

# Exploiting the Potential of Artificial Intelligence in Decision Support Systems

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## ABSTRACT

For several years now, the concept of AI being able to quickly and extensively replace expert workers at massive scales has been on the cusp of becoming a reality. Although AI has shown to be an effective tool for many activities, humans still have a significant advantage in many other areas. Companies are becoming more conscious of this fact. As a result, they are restructuring their business processes to provide their experts and customers with AI support in a more targeted manner. This study aims to present a high-quality review that covers unique, cutting-edge technologies and methodologies connected with the scientific design, development, and implementation of AI-DSS employing the most recent developments in AI and multi-criteria decision-making. The review will be presented in the form of a report. This article examines whether or not the growth of so-called artificial intelligence-driven decision support systems, also known as AI-DSS, threatens decision-making processes and, if so, how that threat manifests itself.

**Keywords:** Decision Support System (DSS), Artificial Intelligence, Intelligent Decision Support Systems (IDSS), Natural Language Processing (NLP)

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## INTRODUCTION

Champions in the battle to automate cognitive and physical work with artificial intelligence in the business world desire more than just AI-powered software to deploy. They require the intelligence as well as the human touch.

In the days before computers, choices were arrived at through experience and instinct. However, how one responds to queries such as "risky or safe" or "positive or negative" has undergone significant development since the introduction of the ENIAC, which was the first electronic programmable computer. This is mainly attributable to the capacity of computers to analyze vast volumes of data while simultaneously reducing levels of complexity. The ensuing choices allow the human brain to discriminate more accurately and concentrate on areas of the task at hand in which intuition may be an asset.

The ability of humans to make decisions has significantly advanced due to the development of computers. We can exercise control over the final result and specific aspects of the process in which human thought can bring value. No dispute exists that including people in the decision-making process benefits the system. Since computers increasingly replicate human thinking capabilities and are "learning to learn" — this is likely the most simplistic but illustrative way to explain what AI does — businesses need to figure out how and where AI enhances efficiency and performance in their processes and workflows. Since computers increasingly simulate human thinking skills and are "learning to learn," this is an illustrative approach to explain what AI does.

For businesses to successfully harness the power of artificial intelligence (AI), those firms need to have a solid understanding of workflows. A workflow is a sequence of operations or activities that can be repeated and involves data movement between humans and technology. In some circumstances, people will be required to take a back seat, while their contribution will be of the utmost importance in others.

It shouldn't come as a surprise that AI has also piqued the financial sector's interest. In most cases, it has taken the form of support systems for making investment judgments. The robo-advisor stands out as the most notable example we can provide. This post aims to bring our audience a step closer to them; however, it also provides further examples of AI helping with decision-making. Let's get right to it.

## STATEMENT OF THE PROBLEM

Within a setting that is both dynamic and comprised of multiple criteria for making decisions, artificial intelligence (AI) has the potential to offer autonomy and flexibility. Because AI's inclusion with operations research would boost the capabilities of the DSS, it enables enterprises and researchers to make informed decisions.

To create such an intelligent DSS, various programming paradigms and frameworks enabled with AI are necessary. To generate better decisions, researchers, decision-makers, and practitioners all need to work together to develop appropriate scientific theories, methodologies, and algorithms. Examples include machine learning, deep learning, data mining, reasoning, inference, and multi-criteria data analysis.

Instead of depending on traditional methods, researchers concerned with the creation and development of AI-DSS attempt to demonstrate fresh scientific procedures, tools, and models to increase the quality and accuracy of the supposed decisions. Operations research has been at the center of the decision-making process for a long time. On the other hand, in today's world, organizations are characterized by a high degree of change and dynamic interaction, which leads to uncertainty. Organizations need an appropriate decision-making process at each level to have a reasonable solution to the problem of coping with uncertain situations.

Traditional decision support systems (DSS) could only enable decision-making through data modeling and numerical computations. These systems could not integrate qualitative, quantitative, and predictive analysis to deliver decision-making capabilities comparable to those of humans. In addition, there are applications in the real world that need to be considered and analyzed based on many criteria and features, which in turn makes the process of making a decision more complicated.

## COMPONENTS CONSTITUTIVE OF A DSS

User interfaces, knowledge bases, and models are the three primary component groupings that make up a Decision Support System (DSS).

