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Research Article

Big Data, Scientific Programming, and Its Role in Internet of Industrial Things: A Decision Support System

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Big data is a challenging issue as its volume, shape, and size need to be modified in order to extract important information for a specific purpose. The amount of data is rising with the passage of time. This increase in volume can be a challenging issue to analyze the data for smooth industry and the Internet of things. Several tools, techniques, and mechanisms are available to support the handling and management process of such data. Decision support systems can be one of the important techniques which can support big data in order to make decisions on time. The proposed study presents a decision support system to deal with big data and scientific programming for the Industrial Internet of Things. The study has used the tool of SuperDecisions to plot the hierarchy of situations of big data and scientific programming and to select the best alternative among the available.

1. Introduction

Big data is termed to be a hot area of research which needs to be shaped in order to derive and extract meaningful information for the specific purpose of research. The data exist in different forms including structured, unstructured, and semistructured. Deriving and extracting meaningful insights from data is quite difficult. Several tools and techniques exist to overcome these deficiencies. Still, researchers try to come with a solution to extract meaningful information from the data of Industrial Internet of Things (IIoTs) in an effective and efficient way.

Decision-making based on multicriteria is one of the most efficient problems solving mean to select appropriate decision among the number of choices. Due to its effectiveness and potential, it is exploited in various domains such as computer science and IT, agriculture, and business sector. The research finds novel means to make the decision support system for the problems of various application domains by using multiple criteria in integration with machine learning and artificial intelligence. Decision support system plays an important role in real life [1–7]. It is one of the major and difficult tasks which ultimately results in success or failure. For example, in the context of a business or organization, the decision support system serves the mid- and higher-level management and assists people in making decision about certain problems that rapidly change and also not easy to be specified. Decision-making becomes more difficult in situations where it is based on multiple criteria. The current approaches for solving issue of decision support system is capable with power of multicriteria decision support system in order to support the decision makers in taking the right decision in situation of complexity. Researchers try to use multicriteria-based decision support system to integrate the effectiveness of power of machine learning algorithms to provide an intelligent decision-making alternative [8–10]. Decision support systems can be exploited in almost any domain to solving decision problems. Various domains exploit the theories and methods used for decision-making based on simple to more advanced [11, 12].

The contribution of the proposed study is to offer a decision support system for selecting the most appropriate alternative (vendor) from the available choices. The tool of

SuperDecisions was considered for experimental process of the proposed research. The goal of the research was based on the defined criteria for selecting the appropriate choice. The results show that the method is effective for decision-making of selecting vendor.

The organization of the paper is as follows: Section 2 represents the related work to the proposed research. Section 3 shows the research methodology with experimental setup and use of tool for decision support system. The paper is concluded in Section 4.

2. Related Work

Several studies exist related to the big data and its scientific programming for Industrial Internet of Things. In this examination, the authors proposed a blockchain-dependent data sharing scheme that entirely considers efficiency as well as security of data sharing. In this plan, a hyperledger fabric and identity authentication-dependent secure data sharing structure was designed for the data sharing security. Additionally, a network recognition algorithm was proposed to partition the customers into various data sharing networks as per the comparability of mark data. The exploratory outcomes demonstrate that the proposed conspire is successful for efficient and secure data sharing among various customers [13]. This work presents a procedure data examination stage worked around the idea of industry 4.0 [14]. The platform uses the big data software tools, ML algorithms, and state-of-the-art IIoT platforms. The displaying results indicated that, in situations where process information about the procedure wonders within reach is restricted, information-driven delicate sensors are helpful instruments for predictive data investigation. In this article, a novel model is developed in the perspective of manufacturing progression that reviews the key big data analytics (BDA) capabilities. The findings are beneficial for the companies in order to understand big data potential implications as well as their analytics capabilities for their manufacturing processes and efficient BDA-enabler infrastructure design [15]. In this study, for big data and cognitive Internet of things, a new architecture is proposed. The planned architecture helps the computing systems through combining Data Lake and WareHouse, as well as for the collection of heterogeneous data, a tool is defined [16].

In this article, for industrial data processing, an Industrial Internet of Things cloud-fog hybrid network framework was proposed. The results have shown that the proposed framework reduces effectively the delay processing of industrial data [17]. In this study, a systematic strategy was used to review the weaknesses as well as strengths of open-source technologies for stream processing and big data to set up its usage for industry 4.0 use cases [18]. In this study, functional and structural properties of cloud manufacturing were analyzed, and a business intelligence architecture was proposed that plans to empower distributing pertinent KPIs identified with intrigued process data, with the helpful layer of dependability [19]. This paper examines the current big data analytics technologies, strategies, as well as algorithms that can prompt the improvement of insightful Industrial Internet of Things frameworks. We devise a scientific classification by characterizing and classifying the literature based on essential factors (for example, analytics types, industrial analytics applications, requirements, analytics techniques, analytics tools, and data sources). The case studies and frameworks of the different endeavours were presented that have profited by BDA [20].

