

Application Areas of Big Data

Hitisha Damani¹, Rajavi Mehta² and Prof. Mitchell D'Silva³

¹²³Dwarkadas J. Sanghvi College of Engineering

¹hvrdamani.hd@gmail.com, ²rajavimehta812@gmail.com, ³mitchell.dsilva@djsce.ac.in

ABSTRACT

Big data is a huge collection of data that is collected from different sources and integrated together. Apart from the IT sector, Big data usage is coming up in sectors like education, manufacturing, public sector and media and entertainment sector. Big data analysis is very useful for such sectors mainly because it helps them to understand the actual market as the data is directly available from the actual users. Like any other technology, big data technologies too have their own pros and cons where the main disadvantage is the security of the data and its availability amongst others but the main advantages would be the accuracy of the analysis, speed for analysis, ability to use the these technologies by a non-programmer and visual representation of the result. So, we have mentioned the growth of big data in these sectors and some basic technological requirements for each of the sectors. Also, we have compared and suggested certain technologies that could be used in these sectors.

Keywords: Big data, Education sector, Manufacturing sector, Media and Entertainment sector, public sector, big data technologies

1. Introduction

Big data involves a huge amount of data that is collected as frequently as every day. This data is used to study and understand the recurring organizational patterns which can be analysed and use it to benefit the organization. Earlier this technology was used only by the IT sector, but now due to the awareness of its benefits and ease of use and precise results, sectors like education, government, manufacturing and media and entertainment industry have also started to use it for their own respective purposes. Big data has evolved over the past few years in all these sectors and is continuing to do so. Big data has managed to make education more relative for the students, manufacturing more profitable to the companies, outcome of the innovations in entertainment more predictable for the companies and government issues more petty. Thus, it is very important to gain a deep understanding of how big data analysis affects these sectors.

2. Big Data in Education

Big data analysis has been seeping into the field of education. Big data has made it possible for the education sector to improve itself in certain parts that were previously difficult to interpret and analyze. Big data was first used in the field of education in the 1990s. At that time, the primary purpose was to focus on inputs which include factors like admissions, revenue, expenditures, and capacity of the institution. Later, in the early 2000s there was a shift in the focus of the institutions and they started applying big data technologies to find more sophisticated outcomes like keeping track of re-enrolling, academic performance, and information related to their finances to understand student's retention, progress and graduation outcomes. As the technology has progressed and the needs have changed, big data is now used to find different satisfactory outcomes in the field of education. Big Data is concerned with providing detailed insights into student's success, designing curriculum, recommendation of shortest and most successful path to degree attainment and triggering innovations to keep the students focussed about their studies all the time.[1].

The major opportunities that big data provides in education are as follows

1. Enhanced student performance:-

Throughout the student's life, a student produces a large data trail. When this data trail is analyzed, a lot of information about the student can be understood in a greater depth. It enables to find out things like whether the student is interested in a particular subject or not, what sort of questions is he uncomfortable with, his comfort zones, his weaknesses, his strengths and many more which makes the student who he is. By analyzing the factors like a student's behavior in class, focus on the topic, ability to answer, participation, etc. the management can take steps to improve the quality of education provided by the institution and the students' performance will consecutively improve.

2. Credible Grading:-

After every exam, quiz or class test, the students wait for the results. The teachers have to meet deadlines and have to grade each student while being fair to them. This is a huge task and sometimes problems like poorly marked tests, missing marks or delayed results are observed. This is a place where big data mining can really help. Colleges and universities have a credible, reliable system based on big data analysis, to grade all the papers and also swiftly release results, making things easier for everyone.

3. Holistic development

Extra-curricular activities are an important part of overall student development. Government agencies, parents and other stakeholders have put constant efforts to highlight the importance of extra-curricular activities. Big data provides a novel approach for the educational institutions to keep a track of performance across several disciplines both at an individual and collective level. These records help the institutions to help the students overcome their weak areas and thus, enhance their overall development [2].

4. Customize Coursework

Colleges and universities enroll lakhs of students each year. These students have to enroll themselves for the various courses. Customized programs can be created for each of these students. This is possible using a technique called 'blended learning'. Blend Learning is

defined as a combination of online and offline learning which helps students to opt for classes that they are interested in and also can work as they prefer to do, while still having the offline guidance of the professors. For example, when the Machine Learning class at Stanford University was taught by Andrew Ng, only 400 students participated. However, when the same course was delivered as a MOOC, it attracted 100,000 students [3].

