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# Enhancing the Quality of E-Learning Systems by Using Big Data and Cognitive Computing Approaches

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**Abstract**: E-learning has evolved from its initial stage of using standalone computers and devices for delivering multimedia content to a more comprehensive and integrated virtual learning system. With cloud-based learning management systems, e-learning is likely to gain more popularity. Today, increasing number of institutions is adopting it to achieve excellence in educational practices. In Cognitive Storage Computers can be taught to learn the difference between high value and low value data *i.e.* memories or information, and this differentiation can be used to determine what is stored, where it is stored and for how long.The main of this paper is discuss the importance of utilizing the concept of Cognitive storage for improving the performance of E-Learning Systems. E-Learning system can essentially be modified to learn the difference between primary and secondary contents, so that it can retain only updated educational data for the maximum benefit of users.

**Keywords**: Cognitive computing ,Cognitive storage, Big-Data, E-Learning, Deep Learning.

## I. INTRODUCTION

Big Cognitive computing represents the third era of computing. In the first era (19th century), Charles Babbage, also known as the father of the computer, introduced the concept of a programmable computer. Used in the navigational calculation, his computer was designed to tabulate polynomial functions. The second era (1950) experienced digital programming computers such as ENIAC and ushered an era of modern computing and programmable systems. Now, that's turned into cognitive computing, which works on Deep Learning algorithms and Big Data analytics to provide insights.reclassification. Thus, the brain of a cognitive system is the neural network, a fundamental concept behind Deep Learning. The neural network is a system of hardware and software mimicked after the central nervous system of humans to estimate functions that depend on the huge amount of unknown inputs.

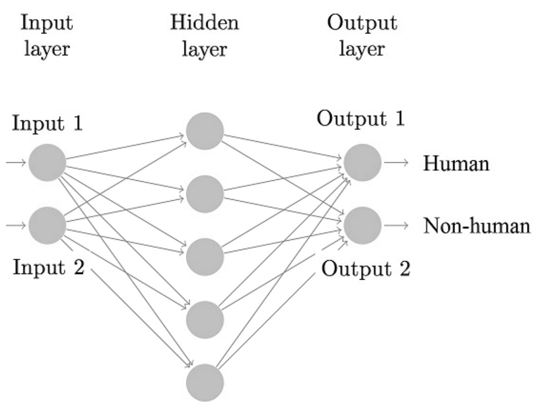


Figure 1: Cognitive Learning Approach

With the present state of cognitive computing, basic solutions can play an excellent role of an assistant or virtual advisor. Siri, Google assistant, Cortana, and Alexa are good examples of personal assistants. In order to implement cognitive computing in commercial and widespread applications, Cognitive Computing Consortium has recommended the following features for computing systems.

- Adaptive: They must learn as information changes and as goals and requirements evolve. They must resolve ambiguity and tolerate unpredictability. They must be engineered to feed on dynamic data in real-time or near real-time.

- Interactive: Similar to brain the cognitive solution must interact with all elements in the system – processor, devices, cloud services and user. Cognitive systems should interact bidirectionally. It should understand human input and provide relevant results using Natural Language Processing and deep learning. Some intelligent chatbots such as Mitsuku have already achieved this feature.
- Iterative and Stateful: They must aid in defining a problem by asking questions or finding additional source input if a problem statement is ambiguous or incomplete. They must “remember” previous interactions in a process and return information that is suitable for the specific application at that point in time.
- Contextual: They must understand, identify, and extract contextual elements such as meaning, syntax, time, location, appropriate domain, regulations, user’s profile, process, task, and goal. They may draw on multiple sources of information, including both structured and unstructured digital information, as well as sensory inputs [2].

