlforth, W. (2020). International studies in an unpredictable world: still avoiding the difficult problems? *European Journal of International Relations*, *27*(1), 3–28. https://doi.org/10.1177/1354066120948124
- Hamid, M., Zeshan, F., Ahmad, A., Ahmad, F., Hamza, M. A., Khan, Z. A., Munawar, S., & Aljuaid, H. (2020). An Intelligent Recommender and Decision Support System (IRDSS) for effective management of software projects. *IEEE Access*, *8*, 140752–140766. https://doi.org/10.1109/access.2020.3010968
- Hovorushchenko, T., Hnatchuk, Y., Herts, A., & Onyshko, O. (2021). Intelligent Information Technology for Supporting the Medical Decision-Making Considering

the Legal Basis. In *IntelITSIS 2021: Intelligent Information Technologies & Systems of Information Security 2021* (pp. 72-82). [RWTH Aachen]

- Kruse, C. S., & Ehrbar, N. (2020). Effects of computerized decision support systems on practitioner performance and patient outcomes: Systematic review. *JMIR Medical Informatics*, *8*(8), e17283. https://doi.org/10.2196/17283
- Aversa, P., Cabantous, L., & Haefliger, S. (2018). When decision support systems fail: Insights for strategic information systems from Formula 1. *The Journal of Strategic Information Systems*, *27*(3), 221–236. https://doi.org/10.1016/j.jsis.2018.03.002
- Wong-Parodi, G., Mach, K. J., Jagannathan, K., & Sjostrom, K. D. (2020). Insights for developing effective decision support tools for environmental sustainability. *Current Opinion in Environmental Sustainability*, *42*, 52–59. https://doi.org/10.1016/j.cosust.2020.01.005
- Jahani, A., & Rayegani, B. (2020). Forest landscape visual quality evaluation using artificial intelligence techniques as a decision support system. *Stochastic Environmental Research and Risk Assessment*, *34*(10), 1473–1486. https://doi.org/10.1007/s00477-020-01832-x
- Bleher, H., & Braun, M. (2022). Diffused responsibility: attributions of responsibility in the use of AI-driven clinical decision support systems. *AI And Ethics*, *2*(4), 747–761. https://doi.org/10.1007/s43681-022-00135-x
- Tekouabou, S. C. K., Diop, E. B., Azmi, R., Jaligot, R., & Chenal, J. (2021). Reviewing the application of machine learning methods to model urban form indicators in planning decision support systems: Potential, issues and challenges. *Journal of King Saud University - Computer and Information Sciences*, *34*(8), 5943–5967. https://doi.org/10.1016/j.jksuci.2021.08.007
- Shyshatskyi, A. (2020). Complex methods of processing different data in intellectual systems for decision support system. *International Journal of Advanced*

Trends in Computer Science and Engineering, *9*(4), 5583–5590. https://doi.org/10.30534/ijatcse/2020/206942020

- Schoonderwoerd, T. A., Jorritsma, W., Neerincx, M. A., & Van Den Bosch, K. (2021). Human-centered XAI: Developing design patterns for explanations of clinical decision support systems. *International Journal of Human-Computer Studies*, *154*, 102684. https://doi.org/10.1016/j.ijhcs.2021.102684
- Giordano, C., Brennan, M., Mohamed, B., Rashidi, P., Modave, F., & Tighe, P. (2021). Accessing artificial intelligence for clinical Decision-Making. *Frontiers in Digital Health*, *3*. https://doi.org/10.3389/fdgth.2021.645232
- Zuiev P., Zhyvotovskyi R., Zvieriev O., Hatsenko S., Adamenko M., Kuprii V., Nakonechnyi O., Shyshatskyi A., Neroznak Y., & Velychko V. (2020). DEVELOPMENT OF COMPLEX METHODOLOGY OF PROCESSING HETEROGENEOUS DATA IN INTELLIGENT DECISION SUPPORT SYSTEMS. Восточно-Европейский журнал передовых технологий, 4 (9-106), 14-23.