5. Reduce Dropouts

A research study conducted in the United States on dropouts, reveals:-

- Every 29 seconds an American high school student gives up on school, amounting to more than 1 million American high school dropouts every year
- Nearly one-third of all public high school students—and nearly one-half of all African-Americans, Hispanics and Native Americans—fail to graduate from public high school with their class. [5]

Big data analysis can reduce the number of students that drop out from a particular college each year. Universities can analyze which courses a student has higher chances of failing in. They can suggest alternative measures to these students or help them improve their records. Also, they can analyze whether a particular course is useful from the corporate prospective or not. This would help the future students also in choosing the right courses [3].

6. Enhance Parent Intervention

By analyzing the students' data, institutions can point out excellence a child in an area and also pick out the deficient ones where more efforts are required to help a child excel in others. Using this information, parents will get a clear view of their child's performance.

7. Different advancement pathways for gifted students

Since the dawn of time, education has been determined by age. The fact whether a student is capable of learning challenging material or not was never considered. Big data helps to identify god-gifted students who are ready to move to an advanced level, without consideration of their age. This can also be integrated to judging if a student is not suitable to go to the next level for every subject he studies [4].

Currently, data is analyzed for the above purposes by collecting it over the cloud, analyzing it using Hadoop and using clustering methods like Basic Statistical Procedures, Visualization, Classifiers, Cluster Analysis, and Association Rule mining. [6]

Although, big data has revolutionized the education industry, the ultimate target has not yet been achieved. There are still a number of hurdles in the path to the zenith. These challenges can be broadly classified as follows [7]:

1. New Laws Helping With Student Privacy

Federal laws of most of the countries across the globe have started to give preference to consider the protection of the privacy of the students. These laws make the availability of data very difficult as most students are not ready to share their data due to the threats like misuse of data. The institutions must also keep a check of who is using the available data and for what purpose. Also, threats to the stored data like cyber-attacks and hacking are not novel.

2. Proper Ways to Collect Data

Another major challenge is the collection of appropriate data. Before the start of any process, the universities must decide what data is most required and how they will collect that data from the students while assuring them the safety of the process and also answering to all their queries to utmost level of satisfaction.

3. Use of Data

Next step is defining the purpose of data. The institution must first decide which aspects of big data in the education sector they are willing to cover through the collected information. They must be specific on whether they are willing to help themselves, parents or the students with the application that they will develop. Also, the idea must be conveyed to their students since they are the one's providing the data.

4. Data protection

The institutions must be ready to invest as much as they can in order to secure the data that they have collected as well as analyzed in order to gain the faith of the users in their application and the safety of it. Securing the data against all the threats is the major challenge faced by the institution.

5. Sharing your data

Sharing the analyzed data directly with the parents can help them in selecting the best approach to satisfy their children's learning needs. Also, sharing it with school staff and teachers can help to refine the curriculum.

3. Big Data In Manufacturing

In the past 20 years, manufacturers have been able to dramatically improve product quality, yield and reduce waste and variability in their production processes [8]. The backbone of today's economic sector is the manufacturing industry. Manufacturing has to constantly involve itself with the significant task of deciding on how it can achieve better productivity. The increasing competition and fluctuating global market makes it very difficult for the manufacturing firms to do so. Big Data analysis helps the manufacturing firms to do so with greater success and at more ease. Big data provides an infrastructure for transparency in manufacturing industry, which is the ability to unravel uncertainties such as inconsistent component performance and availability [9]. Manufacturing area stored close to 2 exabytes of new data in 2010 [10]. This sector generates data from a multitude of sources i.e. from instrumented production machinery (process control), supply chain management systems and systems that monitor the performance of products that have already been sold (e.g., during a single cross-country flight, a Boeing 737 generates 240 terabytes of data). And the amount of data generated will continue to grow exponentially.[10]

No technology is every used unless it is really beneficial to the enterprise. Several benefits achieved by the inclusion of big data technologies in manufacturing are as follows [11]:

1. Improving Manufacturing Processes

Using big data the companies can identify the flaws in the manufacturing processes. In case a particular area is always the cause of the faults or the delays in production, then special

attention for improvement can be given to that area. Recent example of such a activity is the McKinsey and Company use case. Using big data analytics the company assessed process interdependencies and identified nine parameters that had a direct impact on vaccine yield. By modifying target processes the company was able to increase vaccine production by 50 percent resulting in savings between \$5 and \$10 million annually.[11]

2. Customized Design

Most firms prefer manufacturing the product as per the incoming demand. Using big data analysis, these companies can presume beforehand the quantity of the product they must manufacture for a particular time period. For instance, Tata Consultancy Services cites the case of a \$2 billion company that generates most of its revenue by manufacturing products to order. Using big data analytics this company was able to analyze the behavior of repeat customers [11].

