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Big Data with IoT to Develop Sustainability

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I. INTRODUCTION

Things- or internet-oriented perspective, the Internet of Things (IoT) is a collection of unrelated networks that are linked and addressed by a common communications protocol [1]. When using sensors that send complex data at fast speeds via the industrial Internet, it might be challenging to give accurate and practical insights. Since the machine's underlying dynamic patterns vary over time due to a variety of variables, including degradation, processing large amounts of data is a significant problem. The actionable model must now be updated because it has become dated as a result. In the article, a brand-new deep learning technique called Gaussian-dependent dynamic probabilistic clustering (GDPC) is proposed. Models for usage in complicated situations that are built on the fusion and optimization of three well-known techniques. The Page-Hinkley test with the Chernoff constraint had been used to detect concept drifts, and the expectation-maximization (EM) approach had been used to estimate parameter values. In contrast to previous irregular models, GDPC's model gives membership probabilities to clusters. When a concept drift can be identified using a Brier score analysis, this can discover the robustness and evolution of the instance assignment. Additionally, the technique uses a tiny quantity of data, which significantly minimises the amount of processing power needed to determine whether the model should be changed. The method may be evaluated on artificial data and data streams from a test bed where different operational circumstances are automatically recognised with satisfactory results in terms of classification accuracy, sensitivity, and characteristics [2]. The typical behaviour of private autos is derived from trajectory data.

Video-based surveillance is crucial for the smart industries' identification of pedestrians since it can be used with digital technology like IoT and big data. The detection is a challenging problem because of the uneven sorting criteria, including backdrops, illumination, clothing, occlusion, and object collisions in pedestrians. A more effective feature extraction is necessary to address these issues. From several pedestrians, various attributes can be driven. Regarding pedestrian feature detection whether the model should be In the shape of Industry 4.0 and the Internet of Things, the intelligent factory has recently been a topic of research for both academia and industry (IIoT). In the IIoT, there is a growing need for data sharing across diverse smart devices with varying time flows. However, little research has been done on this subject. To overcome the drawbacks of traditional approaches and provide a solution, the integration of a worldwide unified software-defined network (SDN) and edge computing (EC) in IIoT has been considered.

For IIoT, SDN and EC proposed an adaptive transmission architecture. Based on data streams with various latency limitations, the specifications can be split into two groups: standard sources and emergent sources. Using a coarse-grained method quickly situation provides all the way to the hierarchical IoT that meets time constraints. Following that, using the path difference degree (PDD), an optimum planning route is selected, considering the time frame, traffic load ratios, and power consumption add-on. If the net grained strategy is far beyond the scenario, a finely crafted procedure is used to set the effective transmission route using an optimum power strategy for low latency in a high-deadline scenario. Finally, simulation evaluates the success of the proposed plan. The results show that the proposed system is above the average time, goods, output, PDD, and download time in relation to the relevant methods. The proposed method offers a better way of handling IIoT data [7]. With the use of big data in several fields, numerous methodologies and research already exist [8–10]. The proposed study has provided a comprehensive overview of big data and its V's with the Internet of Things to characterise the research into the subject, along with a detailed analysis of the body of existing research and literature.

Following is a description of the paper's organisational structure. The study's proposed literature is presented in Section 2. The methods employed in the IoT field are further described in Section 3. In Section 4, the big data and IoT paradigm is described in detail. The IIoT and big data conclusions are briefly illustrated in Section 5. Section 6 lists current IoT and big data research methods in many fields. The analysis of Section 7 is literature about the area of research.

II. LITERATURE REVIEW

Industry 4.0 is regarded as the synthesis of modern technologies and traditional production techniques. Industry 4.0 significantly improves the productivity processes used by businesses to meet current and upcoming problems and competitiveness. Enterprises can create a digital ordering network between suppliers and producers with the aid of digital architectures. Companies are seeking for an IIoT analytical mapping technique to determine their own partners' success while taking IIoT designs into account. However, businesses also place a strong emphasis on analysing crucial IIoT designs in order to identify the single-layer IIoT models that can use those methods universally. To narrow down their selection of notable IIoT architectures in the first step, the authors conduct numerous significant literature surveys in develop the global model. In addition, a lot of literature reviews assist authors in evaluating empirical IIoT mapping technology for partners and suppliers to compare. The IIoT architectures, such as cyberspace, networking, virtual reality, data storage, and security, are used by the writers to quantify the research. A fuzzy-grey relational analysis com- putational technique for IIoT model was used to enable businesses to map their own partner's accomplishments under the suggested model in order to support Industry 4.0 endeavours using a proposed universal model cum analytical methodology. The premise of the empirical case study by SA Automation Technology Company supported the use of scientific analysis [11]. Big data produced by Industrial IoT is beneficial for gaining yet storing all data would be difficult. information from the data analysis. With loss compression, the neural network was regressed into a representative vector to reduce the size of the industrial data. Efficiency in compression was achieved by using the dividing and conquering strategy. Research has shown that a function may accurately anticipate industrial data by looking at it [12].

The Industrial Revolution 4.0, which is centred on information technology, has gained more attention. Interconnection, robotics, intelligent systems, optimization, and IoT are seen as breakthroughs capable of achieving particular objectives in addition to the Industrial Revolution 4.0. A notable breakthrough that has the potential to usher in the fourth industrial revolution is the Internet of Things. However, because different sensors, modules, and drives are dispersed throughout the IoT, using numerous protocols constantly creates issues with heterogeneity. A framework is now required in order to harness the enormous data generated by the quick uptake of IoT devices in an intelligent and meaningful manner. When virtualizing various IoT devices It has been proposed to use linked data to create a cloud of things. Virtualized devices in the cloud using real-world device metadata are used to handle heterogeneity issues and organise virtualized items in linked data kinds to construct interconnected device meshing devices. This becomes self-sufficient knowledge, such as connecting via a computer mesh based on linked data and outcomes via big data linkage. Examples showed how this approach can be applied to the cloud of things depending on pertinent data [13]. The academic community has recently paid a lot of attention to optical field image technology because of its novel imaging characteristics, such as first and later shooting, changeable field depth, and variable viewpoint. However, due to the sampling of optical field edge signals, the limited number of discrete angle signals that can be acquired by current optical field acquisition equipment causes alias in optical field images. It examines optical field imaging and a depth estimate method based on big data in the Internet of Things. gathered by the camera array system employing the camera array system as a medium, around the angular sampling features of the optical field data gathering. To analyse the characteristics of various depth indices in the optical field data collection, a depth estimation approach is proposed that combines the parallax and focusing procedures. The study first examines the disparity and focus hints identified in the multiview dataset and light field focused image set of the camera array, respectively, and highlights the distinctions and connections between the two approaches to extracting depth hints across the augmented reality frequency field sampling area. The two measurement effects are then combined using a weighted linear image gradient-based fusion technique, which enhances the accuracy and reliability of depth perception. Lastly, the pro- foundly assessment's The method described in this study is more accurate in the measurement of depth in discontinuous scene sections and related texture areas than the method based on one single deep cue, according to results testing on different scenarios [14].

III. APPROACHES USED FOR IOT DOMAINS

The following sections briefly describe the approaches used of the IoT domains.

3.1 IoT and Industrial Applications

In the world of big data, where sensors, for example, offer a substantial threat that must be effectively protected, current approaches to location privacy security rely mostly on traditional asymmetric encryption, fuzzy, and cryptography techniques, with mixed results. Modern technologies, including "Industry 4.0" and the IoT, collect, store, and exchange enormous amounts of autonomy- and security-critical data, making them a simple target for hackers. However, in the past, data protection was not given enough attention, which led to privacy abuses. A data security method was presented to satisfy differential privacy restrictions in order to safeguard the privacy of local data and enhance the usability of data and algorithms in the industrial IoT. Due to the high value and sparse dataIn order to balance privacy and utility, a hierarchical tree model of location data was introduced. Additionally, the difference

