Cognitive Computing's Applications in Knowledge Management

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Abstract. Cognitive Computing has become an essential tool for knowledge management since it's able to perform complex tasks and extract knowledge from the information and the ability for continuous learning based on different artificial intelligence technologies.

This study aim to present the applications for this systems in the different fields and how it's affect the knowledge management processes and make a positive results this will give an image about this technology and show the importance role in the development of knowledge management.

Keywords: Knowledge Management, Cognitive Computing, Artificial Intelligence.

1 INTRODUCTION

Cognitive Computing (CC) utilizes artificial intelligence (AI) – based computerized models to mimic human thought processes by leveraging data mining, natural language processing (NLP), and machine learning (ML) constructs (El Miedany, 2019). Automated driving and facial recognition are excellent instances of cognitive functions imitated by cognitive systems. A system like IBM Watson embodies cognitive intelligence instrumental in knowledge management (KM) – creating, structuring, sharing, using, and managing knowledge (Uden, Ting, & Corchado, 2019). This literature acknowledges the significance of CC applications in KM and focuses on systems and practices essential in implementing AI-based models.

2 TECHNICAL APPLICATIONS

While CC may offer social applications that involve harnessing data from customer feedback and using collected data to improve organizational performance, multiple technical considerations surround CC's applications in KM. This literature details practical applications of CC in different domains, including the financial sector, healthcare, and business operations performance.

2.1 Processing Unstructured Content from Big Data

Unstructured content holds critical insights. It can help corporate executives to understand Big Data by moving corporate knowledge into knowledge graphs. A large percentage of massive datasets are unstructured; the remaining portion is structured. Structured data involves standardized data classification that often resides within relational databases and offers efficiency during retrieval (Balducci &Marinova, 2018; Korfiatis, Stamolampros, Kourouthanassis, & Sagiadinos, 2019). On the other hand, unstructured data does not have a predefined schema, not readily available in a specified format. Unstructured data can arise from any field, including email, images, audio files, and videos. Such data pose a significant challenge when it comes to managing and analyzing crucial information. Notably, most corporations currently generate Big Data in amorphous form, necessitating conversion to structured format before analyzing and interpreting the data.

Findings by Subramaniyaswamy, Vijayakumar, Logesh, and Indragandhi (2015) showed that data centers such as CC could provide many tools like NLP to improve unstructured data management. This improvement can occur through alterations to the former data, which requires a reconfiguration of the text parser. However, such alterations may trap a company in a cycle of define-change, redefine-change, which is a cost incurring proposition. NLP can help solve this challenging problem in unstructured data management (Subramaniyaswamy et al., 2015). NLP is a computational technique that can process natural human language found primarily in business documents (Tsui, Wang, Cai, Cheung, & Lee, 2014). CC uses NLP to base the grammatical relationship structures within words and the semantics of the words found within the text. NLP can further infer the relevance of Big Data in its present context without depending on document templates. This technique decouples the information extraction process from changes to the document structure. Changes to the document structure and placement of desired data do not impact the NLP's ability to perform unstructured data management.

2.2 Data visualization

Data visualization is yet another broad field in which KM applies CC. Data visualization is the graphical representation of the information through elements such as graphs, charts, and maps (Kam, Lee, Park, & Kim, 2015). Data visualization charts occur in various forms such as line charts, bar charts, histograms, area charts, and scatter plots. The visual concept comprises tools that can further provide an accessible way to understand trends, patterns, and outlier s in data as it is another form of visual art (Luo, Qin, Tang, & Li, 2018). This visual art quickly familiarizes an individual's eye on the critical trends and outliers for ease of internalization. Therefore, CC can create a visual representation of knowledge and data charts or graphs displaying a massive amount of volumetric information within a short interval. Applications in KM include determination of frequency for essential data, whereby, in time requiring situations, an elementary logic is a critical requirement in examining how often that event occurs (Qin, Luo, Tang, & Li, 2019). Data visualizing can determine relationships and correlation of variable data as it is essential though challenging to determine the relationship or correlation between two or more variables. Visual data can improve the understanding of statistical data of an organization, fostering informed decisions.Table 1. Font sizes and styles.