3. Quality Assurance

Any product that a company manufactures can be sold only if the quality ensures customer satisfaction. Big data helps in achieving this. Eg. Intel has been harnessing big data for its processor manufacturing for some time. The chipmaker has to test every chip that comes off its production line. Using big data for predictive analytics Intel was able to significantly reduce the number of tests required for quality assurance.[11]

4. Supply Chain Risk

Using big data analytics, the company has managed to identify the potential delays that may occur on a map and analyze weather statistics for calamities like tornadoes, earthquakes, hurricanes, etc. The company uses this predictive analytics to identify backup suppliers and develop contingency plans to ensure that interruption in production due to natural disaster is as less as possible.

To achieve the above mentioned benefits, Big Data analytics offer several tools for manufacturers:

1. Data Storage

Big data for manufacturing requires a large amount of data. All data related to processes, supply chains and clients is required. Hence, a large space required to store them is needed.

2. Data cleansing

Data is collected from various sources so it in varied formats. It can be structured, semi-structured or unstructured. Therefore, to make this data readable and understandable, it needs to be cleaned. The integrity and quality should not be harmed during the conversion. Hence, we need specialised tools to perform proper cleaning and this can be done with the help of the big data analytics tools.

3. Profiling of data

Tools for profiling capture information up to its metadata, enabling manufacturers to create a comprehensive inventory of their critical data so that they can use it in the most of the effective way possible.

4. Data Mining

Data Mining tools enable manufacturers to quickly identify and access the information they need to make further decisions in production and supply chain.

5. Analysis

Data Analysis tools enable manufacturers to identify patterns, measure the impact of those patterns and make better outcomes possible. Data analysis can help manufactures predict the future of the product and firm beforehand. By breaking down equipment, production, and supply chain data, analysis tools help manufacturers achieve better outcomes through better decision-making.

6. Data Visualization

Manufacturing, being a non-technological sector in terms of using computers etc, has few people that can study this data. It is easier to read them when given a visual aspect to it. Therefore, this data is converted from SQL databases into more readable form, i.e., graphs and histograms etc to make it easily readable. These pictorial representation makes it easy for the manufacturers to generate insights and take decisions based on the data that was collected.

These big data tools enable the manufacturing companies to make the maximum of their investments, production, and supply chain and raise their production and efficiency by huge margins[12].

Everything that has benefits has certain challenge to face. Some of the challenges faced in the manufacturing sector are as follows.

1. Adoption of new technologies

Adoption of new technologies is relatively more difficult in manufacturing industries as compared to other industries. This is because much of the industry's functioning is process-driven and involves a great deal of human intervention. Also, manufacturers cannot afford frequent breaks due to the downtime resulting from installations and maintenance of the software. Thus, making it difficult.

2. Supply chain visibility

The supply chain is as important to the manufacturing sector as the assembly line. Big data can really help in managing it. However, to get full visibility of SCM is not an easy task.

3. Timely delivery necessary

A manufacturer may have a better product than its competitor, but if it doesn't reach the target customers in time, then even the best product is bound to failure. That means manufacturers have a very short time-span within which to launch their products, else risk losing out to competitors. There is also the risk of the product being rendered redundant or even obsolete. Thus, the analysis has to be faster and accurate.

4. Market Volatility

In a highly competitive market, it is necessary that marketers live up to their customers' expectations as well as raise the quality bar for the competition. To do this big data analysis requires time and patience. However, market volatility greatly influences the product performance, thus hindering the analysis of large amount of data for accurate results [13].

4. Big Data In Media And Entertainment

The media and entertainment industry is in rising in itself today. It is one of the industries where data is generated on a humongous scale on a day to day basis. Huge amount of data, when collected on everyday basis is very beneficial to study the most recent trends. This can be done by using Big Data and its tools. It enables them to drive digital transformation and the exploitation of the available data as well as new sources of data from both inside and outside of the organization.