Table 1: Different areas of decision support system.

Application domain	Reference
Business sector	[9, 21–23]
Computer field	[24–27]
General problem solving	[28–34]
Industrial domain	[35–40]
Medical field	[8, 41, 42]
People safety	[43, 44]
Supply chain	[10, 45–47]
Sustainable computing	[48]
Waste management	[49–51]
Energy sector	[52–54]
Disaster management	[55, 56]
Information about DSS	[57, 58]
Environmental side	[59]

3. Research Method

With the passage of time, the size and volume of data are increasing. These data will reach a situation where their management and analysis will be a challenging issue. For the analysis and management of big data, there is need of tools and techniques to properly analyze, organize, and extract meaningful information for a specific purpose. The role of decision support system is obvious in different areas of research. Decision support system is a system where the decision can be made based on some criteria to evaluate particular circumstances. The proposed research identified some of the areas where decision support system is helpful in making the decision. Table 1 shows some of the research areas of decision support system.

Figure 1 represents some of the research area domains of the decision support system along with the number of publications.

The current study proposes decision support system in order to select the most appropriate vendor from the available alternatives. The tool of SuperDecisions was used for the experimental process of the proposed study. The goal of the study is to select the most suitable alternative based on some defined criteria. Figure 2 shows the hierarchy followed for plotting the goal, criteria, and alternatives of the proposed study. The attributes of criteria are selected generally which cover most of the criteria of the vendor for the purpose of selection.

The process of giving suitable weights to each criterion against alternatives, and vice versa, was given through experts in the field. Figure 3 shows criteria with their scores for the alternative (Vendor 1). The consistency ratio was checked for Vendor 1 which was calculated as 0.094.

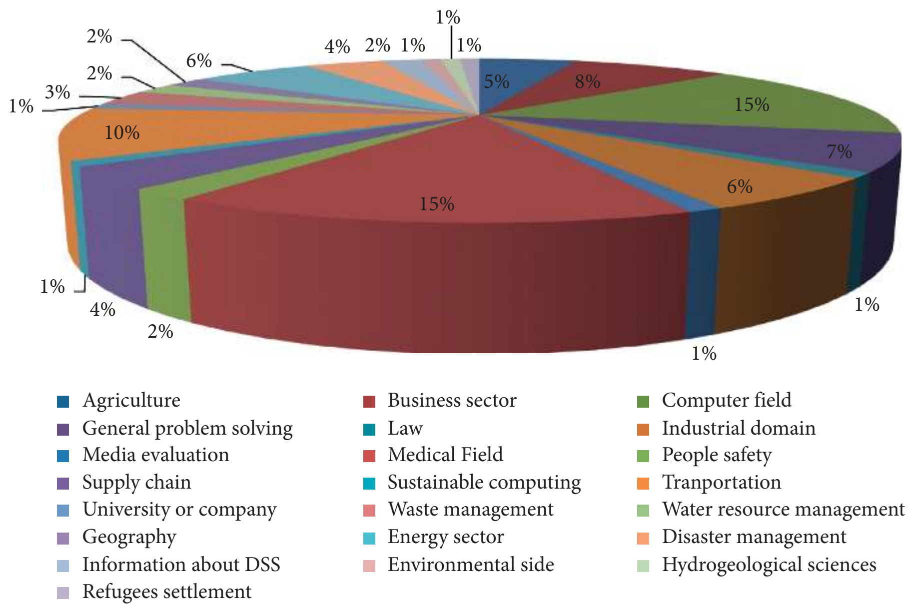

FIGURE 1: Applications of DSS in different domains along with the number of publications.