Depending on how frequently a tree node accesses a piece of data, data is chosen using the privacy index function. The frequency of access to the chosen data is then given sounds using Laplace. According to theoretical study and experimental findings, this approach can significantly improve safety, privacy, and applicability [15]. The recent development of a high-order clustering method with rapid search and density peak detection will have significant practical benefits in the fields of industrial data management and analysis. The prevalence of cloud computing makes outsourcing more common. Calculations that are both user-friendly and put consumers at risk for secrecy By quickly searching for and locating density peaks in the hybrid cloud due to the properties of the safe cloud service system, the current study presents a stable high-order cluster algorithm with a focus on the aforementioned issue. To implement all of the suggested protocols, the client will first produce the encrypted object tensors with user data using homomorphic encryption, and then upload these to the cloud. In order to remove the disturbance, random numbers will finally return clustering results to the client. On an intelligent grid data collection, the performance of the suggested method is evaluated in terms of cluster precision, dependability, and speed-up ratios. Experimental results demonstrate that the approach can efficiently and effectively cluster data without jeopardising user privacy, while making sure the customer has a lot of flexibility. Therefore, the suggested system's strong levels of security and scalability make it perfect for clustering IIoT big data [16]. Industrial Internet of Things, section 3.4 The Internet of Cars (IoV), in conjunction with the Internet of Things (IoT), is the key to the intelligent transportation sector because it permits seamless information interchange and content sharing across vehicles with little to no human involvement. In IoV-based device-by-device vehicle-to-vehicle (D2D-V2V) networks, the combination of physical and social layer knowledge was examined in the research analysis. In the physical layer, the increasing distance of cars is modelled as a Wiener process using The connection probability of D2D-V2V links is estimated by the Kolmogorov equation. In social words, the tightness of the social relationship that is comparable to choosing content is represented by Bayesian non-parametric learning on the basis of social data from reality that is gathered from the two major Chinese video sharing websites, Youku and Sina Weibo. In addition, the defined joint pair discovery, power monitoring, and channel selection problems are solved using a price-based iterative matching algorithm under various quality-of-service requirements. The suggested technique is superior and economical when considering the weighted sum and matched satisfaction benefits, according to numerical data [17]. Through the use of big data and the Industrial Internet of Things, the study intends to illustrate the FSO2 life extension programme (IIoT). The study's goal is to clarify how big data and IIoT technologies should be used to create advanced technology and prediction

Upkeep of the FSO2 program's lifespan. In 2014, the FSO2 life extension software's implementation started. The ABS class certified the FSO2 for a design life of 15 years without the need for dry docking. The objective of this project was to create a plan and a solution for the ABS class that would allow for a 10-year lifespan extension without dry docking. The analysis displays the state of things right now and the previous actions[18]. IoT will collect various kinds of sensor data. Each sensor node has spatial characteristics, and it can also be connected to a significant amount of measuring data that accumulates over time. High-dimensional sensor data is essentially present. Finding outliers in huge IoT sensor data sets is a very challenging undertaking. The majority of anomaly detection techniques rely on vectors. But massive IoT sensor data has characteristics that make tensor approaches for information extraction more effective. The "dimensionality curses" issue is brought on by vector-based algorithms that can remove original structure information and correlations in large-scale sensor data. An OCSTuM based on tensor factorization and a one-class support Tucker machine (OCSTuM) are used in this study. The methods include space tensing in one-class vector machines. The un-checked OCSTuM and GA-OCSTuM anomaly detection algorithms for huge sensor information. The accuracy and reliability of anomaly detection have enhanced while the data's hierarchical organisation has been preserved. The suggested approach increases anomaly detection efficiency and accuracy while preserving the structure of massive sensor data, according to experimental evaluations of real datasets [19].

The larger data collecting and storage system plays a significant role in the design of the industrial data platform (ASS). Big data systems have undergone extensive compression and encoding. Such techniques fall short of meeting the demands of time-consuming, extensive industrial data management storage. Based on current big data systems, an effective industrial big data platform is created to reduce storage requirements while eradicating data processing times. In order to choose the optimum compression and encoding method for an industrial data platform, the study investigates the effects of several compression and encoding methodologies on the functionality of a large data platform. The test findings showed that, with less than 96 percent compressed data, the platform's data compression time was lowered by 73.9 percent and its data serialisation time was decreased by 80.8 percent when compared to Hadoop and Spark techniques. Compare it to benchmarking methods with the expanding data set [20]. The industrial Internet is the context for grouping the privacy-related cybersecurity issues. Two distinct assessment techniques have been used to evaluate the Internet of Things, and they have been built specifically to be applicable to industrial environments. The techniques were used to evaluate the protection of Internet IoT devices that will be used in an industrial infrastructure environment. Case studies demonstrated the cybersecurity difficulties and issues generated by these particular technologies and showed how the regulations, needs, and technological methods were addressed. Such case studies aim to show that technology and regulatory initiatives in industrial contexts prevent against Cybersecurity issues

The research study contributed to the understanding of cybersecurity challenges as well as the application of standards and tools in industrial settings [21[Previous blockchain data transfer methods had poor security, expensive trading centre management costs, and significant IIoT monitoring challenges. To solve these issues, a secure fabric blockchain-based industrial IoT system was proposed. This method makes use of the block-chain-based dynamic secret sharing system. A reliable trading hub is created by the power blockchain sharing model, which can also exchange power trading books. To guarantee effective matching of the power data transfer, the procedure of the power data consensus and the dynamic connected storage were established. Experiments demonstrate that fabric optimised data storage and transfer offer great protection and dependability. The suggested method will boost the pace of packet transmission and reception by 12 and 13 per second, respectively. In addition, the technology suggested has strong management and decen- tralisation supremacy [22]. To collect massive data on machine conditions and send it to a cyber-physical infrastructure in the factory's cloud centre, an intelligent plant will attach hundreds of IT devices and sensors on its production equipment. The device then employs a variety of CBM techniques to calculate the length of time that machines will continue to operate improperly and to keep or upgrade components in order to avoid the creation of huge detecting objects. Problems related to concept drifts, data imbalance, and fault distribution plague CBM (i.e., the data with faults accounts for a minority of all data). Utilizing learning that incorporates the diversity of various classifiers is a high-performance solution to these problems. Several businesses lack classifiers in real time, although their present networks may also contain offline classifiers. However, a large portion of the earlier supervised work focused solely on online classification promotion. As a result, a learning algorithm ensemble that uses the enhanced Dynamic AdaBoost and supports offline grading to satisfy the 3-stage CBM with definition drifts and inequality data has been proposed. Stage 1 (training an ensemble classifier) uses the NC grading and the MOTE technique to solve the imbalance data; stage 2 uses the enhanced method LFR (linear quarter rates); and stage 3 (creating a new ensemble) creates a new ensemble for detecting concept drifts from the imbalance data. The results of the experiments on datasets with various levels of imbalance demonstrated that it is possible for the proposed technique to identify minority class data and detect all idea drifts has a high accuracy rate of over 94 percent [23].

All disaster management operations, including prevention, preparedness, response, and mitigation, depend on spatial data from satellites, drones, and big data (mobile CDRs, trajectory data, GPS, wireless sensor net- work, and IoT). The development of wireless communications and the global navigation system has completely changed how we operate and gather geographical data. For instance, a sizable number of geographical data streams can collected and transferred from the central geodatabase or IoTcloud server, which serves as the database repository's base map. To effectively prepare and reduce risk, all acquired geospatial data must be collected, shared, and shown. The property and life loss recovery teams must be provided with adequate information in a reasonable amount of time. In order to collect, exchange, and monitor data from satellites, IoT devices, and other significant data obtained by geospatial data, the article aids in the creation of a city geospatial dashboard. Large-scale data were analysed for performance evaluation using a collection of spatial analytical tools known as geovisualization, including a nearly real-time rainfall profiling system, an approximation of the population, and the flow direction of mobile CDR [24]. A cross-industrial IoT service network has been built using the current concept and techniques at the group level. Fast deployment of local IoT services to provide social and economic benefit in a city is made possible by the employment of fixed geodistributed wireless IoT gates and mobile facilities. The notion is in line with the "local data output for local data use" strategy since local yet socially beneficial data may be used to offer various IoT services without the requirement for a mobile network or a cloud/data centre for big data. To demonstrate a prototype platform, this concept was tested using soft drink facilities, such as sales machines, vans, and taxi services facilities, such as taxis, in Tokyo, Japan. Using the platform as a It is possible to envisage the data transfer network for the purpose of disseminating data that will benefit society [25]. The facility has a tremendous possibility to transform the current production model into smart production as a result of the large-scale data production. The current gaps between the gathered big data and the intelligent applications driven by data, however, are multisource data modelling and integration difficulties. The widespread Internet deployment of goods on the factory floor necessitates that the big data-driven manufacturing process be managed and structured with appropriate data modelling and integration techniques. This work first presents the spatiotemporal modelling of the data in the temporal, spatial, and attributive dimensions. Additionally, the ontological approach to big data integration is suggested to manage the manufacturing data from multisource sources and make sure the data can be simply indexed and repurposed for a variety of upcoming applications. Finally, the proposed data modelling and integration methodologies are put to the test through the current massive data analysis and decision-making framework [26]. The IIoT is a trend in manufacturing and a crucial element of the smart factory. Data transmission protection is crucial in the industrial IoT. The construction of a new chaotic secure communication system to address the security issue of data transmission is the main contribution of this paper. By synchronising fractional order chaotic systems with diverse structures of different orders, the framework is proposed and examined. For the purpose of verifying synchronisation between the fractional order drive and the reaction system, Lyapunov's stability principle is used. In order to encrypt and decrypt the key data signals, the n-shift encryption principle is used. The main area of the scheme is calculated and analysed. The efficiency of theoretical ap- proach is shown through numerical simulations [27].