The various ways in which Big Data helps in the media and entertainment industry are:

1. Predicts Audience Interests:

In these times when one has a plethora of choices in the media content and mode, it is necessary to understand the choice of people and that is possible due to the large collection of data on an everyday basis.

2. Insights into customer churn[14]

Now-a-days people share a lot of content regarding the media they choose to view which helps the media company owner to understand his users better. In earlier times it was not possible to combine this data and hence it was not easy for the companies to understand their customers. But now due to data analysis, this data can be studied easily and can help in the expanding of the industry in profitable areas.

3. Content Monetization[14]

Big data helps the companies to find out and suggest ways to increase their income by tapping the consumer's behavior revealing new opportunities for the company to increase the subscribers and therefore, gain profits.

4. Effective Ad Targeting[14]

Advertisements are one of the main sources of revenue for the channel owners. Big data helps the owner understand his viewers and their choice of watching a particular show or genre, the appropriate audience (late night shows for adults, evening time shows for family kind of shows, etc.) and then air the advertisements accordingly so they can grab that particular audience's attention and help increase the sale of the product. The popularity of a TV show also determines the ad that would be aired and in which segment.

5. Increasing Acquisition and Retention[15]

The user can subscribe a channel if he finds its content interesting or he might unsubscribe a channel due to his own reasons. Big data helps in understanding the reasons why the users unsubscribe or subscribe the channels and then formulate attractive schemes and strategies to retain their users.

Since big data involves every user's data, his personal information or information he would not want to share with anyone, it has a few disadvantages to it, in this sector:

1. Increased consumer awareness[16]

Social media usage has gone up drastically in today's times. Every other person uses some or the other form of social media. And even though it helps the media companies to increase their viewership, this same social media makes the user more aware of the consequences of actions such as sharing personal information online or through some online applications which in turn develops a sense of insecurity amongst the users.

2. Security[17]

Just like other technological endeavors, big data is also prone to data breach due to the leakage of data to the third parties who might misuse this data for their own beneficiary.

3. Insufficient access to finance[16]

It is easier for the media startups to come up, but difficult for them to employ such services that helps them to expand because startup companies do not have access to a huge amount of money like the already established companies have. They need to have contacts that would be interested to fund them as starting a new business is not easy for everyone when money available is low. There are risks associated with the money, the market, the product and the competition with other companies.

4. Transferability[15]

Transferring of data from one place to another has to be done so that it can be used by the appointed people to study it. All the data that is collected from various sources would be stored in a secured place like a private cloud. This data needs to reach the data analytics team and that too without errors so that no wrong conclusions are made. There cannot be any data loss or erroneous data(missing content). To perform this transfer, someone with the necessary technical knowledge is required so that the transfer is smooth and there is no erroneous data or data leakage.

5. Big Data In The Public Sector

The government is coming up with new applications for the smallest of jobs and making it easier for the common man to reach to them through these applications. They have also come up with newer and better ways for administration such as cameras for traffic control, online document submissions, online ticket bookings, etc.

These are some of the applications of using big data in the government sector:

1. Crime prediction and prevention[18]

By using real-time analytics, the police department can study and understand the criminal's behavior from past records and study his actions by identifying the crime and location patterns and predict his future crimes and hence, be alerted beforehand. By these means there are higher chances of arresting the criminals than mere guesswork from unreliable data.

2. Weather forecasting[18]

Weather-caused disasters can be reduced if they are predicted early. Such prediction can be possible if we have large amount of data from different perspectives, i.e. from the land, sea, and from space. Such kind of data collection is possible through sensors placed in these regions and data is collected on a very high scale every day. Hence, weather prediction can be done through data analytics.

3. Reduction of tax fraud[19]

The tax collection process is a very tedious process as the tax has to be collected from every eligible citizen from the country based on their incomes and transactions. In this large country, many mistakes can occur for small transactions which may sum up to a large

amount of money. Therefore, we can have algorithms processing data and checking such erroneous transactions and correct them to avoid tax frauds.

4. Traffic optimization[18]

Traffic management is a serious problem in highly populated cities. Therefore, it needs to be controlled efficiently. This can only be done when one gets real updates of the movement of traffic and is able to guide the traffic effectively to avoid a chaos. The real-time updates can be received from road sensors, GPS, and video cameras.