2.3 SEARCH AND DISCOVERY

Search and discovery use CC, a high potential area of impact for KM. A search functionality incorporates cognitive abilities, which can provide more comprehensive answers, interpret images and video by extracting information that would otherwise remain hidden in multiple documents (Microsoft, 2020). People can ask questions and get appropriate responses in a narrative form—for example, the use of Cortana or Siri, which specializes in knowledge organization (Nowacki & Bachnik, 2016). ML, in another instance, is a very sophisticated albeit essential machine skill that simulates the human brain and allows improvement of all sorts based on experience. The machine writes algorithms autonomously and suggests solutions to problems. For example, an onboard automobile navigation system relies on massive quantities of topographical data that it analyzes to search and generate a map (Höhle, 2017). However, this entirely depends on CC for the user to explore and the machine to discover the reliable specific route and avoid heavy traffic.

CC applications generate conclusions from available knowledge by using analytical techniques like induction and deduction. They are mainly employed to validate other modules like NLP and statistical analysis, act as the brain to the cognitive systems, and individually solve a problem. These systems increase operational efficiencies (Jennex, 2015). For example, General Electronics (GE) Company effectively detected cracks and other issues in the airplane engine blades (Kollross, 2018), keeping a history of the discovered knowledge and keeping it for future solutions to similar problems, managing knowledge. Cognitive applications can transform previous knowledge into learning information to improve future applications. The applications can involve humans and ML capabilities.

3 BETTER HEALTHCARE DELIVERY AND MANAGEMENT

CC capabilities – understand, learn, reason, and interact – are instrumental in improving outcomes by helping experts derive informed approaches to medical treatment and diagnostics. Cognitive systems can manage data in electronic health record systems (EHR), allowing physicians to focus on other strategic healthcare processes through informed decision-making. The applications of CC in managing healthcare knowledge are almost endless. This section reviews critical development in the CC domain.

3.1 Data Management

CC can manage critical data elements such as analyzing genomic data and converting unstructured documents into structured (Behera, Bala, & Dhir, 2019). Griffith et al. (2015) presented a Genome Modeling System (GMS) – an information system capable of massively analyzing genomes autonomously. Healthcare knowledge management systems (KMSs) handle broad data management arrays that rely on inputs from experts (Kruesi, Burstein, & Tanner, 2020). Such systems rely on computer programs for analysis with limited automation. However, CC leverages ML algorithms to learn from people and situations (El Miedany, 2019); this implies that such systems can offer better analysis within shorter time frames than the KMSs heavily rely on available information. Also, converting unstructured documents into structured data can improve communication in healthcare settings and enhance data analysis through current systems (Behera et al., 2019). Through its Thought Leadership White Paper, IBM (2016) explained how CC could improve population health through effective data management. The white paper indicated that CC could improve KM by rapidly searching text documents then converting unstructured data to structured information necessary for understanding human populations. Essentially, CC can improve healthcare KMSs by increasing their scale of operation and accuracy.

While KM can handle Big Data management, CC can significantly improve Big Data handling through KMSs. Hijazi (2017) speculated that a combination between Big Data and KM increases the wealth of managing knowledge. While Big Data analytics explores massive data sets to reveal the hidden correlations and patterns between the data sets (Hariri, Fredericks, & Bowers, 2019), KM can extract significant insight from the analytics and share it with healthcare experts to make effective decisions. While the potential of Big Data relies on its volume, its variety, and its velocity for understanding systems (Hijazi, 2017), Hariri et al. (2019) believed that the data (Big Data) obtained from repositories like financial records and medical records are inherently uncertain due to inconsistencies and incompleteness. While KMSs may manage such data, increased velocity, volume, and variety, amongst other Big Data constructs, complicates the management process (Hariri et al., 2019). Therefore, CC offers an opportunity for systems to learn from current trends of Big Data generation and acquisition and predict future patterns through pattern recognition and predictive analytics to help experts plan for better approaches in managing knowledge. ML allows data-driven decision-making by creating predictive models for knowledge discovery (Hariri et al., 2019). Grounded in ML, NLP provisions the analysis and interpretations of data and text generation (Hariri et al., 2019). CC can be instrumental in expanding healthcare systems by predicting their capabilities based on performance history following Big Data analytics to the baseline for decision-making.