- 1. User Interface:** DSS user interfaces communicate with users. Users can access the knowledge base and model. DSS's user interface provides all data, simulation outcomes, and recommendations to help users make decisions. This implies DSS developers prioritize developing for usability. Decision Support Systems can have graphical web or mobile user interfaces. This is the most popular choice. However, not all users have large screens to comprehend charts and data. The latest AI model UX developments are voice-based chatbots and AR/VR user interfaces. Both methods make DSS interaction fun and convenient. Modern DSS manufacturers also personalize based on user demands, preferences, and tasks.
- 2. Knowledge Base:** The knowledge base serves as the DSS's basis and is where all of the data, information, and knowledge required for the DSS to make choices is stored. Both structured and unstructured data can be stored with the development of a contemporary knowledge base thanks to this capability. It compiles information from a wide range of sources, including databases, spreadsheets, data streams, and APIs provided by third parties. In addition, model analyses, simulations, and user input all fall under the data category; as such, the knowledge base will preserve them for use in future changes to the system.
- 3. Model:** The model is a component of the DSS that is responsible for the processing and analysis of the data that comes from the knowledge base. The model may be a straightforward rule-based system or an intricate algorithm for machine learning. In addition to using data analytics, models can generate simulations, recognize patterns, insights, and trends, and provide suggestions. We use contemporary data structures due to the requirement to process massive amounts of data.

## WHAT ARE DSS TOOLS THAT HELP US MAKE CHOICES?

A Decision Support System, sometimes known as a DSS, is a piece of software that assists individuals in making decisions by supplying them with pertinent data, analytical insights, and modeling capabilities. DSS is employed in various contexts, including managing businesses and organizations, government and healthcare, and military activities. Listed below are some examples taken from a variety of industries:

- Retail assists in the sales data analysis to help merchants decide on inventory management, pricing, and promotional activities.
- Personal finance is a sort of financial planning that assists individuals in managing their own money, including creating a budget and developing an investing strategy.
- Healthcare assists physicians and other healthcare professionals in making diagnoses, choose treatments, and managing patient care.
- Emergency management is a service that helps manage resources and respond to catastrophes and other unexpected events.
- Transportation feature assists in optimizing routes and schedules for various modes of transportation, including public transit, trucking, and other methods.

The idea that a Decision Support System is merely computer software needs to be clarified regarding the system. Earlier iterations of the DSS depended totally on human labor rather than relying solely on automated processes. To support decision-making, they utilized human expertise in addition to rules and heuristics. A decision support system (DSS) can be as straightforward as a checklist or a flowchart that leads the person to choose a procedure.

An early catastrophe mitigation decision support system is one example of a human-powered decision support system (DSS). When responding to natural catastrophes like hurricanes, earthquakes, or floods, emergency responders follow this system, which consists of a set of standards, checklists, and protocols that they have developed. It facilitates the rapid identification of possible risks, the prioritization of responses, and making decisions regarding evacuation, rescue, and recovery activities.

## BENEFITS OF AI IN DECISION SUPPORT SYSTEMS

Compared to more conventional approaches to data analysis and decision-making, decision support systems powered by artificial intelligence provide several distinct benefits.

**The processing of a significant volume of data:** Artificial intelligence can process vast amounts of data more quickly than humans. This is significant because an IDSS can better recognize patterns and correlations that would be difficult for humans to find the more data it has access to. This is especially true the more data it has access to, the better.

**The process of information filtering:** AI decision support systems can sift through considerable amounts of data to zero in on the aspects of the information that are most pertinent. In the modern corporate world, this is an essential skill when there is an overwhelming amount of data available from various sources.

**Processing data that needs to be structured:** Unstructured data, including posts on social networking platforms, customer reviews, and survey responses, make up a significant portion of the information valuable to businesses and investors. AI systems that use natural language processing most are particularly effective when digesting and gleaning valuable insights from this kind of data.

**Trying not to be biased:** Businesses and investors can be helped to make more objective decisions with the assistance of AI decision support systems. Human data analysts may have personal biases that can skew their understanding of data, but AI systems are immune to this sort of thing happening to them.

**Developing suggestions and ideas:** The capacity of some AI decision support systems to generate recommendations based on the data that they have processed is another advantageous function that these systems possess. When it comes to making judgments, this can save companies and investors significant time and effort.

