IOSR Journal of Computer Engineering (IOSR-JCE)
e-ISSN: 2278-0661,p-ISSN: 2278-8727
PP 45-47
www.iosrjournals.org

Big Data in Visual Analytics

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Abstract: *Big Data explores in Visual analytics to seek and provide more effective ways to understand and analyze large datasets, and also enable them to act immediately. Visual analytics integrates the analytic capabilities of the computer and the abilities of the human analyst, allowing novel discoveries and empowering individuals to take control of the analytical process. Visual analytics enables unexpected and hidden insights, which may lead to beneficial and profitable innovation. In the visual analysis process, It can be done by automated analysis and interactive visual methods. It deals with massive data, the use of automated methods is mandatory -and for some problems it may be sufficient to only use fully automated analysis methods. The challenges of visual analytics various techniques and limitations*

Keywords: *Big Data, Data sets, Interactive Visual Methods, Sense making, Visual Analytics*

I. Introduction

The data is made accessible and often produced with today's technology, but it is very challenging to capture, store and use it productively from both a technological and human perspective. On the Gartner hype cycle, which represents the hype versus maturity of new technologies, big data is at the very top, called the "peak of inflated expectations", and on the verge of falling down into the "trough of disillusionment", as it is being adapted without the necessary expertise or considerations to the many challenges it brings with it. Sense making is one of the big challenges. Many methods are used to attempt to draw insight from the large and complex data. These methods include advanced data mining algorithms, data visualizations, and statistical analysis. But our capacity to collect and store data is out growing the capacity to analyze it . This paper examines visual analytics as a method for sense making of big data. This is the practice of visualizing data in such a way that interesting relationships can be discovered. This paper reviews literature dealing with the human challenges arising at the intersection of the two fields, big data and visual analytics. As such it takes the "human perspective" on big data and visual analytics, and does not emphasize the many technological challenges. The goal of this paper is to identify how human barriers to sense making of big data can be breached with visual analytics. Can visual analytics improve our capacity to analyze big data, and thereby help create understanding about it.

II. Method

This paper is a review article. The findings are based on reviewing a subset of the literature touching on the two topics of big data and visual analytics. Relevant literature was found through the database Scopus, which helped to get an overview and understanding of big data, visual analytics and the intersection of the two. Other media, such as blogs, business whitepapers (IBM, Tableau, SAS, Accenture), and the social media site reddit.com (from the big data, data is beautiful, visualization, and data science sub reddits) was used in the early stage of research to get a basic understanding of the topics. The method of research contributed to items with both "Visual Analytics" and "Big Data" reveals 29 items. The meta-analysis refined the focus of this paper, angling it towards visual analytics. The impression from the literature is that it is an important method for sense making of big data. The shape and focus of this paper. The method can be loosely defined as Review of big data on blogs, social and other media for a basic understanding and overview of the topic. Meta-analysis of the search term "Big Data" in the Scopus database and Google trends. Further searches and search refinement based on the results of the meta-analysis. Reviewing the found literature. This composes the bulk of this paper.

III. Big Data

Data has always been an asset, for uncovering relationships or driving decisions. As such, several methods for making sense of data exist already. So in order to understand why sense making of big data is challenging it is important to understand what makes big data different from "small" data, and why it is seen as potentially valuable. The Gartner definition of big data helps explain the term, but it doesn't convey the sense of scale and impact that big data potentially has. Even though a recent trend, big data has ramifications for government, business, and both "soft" and "hard" sciences. It has emerged as a natural consequence from the simple fact that there is a whole lot more data available today than ever before and increases with technological

advancements. However, it is the author's impression that this view, which is more sensationalistic, is more popular on popular and social media than the scientific literature.

3.1 The use of big data

There exists no set manual for how to use big data, and it is given from the many fields that have an interest or potential value in using big data that this will vary greatly. What follows are some examples of big data in practice.

- Predicting flu trends. Google uses collected search data to predict flu trends around the world .
- Government surveillance, by agencies such as NSA constitutes big data, where the data is used to predict citizen behavior and thereby prevent crime .