5. Improved transparency and decision-making while reducing costs[19]

In the public sector, when complete data about a citizen is provided, this data can be made available to other departments of the public sector, hence, decreasing the costs of collecting the same data time and again. This data when made available to the public is called transparency. This allows the citizens to know how the data is used and where it used. Therefore, there is transparency is necessary between the government and the citizens to gain the trust of each other.

Every solution to a problem has its own pros and cons. Big data in the government sector has it too:

1. Privacy[20]

The sharing of personal data in all the government departments involves a chance of data leak through some source from within the departments thereby breaching the privacy of people.

2. Security[20]

The storing and sharing of data with other departments can be done by technically sound people to avoid any leakage of data. Also, data when stored, should be secured enough so that it is not accessible by any unauthorized third party.

3. Discrimination[20]

Even though the systems are automated, and do not have any human intervention involved, there are chances that the algorithms may have some loopholes and therefore may result in biased and unfair outcomes. These outcomes have a high chance of being overlooked by the analysts and hence, give biased results unknowingly thus leading to discrimination.

4. Digital bias and marginalization[20]

The information that is collected on such a big scale on an everyday basis, is controlled by very few technological companies and data brokers. This data set is very valuable and is only available to few people. There are options to pay and use these data sets but very few people get this opportunity as these companies decide who can access them. Therefore, the small startups face bias as they do not have access to such valuable data that is easy for the already large company by virtue of their position in the market.

6. Technologies And Platforms

There are certain technical requirements that must be achieved before we can define what platform one must use for this sector. Since the motive is to reduce the number of drawbacks and increase the amount of important information generated, it would be apt to use a technological platform that covers maximum technical requirements. Few of the most popular and easily available platforms like IBM, Oracle, BigData Analysis, MongoDB, SAP BigData Analysis, Opera and Google BigQuery are being considered for comparison.

Education:

The following are the technical requirements for this sector:

1. Use only concise amount of data.
2. Protection against data theft.
3. Security against unauthorized users.
4. Real time Analysis.
5. Easily scalable.
6. Availability of analysed data to correct end users.

After researching the features of the above mentioned platforms, we derive that IBM gives a real time analysis and is easily scalable. It also stores less amount of data and analyses more. Oracle BigData is one of those platforms which are most efficient in the security aspects of it. It can give a real time output and has a large scalability. MongoDB has an advantage that it can include new data in the existing dataset with a less downtime. Another best method to implement analysis in education sector is using Google BigQuery. Google BigQuery has a scalability of TeraBytes to PetaBytes. Its features include global availability of data and real time analysis. There is no infrastructure hence it is a cheap method also.

Thus, we can say that Oracle BigData and Google BigQuery are the best platforms to use for education sector as they cover most of the issues.

Manufacturing:

The following are the technical requirements for this sector:

1. Integration and management of critical data.
2. Installation of platform should be cheap.
3. Faster Analysis.
4. Accuracy must be achieved for small dataset also.
5. Output must be in non-technical terms.
6. Customization of huge datasets.

IBM does most justice in satisfying the above requirements. It supports real time predictive analysis, faster decision making, low cost and scalability to large extent. Opera Solution is one step ahead of IBM. It solves scalability challenges, supports higher throughput, reuses existing components so as to make installation of the software faster and easier and make using big data analytics easier for manufacturing industry. Since output is given faster, companies do not have to worry about delay in manufacturing or introducing the product in the market after competitors. For the same reason, even Google BigQuery can satisfy the requirements of manufacturing industries. Thus, IBM, Opera and Google BigQuery are

optimised solutions that meet the above challenges and enhance decision making in manufacturing industry.

Media And Entertainment:

Some technological requirements for the media and entertainment industry would be:

1. To analyse unstructured data according to sentiments, topics and other tangible aspects to get a understanding of the data
2. Enable powerful querying for non-programmers so that they can still use the technology without having to understand the working of it
3. Programmatically interrogate data for trends so that no trends can be missed
4. Connect data from all customer interactions to form a 360 degree view.

According to the above technological requirements, Oracle Bigdata Analytics is considerable as it can work with all data types and it can even integrate new data with existing data. Another technology that can be used for the media and entertainment sector could be Arcadia data as it does not require any coding skills so no professional coder is required. It also analyses real streaming telematics data visually alongside the historical data for deeper pattern analysis. It also helps to connect data from all customer interactions to get an overview of the whole data.