## EXAMPLES OF AI-POWERED DECISION SUPPORT SYSTEMS

Other sectors besides the financial industry are beginning to recognize the value of having artificial intelligence help them make decisions. These systems, also known as intelligent decision support systems (IDSS), are already being utilized in various fields, including healthcare, marketing, entertainment and communication, e-commerce, command and control, and cybersecurity. Some instances are as follows:

- The pre-selection of images using AI-powered image processing software assists radiologists in making conclusions regarding cancer diagnosis more quickly and accurately.
- The utilization of predictive maintenance. Production lines in factories have been outfitted with artificial intelligence technology to identify potential malfunctioning and shortages of supplies.
- Semi-autonomous automobiles make use of visual processing so that they can comprehend things like warning signals and assist their drivers in making judgments. Deep learning is a subset of machine learning utilized here for image processing.
- Weather forecasting improves the odds of preventing natural disasters and, as a result, enables more efficient recovery strategies to be implemented. This brings together data scientists and climate scientists, bridging the gap between the two fields.
- Artificial intelligence may help marketers construct buyer personas by analyzing, for example, user behavior and how consumers engage across multiple brands' touchpoints. This can be done in the field of marketing.
- Recommendations of content on streaming services, online shopping websites, and social media platforms, for example. Indeed, individualized recommendations can be generated by AI by analyzing user data purchase or consumption trends.

## THE EXCITING FUTURE OF NLP TECHNOLOGIES

Natural Language Processing (NLP) is one of the most interesting new developments in artificial intelligence technology with applications in the DSS sector. The ability of computers to comprehend human language is the focus of the field of AI, known as natural language processing (NLP). In recent years, there has been significant development in NLP technology, and it is now capable of comprehending not just the literal meaning of words but also the context in which they are used. This has led to the development of some remarkable applications of natural language processing, such as chatbots that can conduct genuine conversations with humans and voice assistants who can interpret complex orders.

Regarding IDSS, the technology known as natural language processing (NLP) is utilized to process the unstructured data that is frequently pertinent to business choices. For instance, in the commercial world, NLP can be applied to the analysis of customer reviews and social media posts to recognize sentiment and produce insights into the level of client happiness. For the purpose of making decisions on investments, natural language processing (NLP) can, for instance, be utilized during quarterly earnings calls given by prominent firms in a sector. Word choice, tone, and inflection during these conversations can provide analysts with signals about how management thinks about the current status of their firm and the prospects of their organization. By transforming this unstructured data into structured data, data analysts can make informed decisions manually regarding which firms to invest in and when. Alternatively, an artificial intelligence decision support system can further process these insights to provide automated recommendations.

## CONCLUSION

Throughout our daily lives, there is evidence of decision-support systems driven by artificial intelligence. DSSs can assist organizations in various industries, from healthcare and finance to transportation and retail. The capabilities of DSSs are continuously improving as a direct result of developments in AI. The powers of DSSs can be enhanced by applying methods such as computer vision, natural language processing, reinforcement learning, and transformers. AI is bringing about a paradigm shift in the design of DSS because it enables these systems to analyze additional varieties of data, such as photos and videos, to extract useful information from texts, and to give unique ways for users to interact with these systems. Chatbots with Large Language Models are becoming increasingly popular as user interfaces, and many businesses are adopting them. This allows for interactions with the DSS to be smoother and more user-friendly.

Decision support systems powered by artificial intelligence are a potent instrument with a wide range of potential applications, including marketing and medicine. The application of NLP technology in DSS is a particularly fascinating branch of AI since it helps filter and develop insights from unstructured data, which can then be utilized to make informed and database decisions. IDSS can completely revolutionize how businesses function and make choices, reducing wasted time and effort and enhancing precision. In the future, IDSS will likely become an integral component of many different sectors.

Nevertheless, the greatest obstacle for humankind is to master the art of employing these potent weapons effectively to our advantage. Individuals and organizations must understand how to use DSSs in a way that is both successful and compliant with ethical standards as the prevalence of DSSs continues to grow. This entails grasping the constraints imposed by the systems and ensuring that the designs are open, understandable, and impartial. By doing so, we make full use of the possibilities of the DSS, enabling us to make more informed and effective decisions, improving both our lives and society.

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