Cognitive Enterprise and Cognitive Information Systems

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Abstract: The rapid change of world causes new challenges in the business environment and in many other operational areas of enterprises. Those challenges likely increase the chance for client or customer satisfaction meanwhile improve companies' efficiency, improve cost saving, optimize processes in operation and/or manufacturing, enhance security, reduce errors etc. Due to the complexity and to the rapid alterations within the environment, changes in the processes of enterprises are not able to answer these challenges easily in time, e.g. predicting the potential future events as one of the key elements of the long-term success, these events might have a direct impact on the organization future. Those required skills to manage the actual situation are rarely available in one single person or in one team, sometimes it is neither affordable or nor efficient, therefore one of the possible solution is to leverage the capability of a cognitive information system. The aim of the publication is highlight advantages of the cognitive information system. Help to understand and imagine the future of cognitive enterprise, cognitive operation, analyses in different segments, industries. In the areas presented, point to the potential benefits of the application and highlighting the importance of the support to achieve the business goals, realizing the corporate strategy. Cognitive information systems enable the corporate to leverage new technologies, supports effectiveness improvement. Demonstrate with example the possibilities what business process management provides, supported by the cognitive information system how to extend the boundaries of the operation of the enterprise. Challenges out of the environment require continuous improvement; therefore, a business process improvement that needs to adapt to the situation. Cognitive information system enables to reveal the gaps in the current business process, identifies the opportunities for development and supports the daily operation with business intelligence under the framework of business process management, CRM, and Kaizen methodology.

Keywords: Business Information Systems, Cognitive Information Systems, Cognitive Enterprise, Information Systems Modelling, Business Process Alignment.

Introduction

The reconstruction of binary matrices from their projections is a basic problem in discrete tomography. The concept of Cognitive Information Systems appeared as an intersection and shared area of Information Systems and Cognitive Science. Modeling, analyzing, and designing information systems in the most recent technological advancement makes it possible and - at the same time - requests for architectural and design principles that combine the development of technology and theories of Cognitive Science. We think of architecture of information systems within enterprises in the sense of Zachman [9] and TOGAF framework [4]. The technology advancement in the field of information systems can be captured in the concept of Data Science and semantics. Cognitive Science offers the analysis of cognitive tasks, i.e. the investigation of the decision making, reasoning skills of the examined subject whilst the subjects treat the set of complex information [7]. Interdisciplinary research on human expertise and domain specific cognition has yielded theoretical and methodological background that can be employed to create architecture and design principles that can assist in the realization of cognitive information systems [5]. Cognitive science studies "the principles, architectures, organization, and operation of natural and artificial intelligence systems" [2], thereby cognitive science is an intersection of scientific domains among artificial intelligence, psychology, linguistics, anthropology, neuron-sciences, and education. Enterprise operation, through business process management leveraging cognitive information system capability, that supports the organization to respond to the environment challenges. The research methodology and assessment of the available publications pursued the comparative study pattern, i.e. studying and comparing the result published in articles, then a case study paradigm has been used for observing and monitoring the work with a cognitive information system during daily operation.

LITERATURE SURVEY

Cognitive information systems can be regarded as an interdisciplinary research topic that has emerged as an interaction between information systems and cognitive sciences including psychology, neuronscience, cognitive modeling, cognitive ergonomics, linguistics, biology, anthropology, and various branches of artificial intelligence [5]. Taking into account of the cognitive capability: it is an abstract notion that incorporates the temporal and contextual environment to be considered within the analysis and design of cognitive information systems. Cognitive information system are socio-technological systems. What makes a system cognitive is the following according to Hurwitz: "Three important concepts help make a system cognitive: contextual insight from the model, hypothesis generation (a proposed explanation of a phenomenon), and continuous learning from data across time." [3]. Wang postulates that a "denotation mathematical" approach is required that own structures, tools, and methods beyond the traditional mathematical logic [8]. Ogiela [6] collected areas of application of informatics and information technology where cognitive information processing techniques are incorporated into various systems as business information systems, biomedical systems, identity and access management, etc. that undoubtedly has impacts on business and delivers advantages, however none of them are covering enterprise environment in general. Currently, the human, carbon agent extended with a silicon agent with embedded knowledge-bases and reasoning capabilities. The two facets of data interpretation should be fitted together, at least in the sense of rough sets; if they cannot be reconciled then the trial to integrate the different views of data to understand them is not successful.

