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Big Data and Learning Analytics

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***Abstract*—**This paper gives an overview of big data and its various application areas. One of the application areas in terms of education is Learning Analytic ,which in Horizon Report has been cited as the fast growing field. This Review paper gives an overview and idea of . Learning Analytics, its objectives, types and application areas.

Keywords*-big data,learning analytics,education.*

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I. INTRODUCTION *(BIG DATA)*

Any piece of information can be considered as data. This data can be in various forms and in various sizes. It can vary from small data to very big Data. There are various classification of this data:

- Any data that can reside in RAM or memory is considered as small data. Small data is less than 10s of GBs.
- Any data that can reside in Hard Disk is considered as medium data. Medium data is in the range of 10s to 1000s of GBs.
- Any data which cannot reside in Hard disk or in a single system is considered as Big Data. Its size is more than 1000s of GBs.

Big data name specify that large amount of structure and unstructured data not only in size but also in complexity. Now a days data is growing large ar rapid pace and this large amount of data cannot be handled by the traditional software like Oracle, SQL . This huge data is considered to be in GigaBytes/Terabytes/PetaBytes/ExaBytes..But Big data has various challenges in storing that large amount of data ,in peforming data analyitic, in sharing, transfer and visualization of this data.

A. Characteristics of Big Data

Big data posesses 3v characteristics that are classified as-

- **Variety**: the term variety refers as a different types of the data formats. Data can be structured , unstructured and semistuctured.
- **Velocity :** the term velocity refer as speed of processing of the data. This processing is done through batch, realtime, neartime and streams.
- **Volume:** the term volume refer as a what amount of the data is to be processed . Data may in TeraBytes,ExaBytes etc.
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B. Types of Data in Big Data

Big data is collection of different types of data. The different types can be-

- **Structured data**: Structured data mean data is stored in the forms of rows and columns in tables or organized in such a way that it would be easy for search. Structured data like phone number directories, customers name, transaction information, credit card numbers and home addresses . Big data contains almost 20% of structured data. This data is generated by the humans or machines.
- **Unstructured data**: Unstructured data is not in an organized form. Big data contains almost 80% of the unstructured data in its total data. This kind of data can generated by various resources like social media, emails, photos ,audio, videos, texts, satellites images. This type of data is difficult in searching.
- **Semi structured data**: semi structured data is a not fully organized but with some process it could be in tables form . big data have a 5 to 10% its semi structured data. Xml document is semi structured .[1]

C. Sources of Big Data

There are various sources that generate data in few seconds.

- More than 60 blog and 1500 blog posts are done.
- More than 70 domains are registered.
- More than 600 new videos are uploaded on you tube.
- More than 40 questions asked on yahoo are answered and 100 + questions answered on answers.com
- More than 1300 iPhone applications are downloaded every minute.
- 694445 searches are made on google every minute.
- About 320 accounts are created on Twitter and more than 98000 tweets are made every minute.

D. Stages in Big Data

Big data contain the data as dataset. There are various stages through which this data has to pass to get the desired results. The main goal of big data is provide high level data quality and accessibility for business intelligence and big data analytics. Big data is also helpful for making or launching new techniques.

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Big data has some basic stages : data collection ,data storage, data analysis, data report.

- **Data collection** : Data can be collected from various sources like social websites, databases and datacenters. These all collect a various kind of information that can be structured as well as unstructured data. Hardware has a data that can generated by the hardwares. Networking data is an online generated data. Datacenters collect the data from various sources.
- **Data processing:** It is a process technique that is applied on collected data. There are various techniques depending upon the data that is inputted. E.g. Hadoop ,Mapreduce.
- **Data analytics:** analytic is process of cleaning a collect data with purpose of discovering some useful information. This analytic data is used for making better decision and strategies. Data analytic provide the data mining technique with the goal of predicting useful information from dataset.
- **Data executions:** data execution means perform a action on analytic data. execute the decision or strategies that would be make and provide new services.
- **Data Storage**: Collected data are stored in database using some storage technologies. Like in SQL, NoSql.

The following figure Fig1 shows some stages through which data passes.

Fig 1.big data stages

E. Application Areas of Big Data

- Procurement with Big data

  Demand can be forecasted properly as per different conditions available with Big Data.

- Big data in Product development

  What product to be developed to increase sales

- Big data in manufacturing sector

  Big data can be used to identify machinery and process variations that may be indicators of quality problems.

- Merchandising

  Big Data plays a major role in sales for retail market also.

- Big data in Sales

It helps in increasing sale for the business. It also helps in optimizing assignment of sales resources and accounts, product mix and other operations.

