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Big Data in Education

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Abstract Big data refers to the high volume of varied information that our societies produce daily. The education industry has always had the capacity to produce a lot of data, perhaps more than any other industry. The amount of data is so vast that it is even difficult to process it with conventional means. Big data is influencing how decisions are made everywhere, and education is no exception. This paper provides a brief introduction to how big data is used in education.

Keywords big data, education, big data analysis

Introduction

Today, the education sector has changed dramatically by adopting latest innovations. Advances in technology have caused students to be dispersed, classrooms to be virtual, and knowledge to be on the cloud. Technology facilitates an exponential increase in the amount of information collected on students in schools.

Data is generated in huge amount from every sector, be it sports, industry, government, healthcare, banking, social media, or education sector. Over the years, big data and analytics have slowly crept into the education system. Online courses are becoming explicit data platforms. The Massive open online courses (MOOC) are generating large amount of data. This educational data can now be stored, analyzed, and shared. Although skeptics do not see the point of it all, big data in education has become a hot topic.

Education systems produce a huge amount of data about students and schools. This includes data such as registration, attendance, grades, disciplinary records, socioeconomic background, and instruction time. With thousands of students participating in a MOOC, big data will allow universities to find the best students from all over the world. The main goal of big data in the educational sector is to improve student performance. Better students are beneficial to the society, organizations, and business community. Big data be used to determine how each student learns. This can reduce dropout rates for the benefit of the student and the society [1].

Characteristics of Big Data

Big data refers to huge data which cannot be processed by the conventional database system. While most traditional data sources are structured, big data may be structured, semi-structured, or unstructured. BD is often characterized by the five "Vs": volume, velocity, variety, veracity, and value [2] as illustrated in Figure 1 [3].

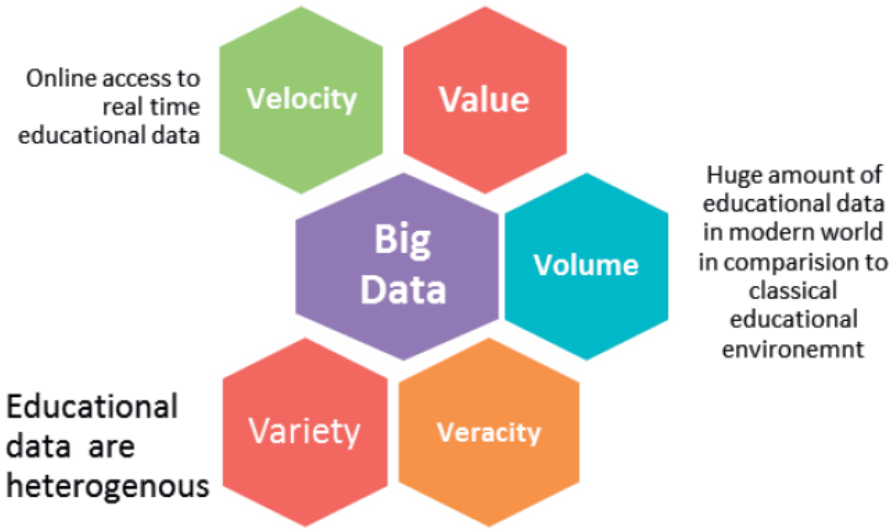

Figure 1: Five V's of big data [3].

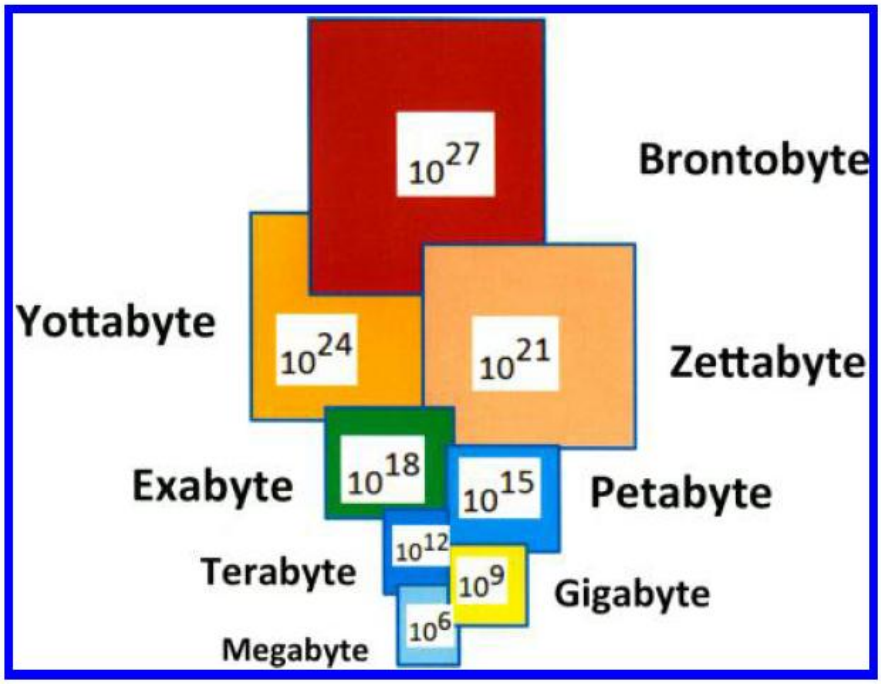

Figure 2: Data units in bytes [4].