3.2 Precision Medicine

CC has a potential favorable contribution to precision medicine. KM has transformed medical delivery by helping experts understand patients' health patterns and responses to medication through Healthcare information technology (HIT) (Alotaibi & Federico, 2017). HIT includes a myriad of technologies ranging from simple applications systems to complex information systems. HIT has transformed healthcare by facilitating care conditions, reducing medical errors, and tracking medical data (Alotaibi & Federico, 2017). However, the high demand for medical care constantly overwhelms the healthcare industry, necessitating better and innovative approaches in healthcare delivery. According to Hijazi (2017), tacit knowledge does not change as it resides in people's minds. Mimicking people's judgments, intuition, and perception through CC is an excellent approach towards knowledge creation. The introduction of AI-based systems for generating knowledge requires a similar approach to manage it; this necessitates advanced tools for supporting explicit knowledge (Hijazi, 2017). Therefore, HIT should adopt advanced techniques for managing Big Data.

Ahmed, Mohamed, Zeeshan, and Dong (2020) cited precision medicine as a recent development in medical care capable of replacing symptom-driven practices with early interventions through advanced diagnostics. EHR systems are vital components in the healthcare sector, providing physicians with critical data for treatment and diagnostics. Unfortunately, most care practices are symptom-based (Ahmed et al., 2020), with most physicians focusing on disease treatment than preventive approaches. Through CC, EHR data can reveal significant insight allowing machines to learn from past and recent medical experiences for better care outcomes (Ahmed et al., 2020). With CC as the basis of KM in EHR systems, experts can predict future medication outcomes and learn about patients, improving patient-specific care instead of generic procedural treatment criteria (Behera et al., 2019; Evans, 2016). CC can offer real-time data management for real-time decision-making. Altogether, the discovery of patient-specific patterns of disease progression through disparate EHR data sources is an instrumental component of AI-enhanced KM.

4 Improving Corporate Strategic Management

Thompson, Peteraf, Gamble, and Strickland III (2018) perceived strategic management as doing things differently to stay competitive. Technology is growing at a relentless pace, forming the foundation for most businesses to establish differentiation strategies in the corporate world. Companies like Amazon.com and Google have stayed competitive by leveraging AI-based approaches to identify and reach their consumers and solve complex problems. The sustainability of some recent technology giants like IBM and Google comes down to advances approaches in KM such as CC initiatives. This section demonstrates how cognitive intelligence is shaping KM in different businesses.

4.1 Facilitating Strategic Investment

Unlike AI, which encompasses multiple technologies for problem-solving, CC goes deeper by analyzing numerous factors, including history, correlations, and trends, mimicking human wisdom and intelligence (Coccoli, Maresca, & Stanganelli, 2016; El Miedany, 2019). Coccoli et al. (2016) delineated that CC learns by studying patterns and system behavioral characteristics, giving suggestions based on its understanding of specific situations instead of intelligent semi-autonomous KMSs, which rely on programs and history records. CC serves as an assistant instead of taking part in task completion. Accordingly, it can be instrumental in improving KMSs in organizations. Through assisting, a gradual investment to CC gives managers the power of accuracy and faster data analysis without worries of bad decision making (Gupta, Kar, Baabdullah, & Al-Khowaiter, 2018). Managers end up getting a better understanding of the value of data and understanding their business's nature (Lai, 2019). By assisting managers in vital decision-making, CC endows a superior grade precision and analysis and control maintenance. Essentially, managers can find detailed and situation-specific data from CC-based KM methods.