- Store Operations using Big Data

Different tools can be used to monitor store operations which reduce manual work. Big data helps in adjusting inventory levels on the basis of predicted buying patterns, study of demographics, weather, key events, and other factors.

- Big data in Human Resources

Big Data has changed way of recruitment and other HR operations. You can also find out the characteristics and behaviours of successful and effective employees, as well as other employee insights to manage talent better.

- Big data in Banking

Big Data has provided biggest opportunity to companies like Citi bank to see the big picture due to balancing the sensitive nature of the data for delivering value to clients along with prioritizing the privacy and protection of information. It has been fully adopted by many companies to drive business growth and enhance the services they provide to customers.

- Big data in Finance sector

Financial services have widely adopted big data analytics to inform better investment decisions with consistent returns. The big data pendulum for financial services has swung from passing fad to large deployments last year.

- Big data in Telecom

A recent report, "Global Big Data Analytics Market in Telecom Industry 2014-2018," found that use of data analytics tools in telecom sector is expected to grow at a compound annual growth rate of 28.28 percent over the next four years. Mobile Telecom harnesses Big Data with combined actuate and Hadoop solution.

- Big data in retail sector

Retailers harness Big Data to offer consumers personalized shopping experiences. Analyzing how a customer came to make a purchase, or the path to purchase, is 1 way big data tech is making a mark in retail. 66% of retailers have made financial gains in customer relationship management through big data.

- Big data in HealthCare

Big data is used for analyzing data in the electronic medical record (EMR) system with the goal of reducing costs and improving patient care. This Data includes the unstructured

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data from physician notes, pathology reports etc. Big Data and healthcare analytics have the power to predict, prevent & cure diseases.

- Big data in Media and Entertainment

Big data is changing the media and entertainment industry, giving users and viewers a much more personalized and enriched experience. Big data is used for increasing revenues, understanding real-time customer sentiment, increasing marketing effectiveness and ratings and viewership.

- Big Data in tourism

Big data is transforming the global tourism industry. People know more about the world than ever before. People have much more detailed itineraries these days with the help of Big data.

- Big data in Airlines

Big Data and Analytics give wings to the Aviation Industry. An airline now knows where a plane is headed, where a passenger is sitting, and what a passenger is viewing on the IFE or connectivity system.

- Big data in Social Media

Big data is a driving factor behind every marketing decision made by social media companies and it is driving personalization to the extreme.[2]

II. OVERVIEW OF LEARNING ANALYTICS

Learning analytic is the measurement, collection, analysis and reporting of data about learners and their context, for purpose of understanding and optimizing learning and the environment in which it occur[3]. The ***2017 Horizon Report*** *describes* Learning analytics is an educational application of web analytics, a science that is commonly used by businesses to analyze commercial activities, identify spending trends, and predict consumer behavior. Education is embarking on a similar pursuit into data science with the aim of learner profiling, a process of gathering and analyzing large amounts of detail about individual student interactions in online learning activities. The goal is to build better pedagogies, empower students to take an active part in their learning, target at-risk student populations, and assess factors affecting completion and student success. For learners, educators, and researchers, learning analytics is already starting to provide crucial insights into student progress and interaction with online texts, courseware, and learning environments used to deliver instruction. Students are beginning to experience the benefits of learning analytics as they engage with mobile and online platforms that track data to create responsive, personalized learning experiences[4]

." Every time a student interacts with their university – be that going to the library, logging into their virtual learning environment or submitting assessments online – they leave behind a digital footprint. Learning analytics is the process of using this data to improve learning and teaching. It encourage the learner to understand and optimize learning. Learning Analytics is user to improve learner as well as learning. The field of learning analytic means how intelligent data and information are used.

A. Objectives of Learning Analytics

Learning analytic help us to make better decision in future with the following aims.

- Reporting data : summarizing the historical data
- Analyzing trends: identify the historical trends and coordinate
- Predictive analysis: predict future outcome and behavior
- Increase the learning in social environment:
- Predict the new model learning styles: by learn old learning styles analytic what change would required in learning styles and predict new model learning styles.
- Predict the new outcome industry trends: learning analytic find the new industries trend that helps the industry to make trend based products.
- Enhance the learner overall performance
- Improve the student learning status: learning analytics help us to improve the student performance and increased the student learning status.
- Predict the new teaching learning methods: learning analytic helps to the find out new teaching method that make the education system more better[5]

C. *Advantages of Learning Analytics*

- As a tool for quality Assurance and quality improvement.
- As a tool for boosting retention rates.
- As a tool for assessing and acting upon differential outcomes among student population .\
- As an enabler for the development and introduction of Adaptive learning.