IV. BIG DATA AND IOT PARADIGM

A significant data explosion would soon be brought on by our typical experiment compared with the matrix-based privacy-preserving compressive sensing (PPCS) [29].

Big data and IoT are increasing the acquisition and retrieval of geospatial data, which is resulting in an increase in the amount of available geospatial data that is growing every minute. A state-of-the-art data processing system must be used for this. On the basis of geographic data from network virtual reality, a "building information model (BIM)" with a hybrid storage architecture and big data-storage-management method has been developed (WebVRGIS). BIM and the integration of spatial and semantic knowledge are related at different stages of urban development. Using the spatial distribution characteristics of BIM geospatial big data as a foundation, a data storage and management paradigm was proposed. More Than the Structured Query Language (NoSQL) but also the database and decentralized peer-to-peer processing are critical components of the architecture. The same software architecture that was employed in the prior WebVR study is used to implement the suggested storage paradigm. The experimental findings demonstrate that, for this study's geo-big data queries, the suggested hybrid storage model is less time-efficient than the traditional connection database. The incorporation and integration of BIM big data in WebVRGIS alters city knowledge management across the full life cycle in a novel way. Additionally, the system shows great promise for storing additional geographic data, such as traffic data [30]. With enhanced wireless communication, high-performance analysis tools and algorithms are required, huge data and the IoT. Data clustering, a potential analytical technique, is frequently used because it can solve IoT and big data-related issues without the requirement for labelled datasets. Recent research has demonstrated the effectiveness of using metaheuristic algorithms to solve a variety of clustering issues. Due to the high computational costs, these methods do not respond in the necessary amount of time when handling huge datasets from IoT devices. The research presented a novel meta- heuristic clustering approach to solve big data problems through the use of MapReduce intensity. The suggested techniques make use of the military dog group's ability to seek for ideal centroids and the MapReduce architecture to handle big datasets. In order to cluster massive datasets produced by industrial IoT, the parallel version of the suggested technique will also be implemented using MapReduce. The optimization effectiveness of the proposed approach is validated by 17 benchmarking functions, compared with 5 other recent algorithms, namely, artificial bee colony, bat, multiverse optimization, particle swarm optimization, and whale optimization algorithm (MR-MDBO). Additionally, 3 genuine industry-related IoT datasets and two UCI benchmark datasets are used to examine the performance of the MR-MDBO. With F measurement and computing time, the MR-MDBO is compared to 5 other cutting-edge techniques. The experimental findings show that, in terms of cluster precision and computation time, the MR-MDBO-based clustering outperforms the other algorithms under consideration. [31].

The abruptly shifting economic standards and ground-breaking IoT innovations. This in turn would involve data gathering and real-time cloud platform processing. A large portion of distributed data centres are served by wide and geographical data centres (DCs). However, these DCs have a significant financial penalty in the form of exponentially rising energy consumption, which also harms the environment. In this regard, efficient resource usage is frequently considered a potential option for enhancing energy efficiencies and easing the pressure on the electrical sector. However, because server load varies widely, resources in most public clouds are typically idle or underutilised, which significantly increases energy consumption and resource loss. It is therefore crucial to have an accurate and efficient resource management system. The advantages of SDDCs (software-defined data centres) have been utilised to reduce resource usage. Particularly for heterogeneous computer infrastructures, SDDC refers to a method of programmatically abstracting the logical computing, networking, and storage resources in order to potentially develop consolidated models based on SDDC to optimise the processes of VM deployment and network bandwidth assignment in order to achieve resource optimization and in addition to formulate a multiobjective optimization problem. The work that is being presented is subpar according to First Fit Decreasing (FFD). Additionally, the suggested framework demonstrates that it reduces energy use by around 27.9 percent. Similar IoT technologies are employed in vertical industry alliances and various smart factories. For instance, IoT monitoring systems and assembly lines are common among automakers. Deep learning and data mining techniques that depend on IoT data are frequently used to observe industrial information. However, as there are currently few samples, some information cannot be easily derived from data from a single factory. More information can be gleaned if an alliance of factories can pool their data collection efforts. However, the primary issue of these factories is data protection. Due to a lack of correlation and existing matrix-based techniques, data cannot be shared between factories but can be protected within a plant. Consequently, their mining productivity is low. In order to guarantee security for tensor-based mining, the research proposed a novel federated tensor mining (FTM) system to aggregate data from various mining sources. The primary contribution of FTM is the sharing of its ciphertext data for tensor-based information mining due to its homomorphic attribution and suitability for security-related uses exclusively. Evidence-based simulation results demonstrate that FTM not only makes use of the same data as plaintext mining, but is also approved of by unified hackers and scattered eavesdroppers to thwart attacks. FTM increases mining accuracy by as much as 24% in The development of 5G has accelerated the IIoT's evolution.

Additionally, there has been a lot of interest in the industrial sensor-cloud system (SCS). Many integrated sensors will be added to industrial SCS in the future, such concurrently gather data that has several uses. The huge amounts of data that have been acquired, however, are unreliable because to the harsh sensor world.

The results of the query and data mining would be erroneous if the data received on the bottom network was downloaded directly to the cloud for processing, adversely harming cloud judgement and feedback. Edge computing provides a good alternative to the traditional approach for data cleansing based on sensor nodes, which is insufficient to manage huge data. During data collecting, a brand-new data cleaning technique based on the mobile edge node is suggested. The cleaning model training data is first obtained at the border node using an angle-based outlier identification method, and a support vector machine is then utilised to define it. The model is also optimised through online learning. According to experimental results, mobile edge nodes for multidimensional data cleaning boost data cleaning efficiency while maintaining data integrity and reliability [32].

As more smart sensors, instruments, computers, and applications are installed and connected across wired and wireless networks, the industrial Internet of Things (IIoT) is quickly gaining pace. There will be a significant improvement in industrial procedures, and more industrial information will be developed. Significant advancements in IIoT big data processing and analysis are required to identify and utilise secret information that is important and useful in the manufacturing process. On the other hand, a large amount of streaming, multi-attribute IIoT output data is unpredictable and unreliable. Therefore, processing these IIoT data requires the use of an appropriate data processing technique, such as a tensor train. On the other hand, current tensor-train decomposition techniques are ineffective and unsuitable for massive IIoT big data processing. For the analysis of IIoT big data, an advanced distributed tensor-train (ADTT) decomposition method was offered with an incremental computing framework. Finally, testing are performed using routine IIoTdata that is made available to the public. Performance verification and assessment of the proposed ADTT system [32]. There are many significant challenges in cloud processing, such as the inability of cloud-based analytics of massive data and decision-making processes to meet the requirements for multiple latency-sensitive applications on the shop floor. These challenges are in addition to the current manufacturing systems' inability to be reconfigured, transparent, open, and evaluable in order to address issues on the shop floor and changes in the market. Ineffective use of the Internet and large data collected from storefronts prevented the automation and modernization of production operations. A collaborative edge and cloud processing open evolutionary architecture of the intelligent cloud development framework has been proposed. To enable latency-sensitive applications to respond quickly, hierarchical gateways connecting and managing "edge" shops are offered. Large, cloud, and gateway data are continuously produced to help build and improve edge-cloud systems and boost performance. A software-defined framing paradigm for AI-enabled Manufacturing Operations (AI- Mfg-Ops) is also suggested because software is increasingly controlling and making decisions in factories.