## II. BIG-DATA BASED E-LEARNING

The term ‘Big Data’ is used to refer large and complex data captured, curated, and drilled down for analyses using advanced computing technology. The big data analysis reveals industry trends and user behavioural patterns and establishes logical association among data. With increasing use of internet and growing demand of e-learning in academics as well as corporate training sectors, big data and analytics can play a crucial role in the benefit of e-learning. E-Learning process is based on various instructional design (ID) principles. E-learning methodologies and practices, as these depend extensively on computing technology, are designed based on scientific analyses of human cognitive skills, mental ability and behavioural traits. These ID principles are practically tested and revised to improve their pedagogical effectiveness by reducing external loads that possibly affect learning. Distance learning, virtual classes and cloud-based knowledge sharing are growing trends in the field of modern education. In addition to traditional classroom-based study, web-based and cloud-based e-learning models throw a challenge to universities and institutes in dealing with the ever-growing pool of student/learner data. However, with data analytics integrated in LMSs such as Edbrix, electronic learning can be more effective and enjoyable. The LMS analytics can capture data and unfold patterns and associations among complex data sets. Learner data analysis from cognitive, emotional and behavioral perspectives can, therefore, largely benefit the e-learning industry.Integrating analytics with learning management system leads to more comprehensive and in-depth evaluation of users’ interaction with the system. LMS analytics produce information that helps administration in making decisions and policies that will benefit students and the process of learning in general. With advanced LMS analytics presenting data in easy-to-understand graphical chart format, it becomes easier for faculties and administrators to monitor and measure students’ performance and assess them more accurately.

Cloud-based learning systems combined with advanced data analytics is sure to take e-learning to a new height in the coming years. While cloud storage eliminates the need for local data server and larger storage as number of students grows analytics provides deeper insights on learner data, both individually and collectively, for better decision-making and policy-making. Educational institutes need LMS analytics that can analyze and evaluate huge amount of data using techniques like data mining and statistical analysis with focus to the core process of e-learning, which is learning and delivering knowledge. Faculties, educational administrators as well as professional trainers can leverage the information produced by LMS analytics in measuring the impact of e-learning and work for betterment and growth of it [1,3].

## III.LITREATURE REV IEW

According to paper [4] Software-based cognitive approaches focused either on representing knowledge, designing thinking or feeling capabilities are detached from brain-like computer machinery. Networks of neurosynaptic cores are designed to efficiently. compute a large number of machine instructions. However, the network of neurosynaptic cores does not explain (i) how domain-specific knowledge is represented in the brain [5] or (ii) the neurological relationship between reasoning and feelings [6]. On the one hand, there is a need for specialized neurosynaptic cores not only focused on efficient computations but also focused on capturing knowledge and feelings. On the other hand, there is a need for integration of cognitive software focused on representing knowledge and modeling feelings into brain-like computer machinery. According to [7] focus of NLP has shifted more towards machine learning algorithms which work on non-annotated data. This brings into picture Artificial Intelligence (AI) which has been a part of the computing field for a prolonged period of time.

AI has always strived to solve computing problems by taking cues from the working of the human brain. It is therefore no surprise that the confluence of AI and NLP have helped develop intelligent language processors. Machine learning (ML) is an important component of AI. Deep learning, which comes under the domain of ML helps achieve the goal of learning with minimal explicit programming of the machines. Deep learning techniques use artificial Neural Network

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to extract hidden information from the language representations and combine them to create new information through concepts like feature learning using supervised and unsupervised methods. The cognitive computing techniques can be categorized into perception based [8] the authors' base their algorithm on the perception cognition model (P-C model) of human brain proposed by Sherwin. They propose a layered unified cognition framework. In this model different layers perform different activities. The lower layers receive the physical signals from the real world and its processing for generating cognition is done in the higher layers. The unified framework enables the unification of different types of perception features like auditory, visual and sense of touch. It is argued that cognition is the end result of creation of concept space of which the concept is a basic cognition unit. In the human mind all the concepts are logically related and can be retrieved as per need. According to this model each word in a sentence creates a concept in the concept space and is associated with numerous features. These features themselves are also mini concepts. Thus there is a hierarchy of concepts.

If all the features are perceived as having the same value, the word is not conceptualized but behaves as an instance. Conceptualization happens only when some features show different values. The word then is abstracted to a higher level as a concept and its associated features provide the relevant semantics. In case of Inference based model [7] The act of reasoning and drawing inferences are important constituents of cognition in humans. Inference is defined as a conclusion which is formed as a result of known facts or is arrived at, by the process of reasoning. The conclusion could also be in a form of opinion. In either case it is something which is not explicitly written down or spoken but is inferred implicitly. From the current computational perspective the problem of drawing semantic inference from texts is limited to recognizing textual entailment (TE) between two given sentences.