D. Uses and Impact of Learning Analytics

- Improving the Quality of Teaching-

Analytics have been used to improve teaching. The value of dashboards for enhancing teaching or future course provision is also highlighted by the studies. At the University of Wollongong, Australia, social network analysis revealed interaction patterns that arise in forums that are too facilitator-centric. At the University of Maryland, it was found that innovations which led to improvements in student performance on one course appeared to lead them to also perform better in subsequent courses. Meanwhile learning analytics can furnish teaching staff with better information on the quality of the educational content and activities they are providing, and on their teaching and assessment processes, to enable its continual enhancement

- Boosting Retention-

Analytics can easily find struggling students earlier. A better understanding of data about learners and their learning can help universities to tackle high attrition rates, which result in adverse impacts on the lives of those affected, and wasted

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expense for the institutions. At Purdue University in the United States, for example, problems are identified as early as the second week in the semester, something which simply was not possible before. Student data analytics can be used to be predict which students will not progress to the next academic year. At New York Institute of Technology (NYIT), approximately three out of every four students who do not return to their studies the following year had been predicted as at risk by the model[7]

- Enabling students to take control of their own learning

Analytics can provide with the opportunity to take control of their own learning, giving them better idea of their current performance in real time and help them to make informed choices about what to study. Giving students better information on how they are progressing and what they need to do to meet their educational goals is another important application for learning analytics. Meanwhile some universities are providing analytics- based systems to help students to select future modules, building on data about their career choices, aptitudes and grades for previous modules to provide optimum pathways through their studies. 89% of students in one survey at Purdue considered Signals a positive experience, while74% said their motivation was increased by using it. At Nottingham Trent some learners report that seeing their own engagement is a positive spur to stay engaged. Indeed, NTU have reported that the provision of learning analytics is now expected by students.[9]

E. Types of Learning Analytics

- **Academic analysis:**
  Academic analytics provide structured and intelligence data for researchers. This structured data help us to administrators and institutions to make the better decisions. Academic analytics is a process of analysis the university academic data for further use. Academic analytics provide the benefits to university administrators, funders, national governments and education authorities. Because using academic analytics these all improve the businesss marketing or profits. This is new technique that provide the efficient way to improve the student success ratio. Academic analytic has some basic analytics points capture, report, predict and act
  - Captured the data from various resources.
  - After captured stored this data and report the current status of data and indentify the pattern of the data.
  - From this report predict the new strategies or decisions.
  - Act means perform the action on prediction that would be made.

- **Networking learning analytics:**
  Network learning is process make connection between peoples and information. Network analytics help us business to understand the network for better dicisions . It also provide the information to business about the latest trend and patterns.
  Network analytic control optimization: Control the network congestion, improve network management and utilizations.
  Network service assurance : help us to determine the customer experience about product and analysis what companies take the step to improve these experience .Network capacity planning and deployment: plan the new strategies .

- **Technology enhanced learning analytics:**
  Use of technology increase the student leaning experience . technology may enhanced by using new e-learning techniques . technology enhanced means increase the technology use in teaching and student learning. Technology make better student classroom learning.[6]

- **Mobile learning:**
  Mobile learning is known as m-learning. M-learning is learning technique that supports the mobiles, computer ,laptops . Many apps are be provided that help us for learning. m-learning also very helpful in education system.
  - Many education related apps are introduced that help the student for easy learning.
  - Through m-learning apps student and teachers to interact with each other online and complete the assignments.
  - Engages the students by conducting the online quizs.
  - M-learning possible to communicate from long distance.
  - M-learning also helpful for teachers to interact with students.
  - m-learning helpful form a business aspects. many business related apps are available like banking.

- **Blended learning analytics:**
  Blended learning is a hybrid learning. Blending learning comes in different patterns or different resources. Blending learning very flexible for the student, student can choose the course material according to our convience. Student can take the traditional classroom learning or conduct online learning. through a blended learning. students learning level is enhanced. By this student has a choice to select the course material which is the best online or classroom face to face discussions.

III. CONCLUSION

Learning analytics has the potential to transform the way we measure impact and outcomes in learning environments – enabling providers to develop new ways of achieving excellence in teaching and learning, and providing students with new information to make the best choices about their education.

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Learning analytics is still at a relatively early stage of development, but the processes for developing its use, and ensuring the authenticity and validity of the findings, are developing rapidly. Although not yet well understood yet across the sector, there is convincing evidence that learning analytics will help to develop more student-focused provision of higher education, and provide data and tools that institutions will be able to use for continuous improvement.

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