Illustrative example of cognitive business operation and analyses

The new operational ways with new business processes, business process management and process re-engineering, agile corporate management, process documentation, are set of activities in order to manage your processes in a fast, error-free, and cost-effective way. Strengths of cognitive computing, the ability to generate value from moving data, like stock exchange data that change in a folio-like manner where processing speeds are key. Real-time analysis involves the part that, if not realized, the value of the data is lost or significantly reduced. The use of the cognitive information system in various field always affects enterprises, and through the networks of business and society has effect on other layers of society. At the University Medical Center, Groningen, Netherlands the paper based administration system showed numerous errors over a 5-months period. These errors were transcription mistakes causing preventable drug event, temporary harms, prolonged hospital admissions, including cases that were life-threatening and fatality [11]. Based on the results of developing systems that reflect the physical, cognitive and social needs and goals of a person or team in the context of the technology, environment and culture with which they operate, positively impacted all of the negatives created by the paper based system as medical errors, adverse events, reduction of mortality, and complications [12].The cognitive information systems like Watson completely different from the traditional information system. The result of the analyses completed with Watson might initiate the transformation of the enterprise, changes on the governance, redefines the mode of operation, and impacts changes in the roles and responsibility in the organization. The customer experience is becoming more important to businesses as a differentiator; the sophisticated grow and increased demand did not pair with loyalty [10]. During of CRM system implementation, cognitive information system that analyses business processes, customer behavior, could help to the management or to the employees in buy in, utilizing visualization capability, demonstrating impacts and factors in a combined view. As is analyses helps to understand the actual situation, and calls attention for extremism. Cognitive information system ability to analyze deviations, highlights weaknesses and possible further development with actions, provides information on impacts drivers and correlation within inputs and outputs and other factors. Those outputs get the attention paid by the management and calls for actions. Kaizen methodology combined with the cognitive information system provides business intelligence, a cognitive business process management, which ensures several opportunities for the corporate for continuous improvement. Actions derivate form the combined methodology might pull immediate advantages. As Kaizen methodology as cognitive computing supports the enterprise on various level form employee to management, providing differentiate view with various visualization and level of information about the enterprise itself and its environment.

Analyses with Cognitive information system

Cognitive information systems with different cognitive level, provide different level of added-value. Descriptive Analytics: Historical and current data elaboration and analytics, which is lack of the above mentioned value add, therefore any traditional/technical analyses and traditional information system basic capability, sometimes with human collaboration. Predictive Analytics: Historical, current and real-time data elaboration and analytics, based on statistical predictive modeling, where the process includes data mining based on semantical analyses and machine learning. The output is presenting the possible future as value add during the decision making that includes real-time data. Prescriptive Analytics: The outcome defines go and no go rules regarding to the future activity highlighting the possible outcomes for it based on historical, current and real-time data evaluation. Advantage to simplify the decision process. Risk might carried by the rigidity of prescriptions. Cognitive Computing with machine learning Carbon agent (human) and silicon agent (CIS) collaboration for problem solving. Historical and real time Big data analytics from multiple sources, with prediction. Risk might carry by the carbon agent collaboration during learning session.

FUTURE RESEARCH DIRECTION

Considering the Zachman framework as an overarching approach, a cognitive information system belongs to the views of Business Analyst, Strategic Planner, System Analyst and System Designer. The cognitive information system is involved in the process/function and data perspectives, exploit the achievements of data science stepping beyond the traditional stimulus-response metaphor for conceptualizing of functional services. It is an adaptive system that can handle the dynamically changing business environment and can incorporate the alteration of business processes by a way that the realization of changes is implemented in a systematic and consistent manner through the three seasons of business processes, i.e. analysis, design and implementation/operation [1]. The above presented analysis about the concept of cognitive information systems in enterprises pinpoints the recent advancements. Enterprises come across regularly business problems, the data analytics as applied Data Science is a new source of information for enterprises to chase efficiency and effectiveness in their operations. The objective of data analytics procedure is to acquire knowledge out of collected data through discovering associations and relationships.

CONCLUSION

According to the most recent literature the definition of cognitive information systems refers to the cognitive architectures, data processing, models for insights hypotheses for new phenomenon and opportunity for the silicon agents for the continuous learning. The scientific and technological literature contains the description of massive cognitive information systems with the enormous resource requirements that may be accessible by huge international enterprises as tenants of cloud services. The subject of the research is two-pronged, on the side of the practice, the main aim is to grasp the notion of cognitive information systems that can be used for micro, small and medium enterprises, on the other side of formal approach the goal is to establish a model that define the business and information architecture, the major services exploiting the formal and semi-formal tool set of computer science.

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