AI is a buzzword in most business platforms today. However, most investors are rushing to invest in AI to improve performance without strategic planning, leading to further losses. Gradual investment in CC can help managers realize the value of their data and understand the nature of their business to make informed decisions on the extent of investment in CC. Speculations from DeAngelis (2019) revealed that CC disrupts the digital sphere, and a gradual investment is more beneficial than any other technology introduced in the past decades. By analyzing and managing large amounts of volumetric data, CC helps employ a computing system relevant for understanding a business (Tarafdar, Beath, & Ross, 2017). CC has a host of benefits that help company managers understand and adapt appropriately to the ever-changing industry. CC improved KM through accurate data analysis whereby the cognitive systems provide a highly efficient mechanism for collecting, juxtaposing, and cross-referencing data (Chen et al., 2019). CC can also analyze emerging patterns, identify business opportunities, and consider critical process-centric issues in the current rime (Veres, 2017). This analysis examines extensive volumetric data (Li, Zhang, Yu, & Meng, 2018). A CC system such as IBM Watson can simplify underlying KM processes, minimize risks, and pivot according to the ever-changing circumstance. This simplification helps managers understand business and prepare them in building a proper response to investment strategies while simultaneously creating lean business processes.

Furthermore, views from Courage, Bakhtiar, Fitzpatrick, Kenny, and Brandeau (2015), implied that CC could provide a better level of customer interactions in that there is a quality in interactions and a drive of a superior front desk and hospitality experience. Through a partnership between Hilton and IBM, CC provides amazingly relevant, accurate, and contextual information on broad subjects (Chen et al., 2019). With such contextual information, managers can avoid rash and immature investment strategies due to a better understanding of the market demand, in this case, the customer. Altogether, managers understand their businesses through proper KM to avoid rash or immature investment strategies. CC is the basis of a knowledge-driven organization.

4.2 Improving revenue

CC uses computerized models to simulate the human thought process in situations where answers may be uncertain or even fuzzy. According to Boolean logic, a statement may be true or false; however, fuzzy logic describes real-world uncertainties by expressing some degree of truth or false (Vlamou & Papadopoulos, 2019). Knowing customers is the best approach to improving revenues. Through CC constructs like NLP, pattern recognition, and ML, companies can understand their customers better. Managers can use the newfound knowledge to sell more. CC is changing the face of customer service by improving service delivery by the agent's base on deep listening of the customer's voice like the level of unsatisfactory or anger linked to the customer's perceived tone and his account connected with previous contacts (Joggerst, 2017). Companies can use the newly profound CC systems to sell more to customers since it is adaptive, interactive and contextual. Therefore, CC can leverage NLP to account for customer concerns and improve revenue through this strategic approach.

CC is instrumental in managing data from customer feedback and the Helpdesk. Research by Wolf et al. (2020) inferred that CC constructs like NLP uses computers to translate languages, convert voice to text and text to vote, and help human-like conversational agents assist the companies' employees, partners, and customers in dealing with their issues, questions, and concerns effectively. For instance, if a customer complains about their problems with a service or product, the NLP system would recognize the feedback, analyze it and mark it for a quick automatic reply appropriately, saving the company a lot of time and money hence increasing their profit margin (Manning et al., 2014). The voice recognition application enables companies to create intelligent voice-driven interfaces to understand human language and queries instead of understanding concepts based on standard human language usage patterns. The voice recognition tool propels the Chatbot feature as they are intelligent and can also recognize human emotions; they help meet the customer's request for personalization by collecting his relevant data and address individually devoid of the human communication stress. They can also target prospects and strike a conversation schedule, increasing profit margins.