Cloud manufacturing systems that are operated and upgraded quickly while being monitored, analysed, planned, and implemented with intelligence. Research may result in the quick reaction and effective operation of cloud production systems [33]. Both academics and business are interested in the study of data mining. The IoT is characterised by the artificial replacement of compiled data by sensor data. It is now worthwhile to conduct research on the ability to extract meaningful data and patterns from a vast volume of sensor data. An approach called dynamic data mining was proposed for processing sensor data. There has been development of a sensor model for data mining that can be applied to dynamic change. In different sensor network configurations in that model, diverse physical structures are observed. The physical system and its parameters are studied through the collection of historical sensor data, and the connections between various sensor network contexts are uncovered by utilising the connections between physical system parameters. Physical parameters like transmission speed, transmission latency, sensor data, and data changes were taken into account in a constrained experimental setting. The model has been put to the test on the experimental platform, and the findings indicate that it is capable of mining erratic data and identifying reliable patterns. The model had a reference value for dynamic sensor data mining, and new techniques for assessing industrial big data were anticipated to be developed after analysing the experimental results [34]. Advanced sensing, data gathering, and communication technologies have helped the IIoT grow significantly in recent years, accelerating the revolution in electronic asset status monitoring and management. For the upcoming IIoT and the open ecosystem design, an open ecosystem was recommended. An open development envi- ronment is needed so that users can freely communicate with power devices and servers on user terminals via web or mobile applications, thus enhancing IIoT scalability and flexibility. The core open ecosystem technology for the fu- ture IIoT will include robust sensing techniques, wide area communication methods, a large data services platform, algorithms for data processing, and smart maintenance schemes. The potential IIoT ecosystem is then addressed in the management of wind farms. It is shown to increase wind farm maintenance quality and efficiency by supporting an open ecosystem of future IIoT offering a ground-breaking perspective on controlling and maintaining electrical assets with great reliability [35].

V. DETERMINATIONS OF THE IIOT AND BIG DATA

The virtualization of real time is usually recognized as one of the central promoters of fog computing and industrial In- ternet of Things (IIoT). Any hypervisor who qualifies as a virtualization solution to be deterrent to the IIoT must meet specifications. An example of the compromise between versatility and deterministic execution is current works in the area of virtualization in real time. There was a shortage of hypervisors that fulfilled all the deterministic virtualization criteria. Preliminary experimental findings comparing ACRN, KVM, and Xen RTDS device latency support statements for further investigation of deterministic virtu- alization requirements [36]. To avoid ransomware attacks on IIoT systems, host machine computer operations need a powerful detection model that can reliably detect ransom- ware behaviour and trigger an alert before the infection spreads to critical control systems. However, detecting models with high-dimensional data, as well as a few qualified observations combined with ransomware dynamics for host machines, is difficult. To address these issues, an effective detection model is essential. To reveal the framework hidden for system operations and ransomware behaviour, the Variational Autoencoder (VAE) model was proposed with a fully connected neural network. To boost the widespread detection model capabilities, a VAE-based data increase method for generating new data was created; it can be used in a fully connected network training. The findings showed that the proposed model is very effective in detecting ran- somware [37]. In our personal lives, digital goods and services are a popular spot in which software and its al- gorithms provide aid. Interactive systems, however, need to match consumer products within an industrial environment, particularly in terms of interactive quality and user expe- rience. The position of human work has been questioned, and the value of collaboration has been highlighted by the increase in automation and data sharing at large scales. New concepts in intelligent factories, where machinery and software perform working tasks, dramatically change work nature from manual labour to increasingly complex tasks in industrial settings. HCI and CSCW in particular have ideas, techniques, and strategies to tackle this disruptive transition to an IIoT. For instance, networked assistance systems may meet the various needs of heterogeneous individual staff. In order to explore the design space of IIoT applications, their impact upon cooperation work and formulation of new research opportunities and new perspectives on HCI and CSCW in industrial contexts were explored in the context of the emerging IIoT [38].

The industrial automation industry undergoes a huge transition to increasingly integrated and globally distributed automation systems with the introduction of Internet of Things (IoT) and cyber-physical system (CPS) concepts. As a result, the industry faces challenges in terms of interoper- ability between devices and systems that have evolved in recent years as a result of business and technology frag- mentation. Due to tighter reliability and real-time con- straints, proven IoT integration techniques cannot be completely adapted in IIoT environments. As design models provide a realistic tool for understanding the specific problem more deeply, models are used to create a software architecture appropriate for implementation in future IIoT environments. IoT world concepts, industrial automation systems, and modern ITarchitecture and cloud architectures are combined in the resulting software architecture. It is easy and versatile design, and the help of state-of-the-art ap- proaches (containerisation, continuous integration (CI), continuous deployment (CD)) makes it just as suitable for cloud, fog, and edge deployment. All these features make it possible to deploy device-level services and communication protocols to make it possible for heterogeneous systems and protocols to be transparent and automatically integrated on request [39]. The IIoT connects control systems to major business and industry innovations. However, new cyber- security vulnerabilities are also involved in this progress. As the utility of IIoT systems is at the edge level, they can be sought by attackers. It is, therefore, of highest concern to protect physical structures at the edge by detection and identification of malicious activities based on an effective detection model. A detection model based on profound learning techniques, which can learn and test using data from Remote Telemetry Unit (RTU) gas pipeline device streams, was proposed. It uses sparse and denotes self- encoding methods to create high-level data representation through unlabelled and noisy information for unchecked learning and deep neural networks for supervised learning. The findings exhibit great success in detecting malicious activities in the proposed model [40]. The IoT continues to expand rapidly and has an increasing manifestation in previously unknown domains. These domains may impose unique constraints which make the development and implementation of IoT systems difficult. Examples of such constraints include the absence of particular protocols, limiting information types that can be obtained, obligation on providing information to the public, and monitoring the communication process. The fast and effective imple- mentation of these projects is vital to capture, reflect, design, and reuse these limitations. For use within an industrial environment, an IoT human was modelled in the loop monitoring system. Experiences with the design and de- velopment of both the first system implementation and software architecture variance points have been identified; they account for subsequent versions and implementation in other settings [41].

When the data is generated on huge scale it is termed big data. Big data is useful; it is considered the next technology on the market, which has many advantages for many ap- plications. Many tools have therefore been created for analysing this data to profit from it because big data can hardly be analysed using conventional tools. Big data ana- lytics have now been one of the latest research subjects in the last decade. Big data and its properties, forms, challenges, analytical tools, and applications have been addressed in business, security, health, education, and industry [42].

VI. EXISTING APPROACHES OF IOT AND BIG DATA IN DIFFERENT RESEARCH AREAS

General strategies against computer network security risks have been summarized and debated in small- and medium-sized firms. There is a broad discussion of emerging new threats beyond conventional threats and modern IoT ap- plications beyond traditional SMEs. The research contri- bution is to alert ITexperts to the potential threats that SMEs may be facing. The dynamics as a whole are derived from Google's big data. Specific interpretations and suggestions are also given to nontechnical business owners [43]. In the automotive sector in particular, the IIoT is a paradigm change. Due to improved operating effectiveness in manufacturing processes, intelligent object identity mechanisms, smart automation capabilities, and clock monitoring capabilities, the idea is very attractive to most of the industrial sectors. It decreases the intervention of em- ployees in dangerous industrial circles. Some of the best areas for training and working for the IIoTare factory floors, inventory processing, installation, manufacturing proce- dures, finalising products, and other logistic entrance and exit tasks. The IIoT phenomenon is based on the IoT technologies, which currently guarantee effective work performance in many areas, in industry and also in com- mercial and social fields. IIoT concepts and meanings are debated about market drivers behind the technological growth and the progression of this phenomenon. The basic tenets of technological implementation methods in various areas and associated frameworks were also addressed. Jap- anese case studies have been conducted for the industry, in which procedures similar to IIoT have already been applied. This included Tsuchiya Gousei, Toyota, Hitachi, and the Zenitaka Corporation [44]. Connectivity is a one-word definition of Industry 4.0 revolution. The IoT and IIoT have grown in importance as a result of the rise of industriali- sation and Industry 4.0. The massive integrated devices of the IIoT have rendered cybersecurity and user privacy critical components as new opportunities raise new chal- lenges. The importance of industrial network intrusion detection is particularly high. It is a key factor, for example, in improving the safe operation of smart grid systems while also protecting customer privacy. Similarly, for industrial networks, data streaming is a viable option for moving research from the cloud into the fog, as it benefits from fast intrusion detection as well as buying time for intrusion mitigation [45]. The Fourth Industrial Revolution aims to improve the efficiency, flexibility, and automation of internal processes that include value chains so that companies can plan and deliver new services based on data generated by various technologies. As a result, businesses are devoting considerable resources to figuring out how Industry 4.0 technology can be used to enhance current processes and provide a more attractive business model to both existing and new consumers. The proposal report presents the findings of a study that aimed to increase market awareness of Industry 4.0, identify key contributors to the advancement of IoT and big data implementation, and recommend ad- ditional research to help Collaborative Industry 4.0 Net- works expand [46].