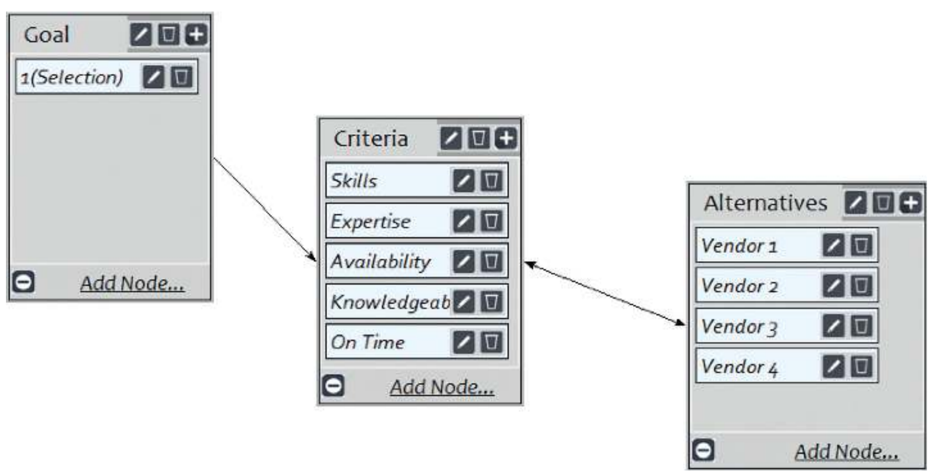

FIGURE 2: Hierarchy of the proposed study using SuperDecision.

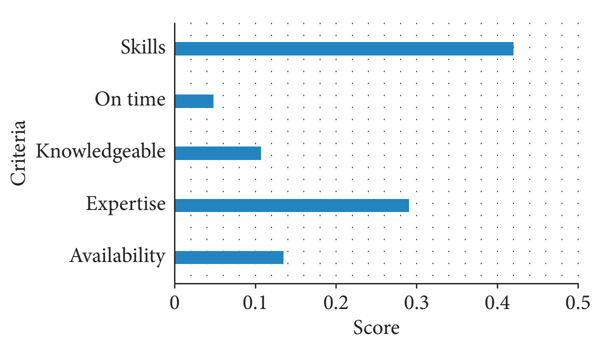

FIGURE 3: Criteria with their scores for the alternative (Vendor 1).

Figure 4 shows criteria with their scores for the alternative (Vendor 2). The consistency ratio was checked for Vendor 2 which was calculated as 0.043.

Figure 5 shows criteria with their scores for the alternative (Vendor 3). The consistency ratio was checked for vendor 3 which was calculated as 0.045.

Figure 6 shows criteria with their scores for the alternative (Vendor 4). The consistency ratio was checked for Vendor 4 which was calculated as 0.082.

After calculating all the pairwise comparisons for the goal, criteria, and alternatives, a summarized matrix of unweighted and weighted matrix were obtained. These were then converted to limit matrix which is shown in Table 2.

The overall score for the goal, criteria, and alternatives are shown in Figure 7. This figure shows the normalization by cluster and the limitation of the calculations.

Figure 8 shows the final score of the vendors for the ideal, normal, and raw cases. This was obtained from the overall process of calculations. From this, it is concluded that

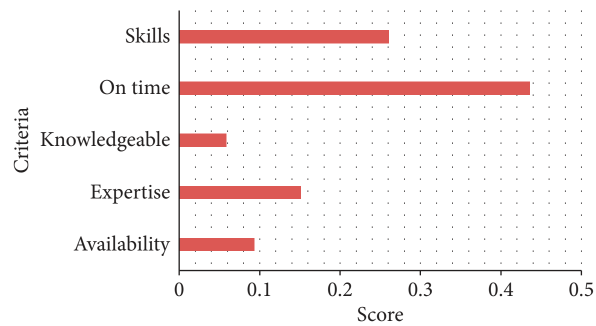

Figure 4: Criteria with their scores for the alternative (Vendor 2).

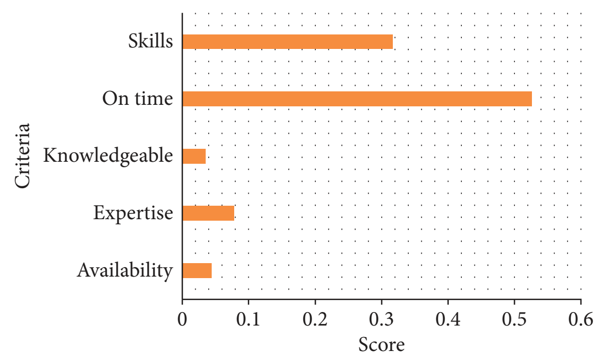

Figure 5: Criteria with their scores for the alternative (Vendor 3).

Figure 6: Criteria with their scores for the alternative (Vendor 3).

Table 2: Limit matrix.