- *Volume*: This refers to the size of the data being generated both inside and outside organizations and is increasing annually. Some regard big data as data over one petabyte in volume. The volume of data available today is measured in zettabytes (ZB), which is equal to 1 trillion gigabytes (GB). The units of data in terms of bytes are shown in Figure 2 [4].
- *Velocity*: This depicts the unprecedented speed at which data are generated by Internet users, mobile users, social media, etc. Data are generated and processed in a fast way to extract useful, relevant information. Real-time information makes it possible for an institution to be much more agile than its competitors.
- *Variety*: This refers to the data types since big data may originate from heterogeneous sources and is in different formats (e.g., videos, images, audio, text, logs). BD comprises of structured, semi-structured or unstructured data. Mobile phones, ecommerce, GPS, and social media all generate torrents of data daily.

- *Veracity*: By this, we mean the truthfulness of data, i.e. whether the data comes from a reputable, trustworthy, authentic, and accountable source. It suggests the inconsistency in the quality of different sources of big data. The data may not be 100% correct.
- *Value*: This is the most important aspect of the big data. It is the desired outcome of big data processing. It refers to the process of discovering hidden values from large datasets. It denotes the value derived from the analysis of the existing data. If one cannot extract some business or educational value from the data, there is no use managing and storing it.

On this basis, small data can be regarded as having low volume, low velocity, low variety, low veracity, and low value. Big data analytic techniques are used in analyzing BD. They include data mining, data analytics, learning analytics web dashboards, web mining, machine learning, social network analysis, visualization methods [5].

Applications

The availability of huge amount of data in education system has stimulated the application of big data in education. Big data concept can be applied in a wide range of education aspects such as recruitment, admission, financial planning, student performance, and donor tracking [6].

- *Personalized Learning*: This has become the most notable application of big data in education. Since students have different personalities, they learn differently. Personalized learning customizes one's learning to maximize his/her learning potential. Big data allows for customization at educational institutions. Algorithms make it possible to track and assess each individual student. Designers can personalize courses by adjusting learners' individual needs. Through customized learning programs, students at different levels can work online and by themselves.
- *Prediction of Performance*: The goal of predicting students' performance is to know how well a student will perform on a given learning task. Big data can be used to predict students' performance, particularly for course grade and standardized testing scores. The prediction may help to improve students' retention, assessment outcomes, and satisfaction. The better we understand students through their performance, the better accomplishment they can achieve [7].
- *Admission Trends*: Big data can be used for admission. By developing interest patterns of already admitted students, big data can be used to predict new students. Admission committees are using algorithms that analyze big data to guide the admission decisions. Such admission decisions will be more fair than traditional decision making [8].

Big data tools have the potential to revolutionize education as the applications are endless. They could free both the students and the educators up to do stuff that matters. The ability to handle and analyze massive data is becoming important in an online environment [9]. The ultimate goals of big data application in education are personalized learning and adaptive learning.

Benefits and Challenges

Big data has the potential to transform education at all levels. It is reshaping the way students think and learn. People learn differently and at different rates. Some students are visual learners, while others are hands on. Standardized tests are not the best way to judge students. The main benefit of big data in education is that it individualizes learning and improves teaching and student academic performance.

Data is important for the administration of education systems. Giving students access to data can help them define their learning goals and strategies. It can help their families make informed decisions and support their children. With the help of big data, educational institutions can effectively classify students' responses, results, and performances to use as reference points for evaluating big policy changes. Big data can also exacerbate existing social and educational inequalities.

But the big data era has just began and there are many challenges due to unanswered questions that must be addressed for its use and full adoption to be effective. Some of these challenges are global and external to the education system. Schools and universities would need to change dramatically to benefit from big data. With new technologies introduced into classrooms, teachers have been slow to change the ways they teach and academic institutions are still lagging behind in the adoption of big data. Not all the educationists and

administrators are ready for big data. Parents and privacy advocates are concerned that student information can be placed in unreliable hands and such sensitive information may limit future opportunities for students. We must balance student privacy on the one hand and access to data for learning purposes on the other.
With online courses becoming more and more popular today, competing with famous universities around the world is very tough.

Conclusion

Online learning tools have been used increasingly in education in recent times. This movement has resulted in an explosion of data, which can now be used to improve educational effectiveness. The age of big data will be that of continuous learning. As the data in education system becomes larger, the application of big data tools becomes necessary.
Big data has made a huge impact on the education system. It will inevitably impact education in a big way. It will dictate what we teach and how we teach it. Educators must understand the value of a data-driven approach to education. To remain relevant and competitive, every education organization must embrace big data in their vision and take full advantage of it. The future is bright for the institutions who are willing to embrace big data analytics into their decision-making process. For more information about big data in education, one should consult the books in [10,11].

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