Given various factors in the healthcare system, such as privacy and confidentiality, maintaining the reliability and accuracy of health data is difficult. EHRs are commonly used because of their diverse clinical advantages to ensure that everybody has real-time health information. EHR refers to a system of historical electronic records that includes patient health information, including demographic information, health problems, drugs, health exam results, progress in recovery, and previous medical records. In order to provide prompt care, the EHR system permits the electronic ex- change of information between interested parties. Even if EHRs have contributed significantly to health recording and storage, interoperability still remains an issue. The ability to share, communicate, and use health information through organisations to improve the quality of healthcare delivery to individuals and to the public is known as interoperability in healthcare care. A lack of interoperability prevents successful healthcare data sharing. It not only impacts health providers for health related programmes, but also limits patients' contact and access to medical records. In the medical sector, IoT has been used widely for a long time. The majority of IoT health apps are designed to recognize and monitor people and objects, collect data from patients and staff, and use sensors for specific purposes (temperature, smoke, etc.). The IoT provides a patient-care ecosystem. Many medical devices now have sensors that capture continuous health indicators for patients, such as blood pressure, blood oxygen levels, heart rate, cholesterol level, and other information. The data is then sent over a wireless network to a central computer or a mobile device for analysis and classification. IoT helps medical professionals save time and money by allowing them to monitor patients in a continuous data flow rather than conduct repetitive data collection activities. Patient data can be accessed and tracked remotely at any time with wireless IoT solutions. Collecting a patient's full health profile as a guide to treatment decisions and appropriate medications is easy thanks to a network of sensors and healthcare wearables. Doctors and nurses can take care of all vital signs and use records to prevent misdiagnosis or medical misuse. In-time RFID tag monitoring systems or IrDA technology will keep patients as well as hospital staff up to date with the real-time location and conditions. The marks may be applied to medical equipment or a patient's bracelet, to determine where the tagged items are located. Under emergency conditions, the device may help locate a patient's exact position or warn caregivers when a patient leaves the hospital without permission [1].

Fog computing, cloud computing, semantic computing, edge computing, and other innovations have all evolved in parallel with the IoT. Sensor and imaging data produced by ubiquitous IoT applications, such as healthcare, must be properly processed. In a traditional IoT framework, cloud computing confirms an optimal solution for the successful managing of vast volumes of data and provides shared services and infrastructure.

Most IoT applications are extremely time sensitive, and requirements are latency bound. When data is trans- mitted between the cloud and the application, a delay that is not reasonable is created. Various facets and trends have been revealed to resolve the challenges existing in the conventional IoT world, in the assimilation evolving computing systems, and in the disruption technologies like edge/fog computing, big data, and IoT blockchain. In addition, a number of IoT and cloud computer frame- work problems exist, including the fact that any single component of the IoT architecture can serve as a point of departure that can disrupt the entire network. Trends in the bracing and administration of massive data using Internet data centres are discovered on the IoT ecosys- tems. The evaluation is promoted by a case study of fog/ edge computing and cloud computing on waste man- agement systems. In addition, some developments in the application of the blockchain are also examined within the IoT ecosystem. An overview of the fundamental as- pects of different computer paradigms and approaches that can help solve big data problems by building IoT ecosystems is also presented [47].

The interaction between digitalized (data), intellectual property, privacy laws, and competition law is currently triggering politicians, businesspeople, academic sector, and even the general public in the IoT scenario. The groups are concerned for a variety of reasons: busi- nesspeople, for example, will have the opportunity to create resources; researchers will be able to easily com- pile, analyse, and distribute information; and everyone agrees that the processing and sharing of personal data will raise concerns regarding privacy and data protection. It is difficult to understand the interface between legal systems caused by data processing, delivery, and use, trying to dissect this interface with details, such as "the data," from its sources, to clients and ultimately to consumers in IoT environment. Data sources are diverse, but they can be grouped into three categories: First, government ("open data") collects data from public sector bodies. Second, data can be voluntarily provided by consumers, clients, or businesses through e-platforms or other IT-based service formats. Third, it may be collected by means of cookies, patient data, and ISP data. In this step an attempt was made to identify what legal frame- works apply. When computers collect data, disburse it in "the cloud," and eventually reuse it, what intellectual property law scheme can apply? Who "owns" personally identifiable information? Do data privacy laws create new rules on personal data? The research proposed when producers and users of raw or processed data should benefit from the applications of competition law, whether public or private authorities should assist with this, and whether competition law facilitates established needs. The research focused mainly on applying competition law to bodies which collect or maintain data. The question of the sector-specific regulation is posed in the data arena. Data access is a controversial topic not only under the general "competition" regulations but as regards sector- specific regulations including the directive on public sector information, e-Call, financial services, and e-platforms. Indeed, there appear to be rules on access to information (antiregulation) currently being included in industry-specific regulations which require either data exchange or open access to the data collection device. It was concluded that general competition law does not apply readily to the access of generic data, except where the set of data is indispensable for the access to business or to a market in particular, whereas sector-specific regulations tend to arise as a data processing tool owned by competitors or enterprises in general. However, at its present stage of growth, the key question under com- petition law in the data industry is to establish level playing field by attempting to promote the adoption of the IoT [48].

In order to collect and share data, millions of devices equipped with sensors are linked together. The IoT is defined as the phenomenon of the everyday objects which are interconnected through an integrated system. These sensors produce a massive amount of data from a large range of equipment or items at the same time and continuously, also called large data. When time, energy, and processing capacities are constrained, handling this enormous volume of data and different variants imposes significant challenges; big data analytics are therefore increasingly difficult for the data obtained by IoT. Data processing, data interpretation, unstructured data ana- lytics, data visualisation, interoperability, data semantics, scalability, data fusion, data integration, data quality, and knowledge discovery were all revealed and solved as part of the IoT big data project [49]. Big data (BD) and the IoT are regarded as creating large enterprises and impacting on the labour market through and beyond 2050. How- ever, the success of BD and IoT applications still slows down, especially in view of a lack of standardisation and the challenges of the various players to cooperation. On the other hand, access to vast cloud test beds has become an asset, and enormous potential in areas such as agri- culture, automotive, green energy, health, and smart cities can be optimized. The objective is to present ideas and steps for business growth that a young and intelligent entrepreneur can take to begin and speed up his suc- cessful business career, which will increase beyond 2050 [50].

Emerging technologies have developed a new wave of industrial reform in recent years. The latest industrial revolution is profoundly integrated into modern indus- trial and manufacturing industries to support transfor- mation and enhancement by the new information technology generation. Smart equipment plays an im- portant role in the reform since it is the backbone of the manufacturing industry. An innovative method for de- signing smart equipment has been suggested. First of all, a method's architecture and various layers for processing the data were suggested, with reference to the Cognitive Internet of Things and architecture of industrial big data. An algorithm was then used to evaluate and decide the acquired external data, together with CIoT and industry big data technology. Finally, this approach was validated by case studies as being accurate and feasible. The findings revealed that the method could significantly reduce the depth of understanding about smart equip- ment while also providing more valuable information about design assistance for significant impact on firm equipment design [51]. The IoT connects computers, individuals, locations, and even abstract objects like events. Smart sensors, heavy embedded microelectronics, high-speed networking, and Internet standards are on the verge of changing today's value chains. Big data is both a product and a driver of the IoT system, with high speed, high volume, and variation of modes. Market data de- velopment poses whole new risks and opportunities. IoT requires robust modelling tools to address the techno- logical risks associated with the interaction of "anything." Furthermore, the processing and storage of unstructured, structured, repetitive, and nonrepetitive flow of data in real time require the development of new IT systems and architectures. Only powerful analytical tools can derive "significance" from the increasing amount of data and, as a result, data science has now become a strategic ad- vantage. The existence of IoT is largely based on tech- nology standards that ensure the interoperability of everything. Some basic standardization exercises are outlined and methods for analytics such as large data processing approaches for real-time processing are pre- sented. IoT is therefore a (fast) evolutionary mechanism that depends heavily on the close collaboration between standardisation organisations, open-source communi- ties, and information technology experts to penetrate all dimensions of life [52]. Table 1 depicts the approaches of IoT and big data in different domains of research. Various most popular libraries were searched in order to find relevant materials in the area under study. These libraries include ScienceDirect, IEEE, ACM, PubMed, and Springer. The initial search results were identified in the various libraries. Figure 1 shows the details of the libraries searched.

VII. ANALYSING LITERATURE IN THE AREA OF RESEARCH

This section discusses the overview of the analysis done from various perspectives which are visually described. Popular li- braries were used for the search process of the proposed study. Figure 1 describes the details of search process in the libraries. The initial number of papers obtained was filtered in order to further reduce the materials and to find the exactly matching papers. Figure 2 describes the final number of included papers. The figure shows high number of publi- cations in the ScienceDirect library.

