ROLE OF BIG DATA IN EDUCATION SECTOR: A REVIEW

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Abstract - "The goal is turn data into information and information into insight" says Carly Fiorina former executive, president and chair of Hewlett Packard Co. The emergence of Big Data and its constituent tools and technologies have found profound relevance and are the prime force of success in any business sector. The adaption and operations of Big Data technologies in the educational sector is still at a slower pace in comparison to others. The paper aims to highlight the importance of applying Big Data technologies to various aspects of the education sector and primarily focuses on three specific target users namely students, teachers and the organization as a whole.

Keywords - Big Data, Education Sector, Student, Teacher, Predictive Analysis, Sentiment Analysis.

I. INTRODUCTION

The innovation in technology combined with variety of data techniques have now provided the mechanism to deal with wide spectrum of issues that appear during the process of data collection and also during working with large volume, variety and velocity of data [1]. The primary idea behind Big Data is the application of information tools to pave way for data analysis and extract useful information for better estimation, planning and judgment in any business process [2]. Globalization has not only paved way for competition in world economics but has also driven educational reforms. Public expectations for accountability and transparency have immensely grown in every sector and education is no longer an exception. Even though the education industry is continuously spawning large amounts of data, the application of Big Data analytics is yet to gain momentum in comparison to sectors like Banking and Securities, Communication, Media and Services and so on [3][5]. There certainly is a thriving enthusiasm in the education community to make use of Big Data analytics to derive value which can be applied for the holistic betterment of the community [4].

Big Data analytics can resolve all the issues of the education sector. Georgia State University for example adopted new data analytic tools to deliver solutions to the long pending problem of student retention [6]. Various groups in the education sector look at the information collected in accordance to their own view and objective. Students, teachers and the educational institution itself can benefit by deriving values from the large volumes of data sets available. The remainder of the paper is organized as follows. Section II focuses on the key business challenges of the education sector. In section III, the paper sheds light on some application examples of Big Data in the education sector. The concluding remarks are given in section IV.

II. KEY BUSINESS CHALLENGES

A. Student Acquisition

Tools that are used for communication with target crowd have changed from traditional media to a new concept called social media. Universities and colleges have started clinging to social media for the overall marketing model. Acquiring the most talented students is not just mere enlisting. Eventual students do extensive on-line research about the prospective institution before getting enrolled [8]. They understand and discuss student sentiments of the institution through discussion forums and thereby connect with others of similar interest before actually making any physical contact with the institution. Harvard, The University of California and others are using social media as an advertising tool. There are few prominent factors that drive students to educational institution namely personal factors, academic quality, facility, campus, socialization, financial aid and policies. Research done at the University of New Hampshire shows 96% students use Facebook, 84% use YouTube, 20% use blogs and 14% use Twitter. Thorough sentiment analysis of the student’s sentiments helps wonders in the student enrolment process. Big Data solutions therefore serve as insight analysis podium [7].

B. Student Conduct

Conduct of a student is a measure of how well they perform academically. An early assessment of the student’s overall campus life which includes task, social habits, eating and sleeping habits, effectiveness of the tutor and so on play a very vital role towards a student’s conduct. Big Data solutions enable better analysis of student’s sentiments. Installation of sensors in the college premises provide an insight of student’s academic life by tracking the amount of time they spend in classrooms, library, hostel, cafeteria and so on. IoT technology clubbed with analysis of large data sets provides the desired result [8].
A student’s profile, archival conduct and demographic information provide precise and dependable prognosis. Big Data technologies progressively pave the way for the collection, storage and processing of massive amount of data traversing reasonable amount of time encompassing a large variety of data types and samples [4]. These facets thus make them extensively and ideally suitable to mine and measure varying student characteristics engaged in the learning process. Big Data analytics can used to identify the at risk students and increase the student retention rate.

C. Research Optimization

Research practices play an important role in affirming the credibility of any educational institution. The quality of the research work brings grants from government and others sectors thus bringing the institution to limelight. For the enablement of good quality research projects the interested and intuitive faculties, students and the available resources should be brought under a single umbrella. Big Data tools and applications make use of intellectual data that aids research practices and management on both personal and collaborative grounds [10]. Academic social networks such as Academia and ResearchGate provide a platform for the reasoning of research work. Collaborative cloud based Big Data analytics provide insights thereby allowing researchers across the globe to find likeminded people who could contribute to the projects. The success or failure of a research work can be determined by using predictive analysis. If early results are unsatisfactory the research can be brought to conclusion and if the results look promising then an estimation of the research pace and resources can be thought about. Big Data solutions incur much lower cost for the storage and processing of magnitudes of research data thereby serving as a storage and analytical platform.

D. Improving Teaching Efficiency

The role of teachers has drastically changed with the emergence of Big Data enhanced education. Enormous amount of educational data generated requires teachers to be more equipped and qualified to work on the analysis process. Teachers are required to master cutting edge technologies and keep pace with new tools and technologies. Instantaneous feedback helps to determine the student’s learning curve, detect student requirements, foresee future performances and enables teachers to make effective changes in the teaching methodologies [12]. Teachers must be quick enough to work on the required entity from the explosive student dataset. The course material level and its effectiveness can be judged by student’s sentiments about a particular teacher. This can help the teacher and the organization take corrective actions. Appreciation and rewards can be conferred to those teachers about whom students exhibit positive sentiments [11].

III. SOME APPLICATION EXAMPLES

[12] Degree Compass matches students with courses that best suits their capability. The project was inspired by the recommendation systems developed by Netflix, Amazon and Pandora. Degree Compass uses predictive analytics techniques established on grade and enrolment data and ranks courses in accordance to factors that determine how helpful a particular course might be to the student to advance through the degree program. Tools such as Tableau, Quibble, Qlike and the others can analyze educational data. [13] The Electro Encephalography (EEG) sensors measure brain’s electric activity and determine the attention level. EEGs which are available at much affordable prices can be used to determine the focus level of students of a particular cohort during lectures. The data obtained from these sensors can be fed to Big Data systems for predictive analysis.
[2] Conceptualize a framework that analyses and applies the learning platform and recording data. The learning service platform is added with various learning contents, search paths, recording and feedback data and thus gathers data about individual behavior. The obtained data can be sent for future analysis. [14] Proposes an Education Big Data Open Service model as shown in Figure I. The platform was tried at the Central China Norma University and offers assistance to the keys aspects of education sector namely teachers and students. The model effectively provides solution to the data acquisition problem for staffs and researchers.

Decision time is the most critical aspect of education data which is real time in nature such as daily course attendance, online learning activity, campus behavior and so on. Organizations are keener on obtaining real time data in order to make a more enhanced analysis and derive value from it. Visualization, exploratory, descriptive and predictive analysis with statistics, machine learning, computational linguistics and other techniques aptly enables mining of enormous amount of data sets to arrive at solutions and to further enhance the education sector.

CONCLUSION

The paper depicts the importance of applications of Big Data mining technologies to mine large educational data sets. Various scenarios pertaining to different target users namely students, teachers and educational institutions have been taken into account. Though Big Data has unfolded its wings in various domains in an unprecedented manner, educational institutions are yet to utilize it to the maximum possible extent. Lack of computational capacities, tools and human resources can be attributed to this. Confidentiality and privacy of student data and the need for greater security could also contribute towards the slow pace of education sector in utilizing Big Data technologies. Every aspect of the education sector can be harnessed with suitable data mining technologies to predict and understand the relevant sentiments.

REFERENCES


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