Public Sector:

Like every sector, even public sector has its own technological requirements. Some of them are as follows:

1. Data security and Privacy of data so there is no misuse of data
2. Predictive analysis to predict the outcomes of a situation based on previously collected data
3. Identifying patterns and similarities for detection of similar occurrences which would make prediction easier
4. Real time data transmission
5. Natural language analytics which would help in sentiment analysis

After considering these basic technological requirements for the public sector, there are a few technologies that serve one or the other requirements. For eg., the security aspect is covered by IBM Bigdata Analytics whereas the predictive analysis measure is served by SAP Bigdata analytics and IBM Bigdata Analytics. The identification of patterns and similarities can be done by Opera Solutions Bigdata, and it can also address the natural language analytics requirement. IBM Bigdata and Oracle bigdata Analytics can perform real time data transmission. Looking at the above research we can say that IBM Bigdata Analytics can be used for Big data in Public sector as it addresses more than half of the requirements. also , it is cost effective and scalable too and data is secured.

7. Conclusion

Using Big Data Analytics has both its pros and cons. Big Data has managed to establish a platform in education, manufacturing, entertainment and has also gone as far as in the government sector. It astounds us that just about a short period of 20 years' big data has developed to such a great extent that it has become a way of life. Platforms like IBM, Oracle, BigData Analysis, MongoDB, SAP BigData Analysis, Opera and Google BigQuery have helped develop the rise of Big Data in the various industries outside technical sector. When these technologies are used in the right manner, they can enhance the output and change the perception of these industries about adopting big data analytics. When problems are solved, the advantages outgrow the difficulties and make things possible. So far, things have continued in the required manner and progress has been noted and success has been achieved. However, there is still much more to achieve before the industry can be done with the growing phase of big data. Issues like proper ways for data collection, protection, storage, manual analysis, security, and discrimination are yet to be solved. Unless, these are done, we cannot say that big data analysis is the optimal solution to all the problems. Thus, we can say that in near future, big data analysis will be the mother technology after it has dealt with all its problems.

8. References

1. <https://evollution.com/technology/metrics/the-past-present-and-future-of-big-data-in-higher-ed>
2. <https://anadea.info/blog/big-data-in-education>
3. <https://www.allerin.com/blog/4-ways-big-data-is-transforming-the-education-sector>
4. <https://www.indiatoday.in/education-today/featurephilia/story/big-data-in-school-education-964809-2017-03-09>
5. <https://bridgei2i.com/big-data-brings-big-changes-in-education-sector/>
6. <https://waset.org/publications/10001396/applications-of-big-data-in-education>
7. <https://www.jaroop.com/education-big-data-challenges-face/>
8. <https://www.mckinsey.com/business-functions/operations/our-insights/how-big-data-can-improve-manufacturing>
9. https://en.wikipedia.org/wiki/Big_data#Manufacturing
10. http://www.dbjournal.ro/archive/13/13_2.pdf
11. <http://www.ingrammicroadvisor.com/data-center/4-big-data-use-cases-in-the-manufacturing-industry>
12. <https://www.liaison.com/blog/2017/09/20/big-data-analytics-tools-manufacturing-industry/>
13. <https://www.msocosmos.com/challenges-of-the-manufacturing-industry-big-data-analytics/>
14. <https://www.analyticsindiamag.com/5-ways-big-data-plays-major-role-media-entertainment-industry/>
15. <https://www.dexlabanalytics.com/blog/the-role-of-big-data-analytics-in-the-world-of-media-and-entertainment>
16. https://link.springer.com/chapter/10.1007/978-3-319-21569-3_14#Sec4
17. <https://www.ciklum.com/blog/limitations-of-big-data-analytics>
18. https://www.edureka.co/blog/big-data-applications-revolutionizing-various-domains/#Big_Data_in_Media
19. <https://intellipaat.com/blog/7-big-data-examples-application-of-big-data-in-real-life/>
20. <https://dataflok.com/read/4-benefits-public-sector-governments-start-big-dat/171>

21. <https://cis-india.org/internet-governance/blog/benefits-and-harms-of-big-data>
22. <https://blog.equinix.com/blog/2018/08/02/the-future-of-media-and-entertainment-is-big-data/>
23. <https://www.infosys.com/data-analytics/verticals/Pages/life-sciences.aspx>
24. <https://www.predictiveanalyticstoday.com>