After this, each library was presented separately for its representation. The representation SD is given in Figure 3.

The representations of the ACM library with their details are given in Figure 4.

The search details of IEEE library are shown in Figure 5.

After this, the Springer library was searched, and the results are presented in Figure 6.

Lastly, the PubMed library was searched, and the details are depicted in Figure 7.

TaBlE 1: Approaches of big data and IoT in different domains.

No.	Method	Year	Citation
1	Analytics big data and IoT in healthcare	2019	[1]
2	Clustering of data streams	2018	[2]
3	Industrial surveillance through fog-enabled IoT and big data	2018	[6]
4	SDN-based IIoT with edge computing	2018	[7]
5	Performance assessment of companies under IIoT architectures	2018	[11]
6	Data compression and prediction for IIoT	2018	[12]
7	Cloud of things based on linked data	2018	[13]
8	Depth estimation approach of light field imaging	2018	[14]
9	Location privacy protection for big data in IIoT	2018	[15]
10	Secure high-order CFS algorithm on clouds for IIoT	2018	[16]
11	Social big-data-based content dissemination in Internet of Vehicles	2018	[17]
12	FSO2 life extension program through IIoT and big data	2019	[18]
13	Outlier detection method towards big sensor data in IoT	2019	[19]
14	Data acquisition and storage system for designing industrial data	2019	[20]
15	Cybersecurity in an environment of IIoT	2019	[21]
16	Secure fabric blockchain-based data transmission for IIoT	2019	[22]
17	Concept drift detection and adaption in big IIoT data	2019	[23]
18	City geospatial dashboard	2019	[24]
19	IoT service platform for locally disseminating socially valuable data	2019	[25]
20	Spatiotemporal modelling and integration of manufacturing big data	2020	[26]
21	Data transmission scheme in industrial IoT	2020	[27]
22	Big data-enabled framework for energy efficient software-defined data centres in IoT	2020	[28]
23	Federated tensor mining for secure IIoT	2020	[29]
24	BIM big data storage in WebVRGIS	2020	[30]
25	Clustering big data in cognitive IIoT	2020	[31]
26	Big data cleaning based on mobile edge computing	2020	[32]
27	ADTT	2020	[32]
28	Big data driven edge-cloud collaboration architecture	2020	[33]
29	Dynamic data mining of sensor data	2020	[34]
30	Open ecosystem for future IIoT	2020	[35]
31	Deterministic virtualization in the IIoT	2019	[36]
32	IIoT based ransomware detection	2019	[37]
33	HCI and CSCW within industry settings	2018	[38]
34	Microservice architecture for the IIoT	2018	[39]
35	Intrusion detection for edge system in brownfield IIoT	2019	[40]
36	IIoT monitoring application	2017	[41]
37	Big data analytics tools and applications	2019	[42]
38	Precautions against security threats for computer networks in SMEs	2017	[43]
39	IIoT, principles, processes, and protocols	2019	[44]
40	Industrial networks and IIoT	2020	[45]
41	Awareness of Industry 4.0	2018	[46]
42	IoT and big data analytics in healthcare	2019	[1]
43	Big data & disruptive computing platforms braced IoT	2020	[47]
44	Big data, privacy regulations, open data, intellectual property, and competition law in an IoT	2018	[48]
45	Big data challenges for the IoT	2017	[49]
46	Big data and IoT	2016	[50]

47	Equipment design assisted by cognitive IoT and industrial big data	2020	[51]
48	IoT and big data	2018	[52]
49	Accurate vehicle state estimation	2019	[53]

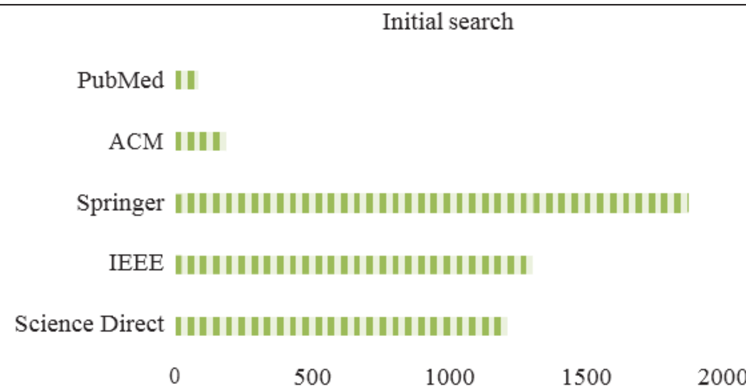

Figure 1: Details of search process in the libraries.

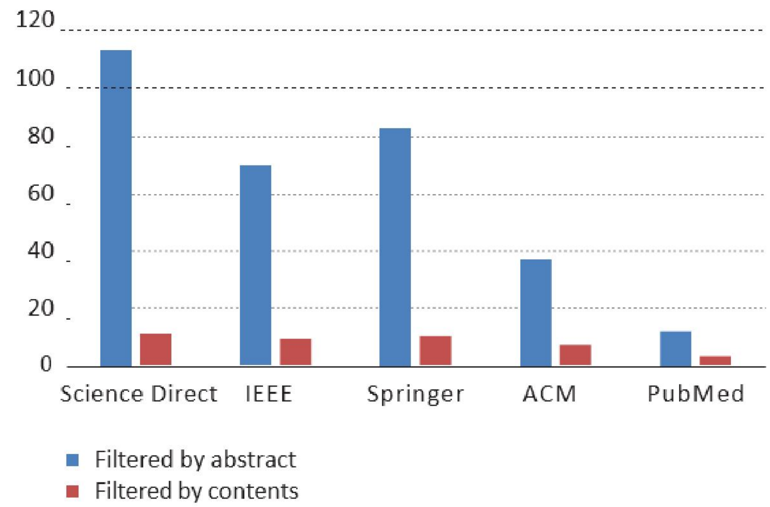

Figure 2: Final papers in the given libraries.

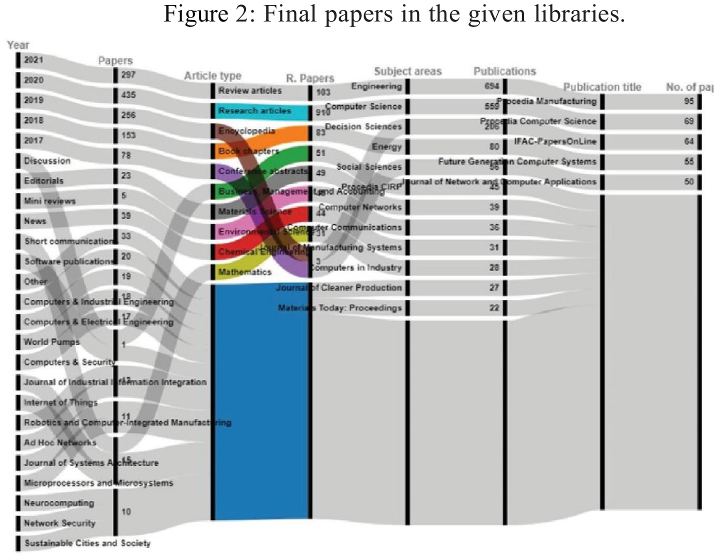

Figure 3: Representation of Science Direct library.