Pattern recognition as a CC construct uses operational data from the computers for pattern analysis, consisting of successive measurements made over a time interval, which would otherwise remain unnoticed (Hirschberg & Manning, 2015). Companies may look for suitable algorithms and good data sources to automatically discover patterns that affect their sales and are primary consumption to their customers. The analytics on sales data indicate market trends, customer interests, latent needs, and future sales trends (Alamäki & Korpela, 2021). The analytics can show the high selling products and services based on geographical interest and global news to improve price products and quality. As a result, it drives more sales and satisfies the customer's wants. Managers can also leverage the structured and unstructured data to analyze and detect a possible security threat through pattern recognition relevant to what is happening with the security systems as new, unexpected patterns are in comparison with standard designs.

ML decodes consumer behavior by extracting meaningful insights from raw data to solve primary data-rich business challenges quickly in real-time (Goldberg, 2016). ML algorithms help companies enhance their service delivery by improving business scalability and improving its operations due to easy data availability and cheaper and faster computational processing. ML serves as a solution to various business complexity problems and predicts customer behavior through product recommendations (Gardner et al., 2018). ML algorithms use the customer's purchase history and match it with the extensive product inventory to identify the hidden patterns and similar group ones, which are then suggested to customers, hence motivating the product purchase. Managers can use ML technology to improve cybersecurity and boost the company's security. Cybercrime threatens companies' well-being by allowing new generation providers to build new technologies to detect unknown threats. A secure platform increases customer loyalty leading to more profit.

4.3 Easing Workforce Transitions

Transitioning from an aging employee population to recruits can disrupt an organization's performance. Lewis (2017) acknowledged that creating experts out of new employees and maintaining existing legacy systems while introducing new programs is a daunting endeavor that can take years. Therefore, managers should consider critical factors impacting organizational knowledge transfer. For instance, the transfer of knowledge between employee generations and getting new employees to conform to current practices are crucial capabilities (Lewis, 2017). Employees accumulate tacit expertise over the years, and KMSs can help capture the experiences and transfer them to new generations. Unfortunately, the volume and sensitivity of information is a critical priority in a successful transition. Accordingly, cognitive systems can improve the ease of using knowledge-based systems (Savoy et al., 2018). A successful change in employee generation (without losing essential knowledge acquired over the years) may involve a complex and extensive knowledge-sharing process. Yan and Tian (2016) realized that people's expectations based on their prior knowledge shapes perception and understanding. Yan and Tian (2016) perceived a 'cognitive schema' as a unit that organizes prior knowledge. Relatively, CC can provide an excellent schema for managing Big Data or massive knowledge accumulated by outgoing employees, which effectively and seamlessly transfers the knowledge to new employees. A cognitive schema can influence knowledge acquisition by choosing relevant knowledge, understanding the knowledge, and integrating it into long-term memory (van Kesteren & Meeter, 2020; Yan & Tian, 2016). A cognitive schema is necessary for developing a CC application that improves and eases the use of KMSs.

Further, Lewis (2017) presented Woodside Energy – Australia's largest independent oil and gas company – as one of the companies that leverages the advantages of IBM Watson's cognitive capabilities, enabling the successful transfer of knowledge across generations. The author stipulated that "Woodside Energy uses IBM Watson cognitive services to help facilitate this new style of learning, so that the new workers accumulate just as much industry knowledge as their predecessors, but in a different way – one that is better geared to their generational mindset." (Lewis, 2017, para.20). Essentially, CC is instrumental in designing applications capable of transferring tacit and explicit knowledge across employee generations, easing workforce transitions.

5 CONCUSION

Cognitive computing systems address the limitations of conventional knowledge management systems, leading to a robust computational framework that enhances information systems' success. This architecture depends on advances in cloud computing, artificial intelligence, parallel and distributed computing, and neuromorphic design that provide underlying hardware and software infrastructure. The integration of these technologies in the cognitive system optimizes machine learning, artificial intelligence, and data analytics in business decision making and problem-solving. Pervasive implementation of these systems enhances the firm's competitive advantage, fosters innovation, and enables corporations to retain market dominance. Deploying this computational framework in different fields offers a robust and automated framework for applying knowledge management processes. Thus, cognitive computing systems offer a robust, efficient, and comprehensive computational framework that resolves current knowledge systems' limitations

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