	Vendor 1	Vendor 2	Vendor 3	Vendor 4	Availability	Expertise	Knowledgeable	On time	Skills	Selection
Vendor 1	0.000	0.000	0.000	0.000	0.463	0.402	0.476	0.485	0.651	0.000
Vendor 2	0.000	0.000	0.000	0.000	0.275	0.325	0.254	0.276	0.167	0.000
Vendor 3	0.000	0.000	0.000	0.000	0.177	0.157	0.177	0.153	0.119	0.000
Vendor 4	0.000	0.000	0.000	0.000	0.085	0.115	0.093	0.087	0.063	0.000
Availability	0.135	0.093	0.044	0.142	0.000	0.000	0.000	0.000	0.000	0.136
Expertise	0.290	0.151	0.078	0.188	0.000	0.000	0.000	0.000	0.000	0.302
Knowledgeable	0.107	0.059	0.036	0.101	0.000	0.000	0.000	0.000	0.000	0.068
On time	0.048	0.436	0.526	0.044	0.000	0.000	0.000	0.000	0.000	0.035
Skills	0.420	0.261	0.317	0.526	0.000	0.000	0.000	0.000	0.000	0.459
1 (selection)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

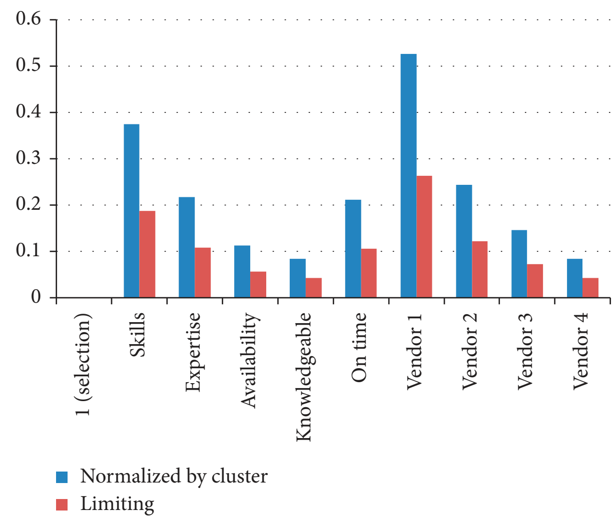

FIGURE 7: Overall score of goal, criteria, and alternative.

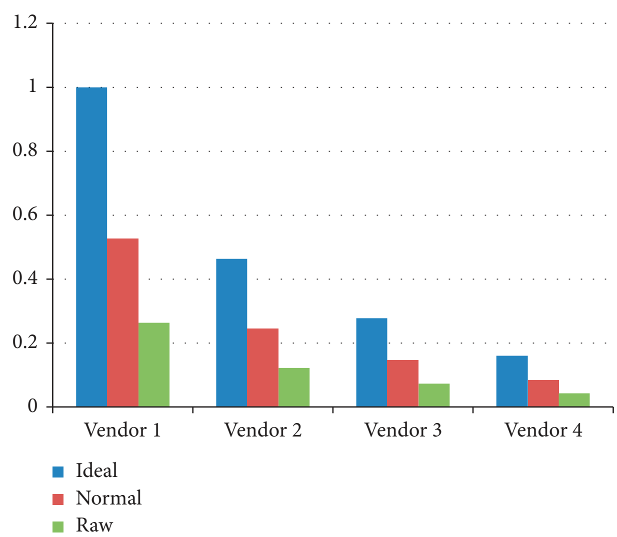

FIGURE 8: Calculated score of vendors for three cases (ideal, normal, and raw).

Vendor 1 is the best choice among the available alternatives followed by Vendor 2, and so on.

4. Conclusions

With the advancements in technology and communication of different devices, the size and volume of data are increasing with the passage of time. For the analysis and management of big data, there is a need of tools and techniques to properly analyze, organize, and extract meaningful information for a specific purpose. Big data is a challenging issue as its volume, shape, and size need to be modified in order to extract important information for a specific purpose. The amount of data is rising with the passage of time. Several tools, techniques, and mechanisms are available to support the handling and management process of such data. Decision support systems can be one of the important techniques which can support big data in order to make decisions on time. The proposed study presents a decision support system to deal with big data and scientific programming for the Industrial Internet of Things by using the tool of SuperDecisions to plot the hierarchy of situations of big data and scientific programming and to select the best alternative among the available. Results of the experiments show that the proposed decision support system is effective in terms of selecting the most appropriate alternative which is vendor in situation of multicriteria.

Data Availability

No data are available.

Conflicts of Interest

The authors declare no conflicts of interest.

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