## IV. PROBLEMS IN COGNITIVE BASED E-LEARNING SYSTEMS

Major challenges faced in cognitive modelling are:

- Cognitive computing and machine learning were originally designed to make sense of massive amounts of data. The systems require a lot of raw material from which to extract insights, learn and predict.
- Another significant challenge for implementation involves "training" cognitive systems. In many cases, enterprises need not only a sufficient data set, but also skilled resources who can invest time in tuning the cognitive engine before valuable outputs can be gained. That may create an initial barrier to entry for some organizations.
- The next challenge is the cost of implementation. Cloud and app-based systems are being developed that at a minimum facilitate affordable trials of the technology [9].

## V. IMPLEMENTATION APPROACH FOR COGNITIVE BASED E-LEARNING

A.Dataset Generation

The dataset for Cognitive based E-Learning approaches has the following features:

- Content related features: These include the content relevancy related features which will most benefit the users.
- User related features: These features include user interest level for different topics. These data can be taken from user interaction using social media websites.
- Area wise popularity: These data will contain features related to area name, topic popularity etc.

B. Cognitive computing using Hadoop: Hadoop makes it possible to run applications on systems with thousands of commodity hardware nodes, and to handle thousands of terabytes of data. Its distributed file system facilitates rapid data transfer rates among nodes and allows the system to continue operating in case of a node failure. This approach lowers the risk of catastrophic system failure and unexpected data loss, even if a significant number of nodes become inoperative. The basic approach is as follows:

- Pre-Processing: In this step features are extracted on the basis of metadata like relevance, popularity, storage tier etc.
- Classification and Selection: The data is further sent for classification using appropriate classifier. After classification the selector sorts the dataset according to relevance class to determine the level of protection and the tier for each dataset as per requirements of MTSU (Multi-Tier Storage Unit) .
- Storing Process: The storage process is governed by MTSU which comprises of Migrator and storage capacity manager. These two components take into account information from the access pattern evaluator. The basic task of migrator is to move the data from one tier to another which entirely depends on the corresponding relevance class and access patterns. Accordingly, the migrator also needs to maintain the protection level by adapting the respective redundancy schemes.

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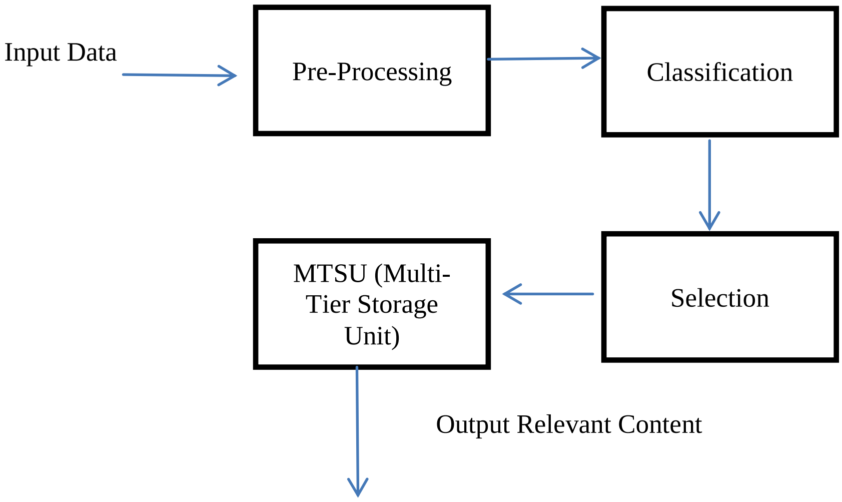


Figure 2: Block Diagram of Cognitive Computing Proccess

## VI. CONCLUSION

The frequent interactions between academia and industry are a remarkable feature of cognitive computing, especially when it comes to its applications in education and learning. The main aim of the paper is discuss the importance of utilizing Big-Data and Cognitive computing approaches in the area of E-Learning. According the paper the E-Learning systems can be made highly efficient by applying the cognitive computing and storage. According to the suggested approach the data feeded to the system is first pre-processed according to features like relevance, popularity etc. Only those learning related content are retained which are selected by the classifier according to the most relevant features. The approach can be utilized to provide more quality content to student and other users in case of e learning. Also the approach makes the server processing and memory utilization more efficient.

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