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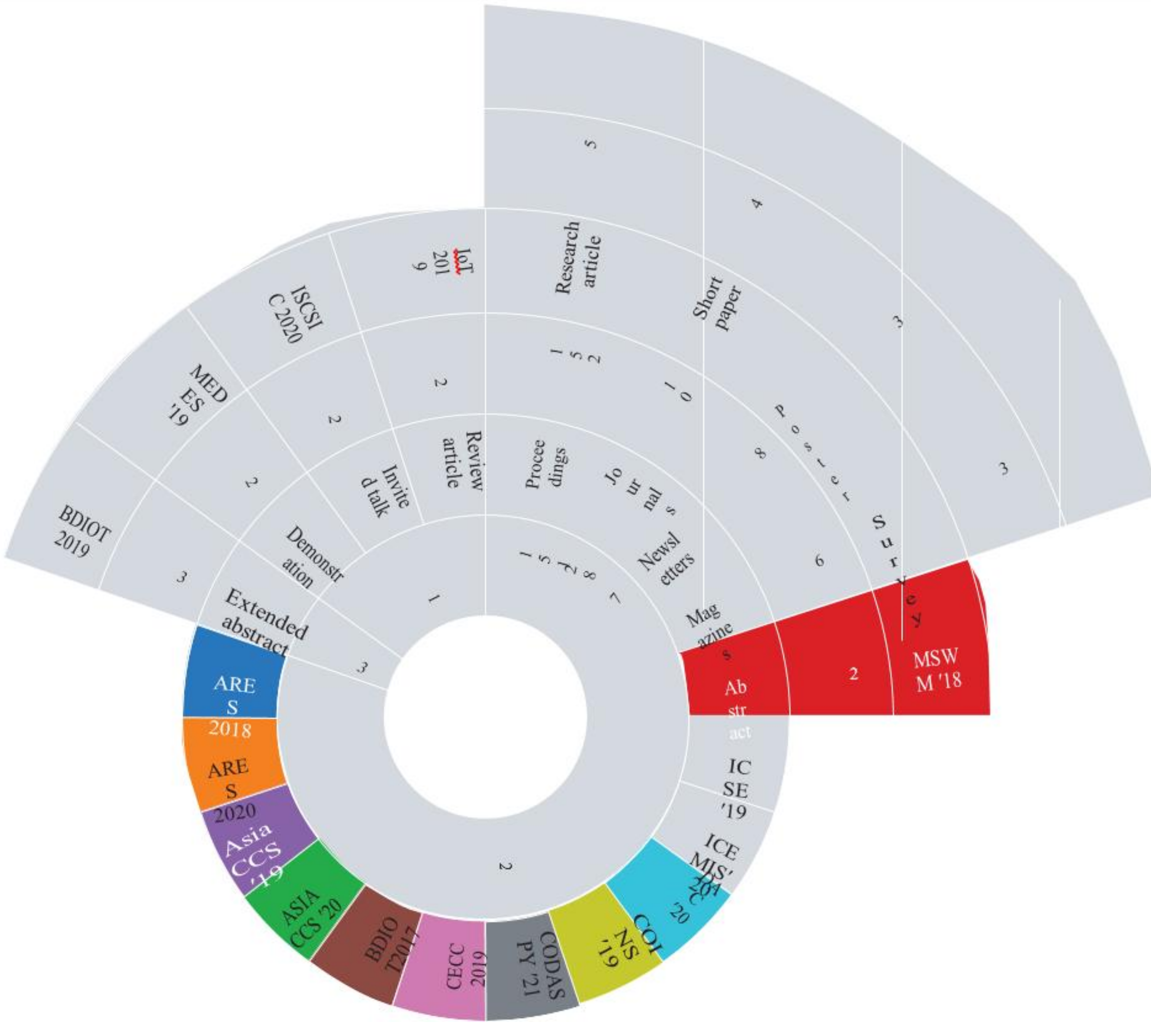

Figure 4: Details of ACM library

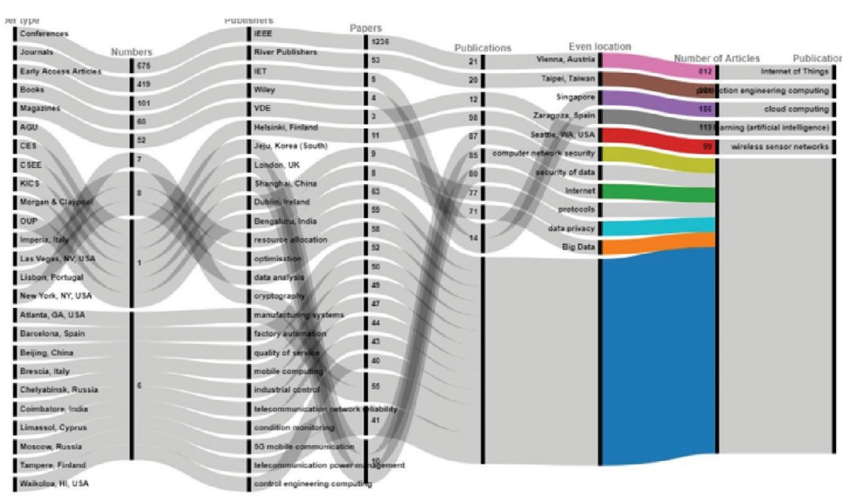

Figure 5: Details of IEEE library

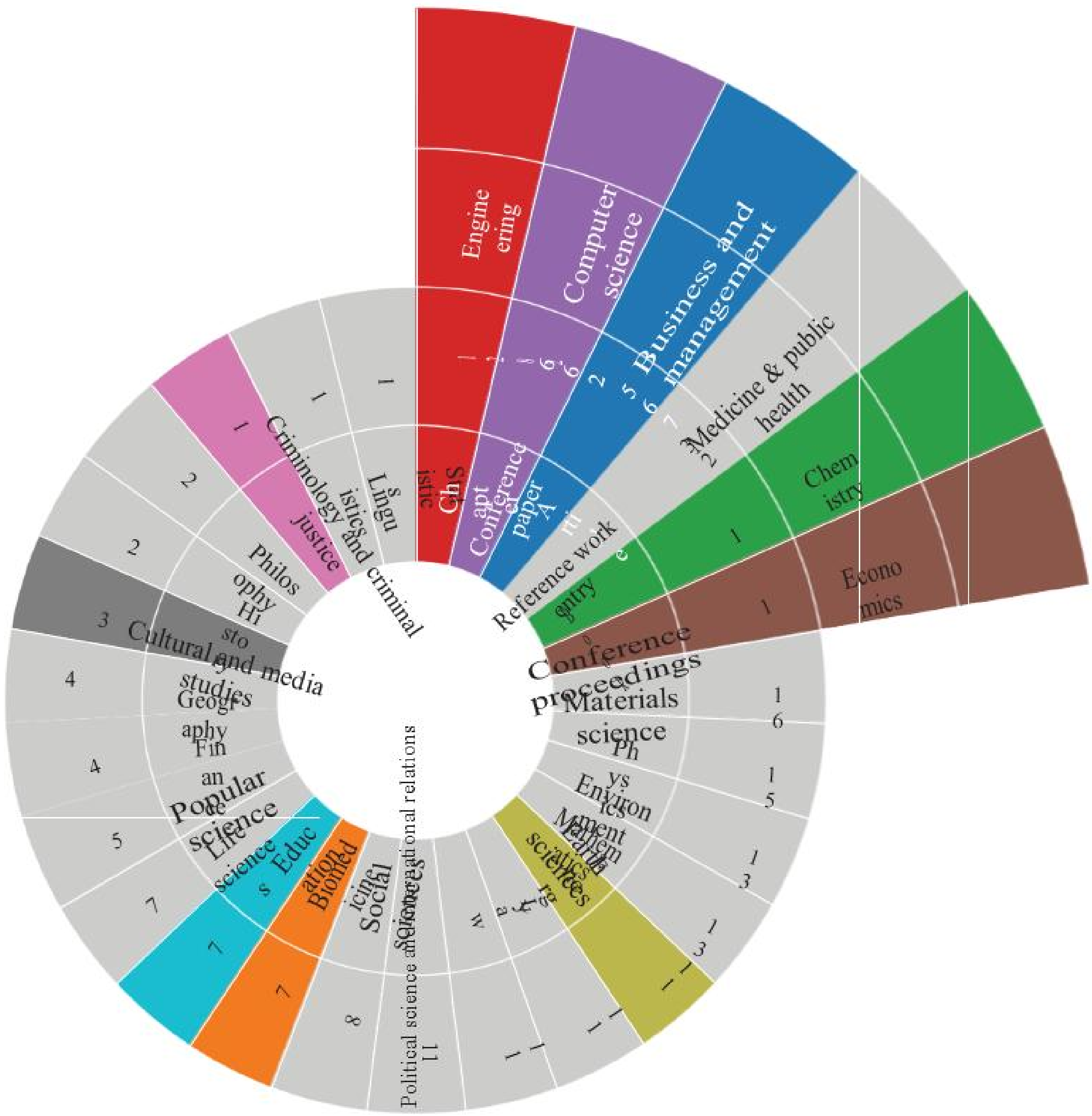

Figure 6: Details of Springer library

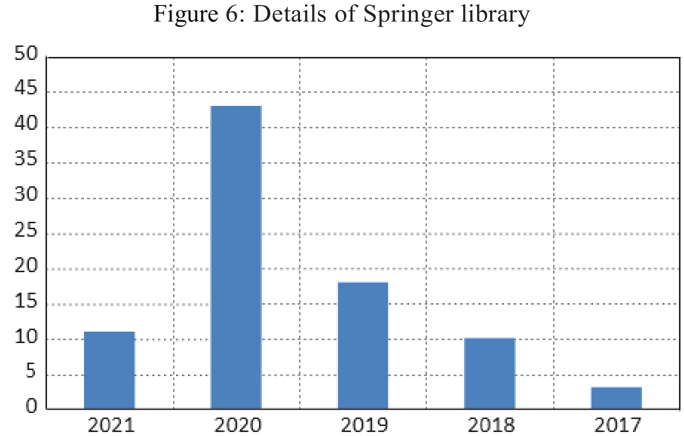

Figure 7: Details of PubMed library.