- Lee, M., Kwon, W., & Back, K. (2021). Artificial intelligence for hospitality big data analytics: developing a prediction model of restaurant review helpfulness for customer decision-making. *International Journal of Contemporary Hospitality Management*, *33*(6), 2117–2136. https://doi.org/10.1108/ijchm-06-2020-0587
- Yamamoto, S. (2017). *Human Interface and the management of information: supporting learning, Decision-Making and collaboration: 19th International Conference, HCI International 2017, Vancouver, BC, Canada, July 9–14, 2017, Proceedings, Part II*. Springer.
- Zhang, C., & Lu, Y. (2021). Study on artificial intelligence: The state of the art and future prospects. *Journal of Industrial Information Integration*, *23*, 100224. https://doi.org/10.1016/j.jii.2021.100224

- Lee, D., & Yoon, S. N. (2021). Application of Artificial Intelligence-Based Technologies in the Healthcare Industry: Opportunities and challenges. *International Journal of Environmental Research and Public Health*, *18*(1), 271. https://doi.org/10.3390/ijerph18010271
- Shen, H., Jin, H., Cabrera, Á. A., Perer, A., Zhu, H., & Hong, J. I. (2020). Designing alternative representations of confusion matrices to support Non-Expert public understanding of algorithm performance. *Proceedings of the ACM on Human-Computer Interaction*, *4*(CSCW2), 1–22. https://doi.org/10.1145/3415224
- Chicco, D., Tötsch, N., & Jurman, G. (2021). The Matthews correlation coefficient (MCC) is more reliable than balanced accuracy, bookmaker informedness, and markedness in two-class confusion matrix evaluation. *BioData Mining*, *14*(1). https://doi.org/10.1186/s13040-021-00244-z
- Itoo, F., Meenakshi, N., & Singh, S. (2020). Comparison and analysis of logistic regression, Naïve Bayes and KNN machine learning algorithms for credit card fraud detection. *International Journal of Information Technology*, *13*(4), 1503–1511. https://doi.org/10.1007/s41870-020-00430-y
- Roy, M., Das, S., Deb, N., Cortesi, A., Chaki, R., & Chaki, N. (2023). Correlating contexts and NFR conflicts from event logs. *Software & Systems Modeling*, *22*(6), 1987–2010. https://doi.org/10.1007/s10270-023-01087-4
- Gasparotto, M. (2024). Fostering linguistic justice in digital spaces: Using Indigenous methods in the study of NLP. *Emerging Media*. https://doi.org/10.1177/27523543241305814
- List, J., Forkel, R., Greenhill, S. J., Rzymski, C., Englisch, J., & Gray, R. D. (2022). Lexibank, a public repository of standardized wordlists with computed phonological and lexical features. *Scientific Data*, *9*(1). https://doi.org/10.1038/s41597-022-01432-0

- Nishtar, Z., & Afzal, J. (2024). Seq2Seq-Based-Day-Ahead Scheduling for SCUC in Islanded Power Systems with Limited Intermittent Generation. *Deleted Journal*, *1*(1), 43–50. https://doi.org/10.48112/jestt.v1i1.683
- Wu, M., Ma, L., & Fan, J. (2024). A large-scale group decision-making framework based on two-dimensional picture fuzzy sets in the selection of optimal carbon emission reduction alternatives. *Expert Systems With Applications*, 125488. https://doi.org/10.1016/j.eswa.2024.125488
- Li, M., Huang, Z., Shan, Q., Chen, S., Zhang, N., Hu, H., & Wang, W. (2022). Performance and comparison of artificial intelligence and human experts in the detection and classification of colonic polyps. *BMC Gastroenterology*, *22*(1). https://doi.org/10.1186/s12876-022-02605-2
- Romay-Barja, M., Iglesias-Rus, L., Boquete, T., Benito, A., & Blasco-Hernández, T. (2021). Key Chagas disease missing knowledge among at-risk population in Spain affecting diagnosis and treatment. *Infectious Diseases of Poverty*, *10*(1). https://doi.org/10.1186/s40249-021-00841-4