VIII. CONCLUSION

The fast and growing development of smart devices such as actuators, sensors, and wearable devices has made the IoT enable for smart and sustainable developments in the area. The IoT is one of the emergent network and in- formation technologies comprehending automatic operations in the network of devices connected to the IoT. The use of IoT in effective and efficient way in the area has increased effectiveness and decreased errors. Physical objects are linked with these smart devices for analysing, processing, and managing the data produced from the surroundings. Such data can then be further used for different purposes such as smart decision making, early analysis, and many other purposes. The IoT network is connected with big data through Internet for manipulating and storing huge bulk of data on cloud storage. Managing huge bulk of data in real time is a very crucial task. Various approaches are in practice for the management and recovery problems of data. Extracting correlation data became difficult specifically as the coupling degree between diverse perceptual attributes is low. The existing literature has provided comprehensive techniques, tools, and methods for various purposes of data. The proposed study has reported a wide-ranging overview on big data and its V's with IoT to describe the state-of-the-art research into the field with in-depth re- view of existing literature. Various popular libraries were searched for analysing the existing literature, and comprehensive report is presented.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding this study.

REFERENCES

[1]. J. Chanchaichujit, A. Tan, F. Meng, and S. Eaimkhong, "In- ternet of things (IoT) and big data analytics in healthcare," in Healthcare 4.0, Palgrave Pivot, Singapore, 2019.

[2]. J. Diaz-Rozo, C. Bielza, and P. Larranaga, "Clustering of data streams with dynamic Gaussian mixture models: an IoT application in industrial processes," IEEE Internet of Things Journal, vol. 5, no. 5, pp. 3533–3547, 2018.

[3]. Z. Xiao, S. Xu, D. Wang, and R. Zhang, "On extracting regular travel behavior of private cars based on trajectory data analysis," IEEE Transactions on Vehicular Technology, vol. 69, no. 12, pp. 14537–14549, 2020.

[4]. Y. Huang, Z. Xiao, D. Wang, H. Jiang, and D. Wu, "Exploring individual travel patterns across private car trajectory data," IEEE Transactions on Intelligent Transportation Systems, vol. 21, no. 12, pp. 5036–5050, 2020.

[5]. Y. Huang, Z. Xiao, X. Yu, D. Wang, V. Havyarimana, and J. Bai, "Road network construction with complex intersections based on sparsely-sampled private car trajectory data," ACM Transactions on Knowledge Discovery from Data, vol. 13, no. 35, pp. 1–28, 2019.

[6]. S. Din, A. Paul, A. Ahmad, B. B. Gupta, and S. Rho, "Service orchestration of optimizing continuous features in industrial surveillance using big data based fog-enabled internet of things," IEEE Access, vol. 6, pp. 21582–21591, 2018.

[7]. X. Li, D. Li, J. Wan, C. Liu, and M. Imran, "Adaptive transmission optimization in SDN-based industrial internet of things with edge computing," IEEE Internet of Things Journal, vol. 5, no. 3, pp. 1351–1360, 2018.

[8]. S. Nazir, M. Nawas, S. Anwar et al., "Big data visualization in cardiology—a systematic review and future directions," IEEE Access, vol. 7, no. 1, pp. 115945–115958, 2019.

[9]. S. Nazir, M. Nawaz, A. Adnan, S. Shahzad, and S. Asadi, "Big data features, applications, and analytics in cardiology—a systematic literature review," IEEE Access, vol. 7, no. 1, pp. 143742–143771, 2019.

[10]. S. Nazir, S. Khan, S. Ali et al., "A comprehensive analysis of healthcare big data management, analytics and scientific programming," IEEE Access, vol. 8, pp. 95714–95733, 2020.

[11]. C. Mbohwa and A. K. Sahu, "Performance assessment of companies under IIoT architectures: application of grey re- lational analysis technique," in Proceedings of the 2018 In- ternational Conference on Inventive Research in Computing Applications (ICIRCA), pp. 1350–1354, Coimbatore, India, July 2018.

[12]. J. Park, H. Park, and Y. Choi, "Data compression and pre- diction using machine learning for industrial IoT,"

in Pro- ceedings of the 2018 International Conference on Information Networking (ICOIN), pp. 818–820, Chiang Mai, Thailand, January 2018.

[13]. Y. Son and K. Lee, "Cloud of things based on linked data," in Proceedings of the 2018 International Conference on Infor- mation Networking (ICOIN), pp. 447–449, Chiang Mai, Thailand, January 2018.

[14]. Y. Wu, "Research on depth estimation method of light field imaging based on big data in internet of things from camera array," IEEE Access, vol. 6, pp. 52308–52320, 2018.

[15]. C. Yin, J. Xi, R. Sun, and J. Wang, "Location privacy pro- tection based on differential privacy strategy for big data in industrial internet of things," IEEE Transactions on Industrial Informatics, vol. 14, no. 8, pp. 3628–3636, 2018.

[16]. . Zhao, L. T. Yang, and J. Sun, "A secure high-order CFS algorithm on clouds for industrial internet of things," IEEE Transactions on Industrial Informatics, vol. 14, no. 8, pp. 3766–3774, 2018.

[17]. Z. Zhou, C. Gao, C. Xu, Y. Zhang, S. Mumtaz, and J. Rodriguez, "Social big-data-based content dissemination in internet of vehicles," IEEE Transactions on Industrial Infor- matics, vol. 14, no. 2, pp. 768–777, 2018.

[18]. A. Bamrungwong, "Implementation of the FSO2 life exten- sion program by using big data and IIoT," in Proceedings of the 2019 Petroleum and Chemical Industry Conference Europe (PCIC EUROPE), pp. 1–8, Paris, France, May 2019.

[19]. X. Deng, P. Jiang, X. Peng, and C. Mi, "An intelligent outlier detection method with one class support tucker machine and genetic algorithm toward big sensor data in internet of things," IEEE Transactions on Industrial Electronics, vol. 66, no. 6, pp. 4672–4683, 2019.

[20]. D. Geng, C. Zhang, C. Xia, X. Xia, Q. Liu, and X. Fu, "Big data- based improved data acquisition and storage system for de- signing industrial data platform," IEEE Access, vol. 7, pp. 44574–44582, 2019.

[21]. F. A. B. Jua´rez, "Cybersecurity in an industrial internet of things environment (IIoT) challenges for standards systems and evaluation models," in Proceedings of the 2019 8th In- ternational Conference on Software Process Improvement (CIMPS), pp. 1–6, Leon, Mexico, October 2019.

[22]. W. Liang, M. Tang, J. Long, X. Peng, J. Xu, and K. Li, "A secure FaBric blockchain-based data transmission technique for industrial internet-of-things," IEEE Transactions on Industrial Informatics, vol. 15, no. 6, pp. 3582–3592, 2019.

[23]. C. Lin, D. Deng, C. Kuo, and L. Chen, "Concept drift detection and adaption in big imbalance industrial IoT data using an ensemble learning method of offline classifiers," IEEE Access, vol. 7, pp. 56198–56207, 2019.

[24]. K. K. Lwin, Y. Sekimoto, W. Takeuchi, and K. Zettsu, "City geospatial dashboard: IoTand big data analytics for geospatial solutions provider in disaster management," in Proceedings of the 2019 International Conference on Information and Com- munication Technologies for Disaster Management (ICT-DM), pp. 1–4, Paris, France, December 2019.

[25]. Y. Shoji, K. Nakauchi, W. Liu, Y. Watanabe, K. Maruyama, and K. Okamoto, "A community-based IoT service platform to locally disseminate socially-valuable data: best effort local data sharing network with no conscious effort?" in Pro- ceedings of the 2019 IEEE 5th World Forum on Internet of Things (WF-IoT), pp. 724–728, Limerick, Irekand, April 2019.

[26]. W. Fang, Y. Guo, W. Liao, S. Huang, C. Yang, and K. Cui, "The spatio-temporal modeling and integration of manufacturing big data in job shop: an ontology-based ap- proach," in Proceedings of the 2020 IEEE 7th International Conference on Industrial Engineering And Applications (ICIEA), pp. 394–398, Bangkok, Thailand, April 2020.