From these and other examples it is the author's impression that the use of big data could be crudely split into two groups: Targeted use of data to inform decisions, where the data is collected and analysed to find the answer to a specific problem, and exploratory use, where data is collected and explored with the hope that it will yield something interesting or of value.

IV. Big Data Analytics

As an observation from the literature, big data analytics and big data are intertwined. The problems are extensively covered in the literature, often alongside potential solutions. These are often technical in nature, but not all. Some are inherent sense making problems requiring consideration for any platform dealing with big data. The goal for any such platform is to enable sense making, and thereby extract valuable insights from the data.

4.1 Datafication

Transforming the original data into a useful format for analysis is necessary. This is the process of datafication, and is divided into three: dematerialization, liquidity and density. Summarized, this is our ability to separate the information from the physical world or an asset (dematerialization), so it can be manipulated and moved around (liquidity), and then recombined for another context (density). From the big data value chain perspective, these three come into play in data collection and integration (dematerialization), then in analysis (liquidity and density), and decision-making (density). This explains what happens to the data in each step of the sense making process.

4.2 Types of Analytics

Big data is multidisciplinary, and is used in several contexts. Manufacturing, retail, healthcare, government, insurance, telecom and energy industries are some examples reaping benefits from big data (SAS, 2012), and these require different and often several, types of analytics in order to extract the desired knowledge from data. Statistical analysis, data mining, machine learning and visual analytics all have advantages and disadvantages for sense making of data. Depending on how they are used, in terms of descriptive, estimative, predictive and prescriptive analysis they can lead to very different decisions. This is important to keep in mind as this paper only covers visual analytics.

4.3 Enabling users

A similar concern is expressed frequently in the literature, often in relation to another problem, namely the required expertise to deal with big data analytics. Data scientists and data analysts today rely on deep knowledge of computer science, programming and statistics for sense making of data . Not only is this skill set in short supply, but can also come at a cost in domain understanding. Domain understanding can also be called "specialist knowledge. It is crucial that analysts have a deep understanding of what they are analyzing, and not just the technical proficiency required to perform the analysis as their expertise.

V. Visual Analytics

Visual Analytic stems from the field of information visualization. An accepted definition is that visual analytics is "the science of analytical reasoning facilitated by interactive visual interfaces" It is a tool that enables sense making of information. Other attempts to define visual analytics typically expand on the aforementioned definition, pointing out that visual analytics combines automated techniques along with the interactive visualizations As such visual analytics is an interdisciplinary field, much like big data, and it draws from multiple analytical techniques, as well as interaction design, and cognitive and perceptual science ,visual analytics is identified as an accepted and promising method for sense making of big data go as far as claiming visualization to be a basic function for both normal and expert analysts, precisely because it can make data to speak to the user at an intuitive level.

5.1 Working with visual analytics

The concept of datafication is closely related to visual analytics and datafication is also well exemplified by it. Data is taken from its context and placed into a visual framework, where hopefully new insights can be extracted. The user needs to interact and engage with the visual analytics tool in order to reach the desired endpoint. If one were to put it into the big data value chain Within the framework of the visual analytics there is room for several types of workflows, but as the end goal is always sense making they can be judged by this as a common metric .The art of selecting the right type of visual representation and the visual literacy that is required to extract value from them are topics of research on their own within the field of information visualization but this is closely related to the process of working with visual analytics. In particular with big data being so varied and used in a myriad of fields, there is a need for several types of visualizations.

VI. Challenges For Visual Analytics

Big data is different and other sense making challenges presented earlier also apply to visual analytics. As are the demands for big data analysis. The underlying premise of big data means that the potential value would disintegrate if one had to break up the data and analyze it all in separate. The issue of scalability has been mentioned, but to understand what it actually means we also have to consider the context of visual analytics. The following areas are those in which the field of visual analytics has identified sense making challenges for dealing with big data: information space, visual representations, interpretability, multidimensional data, network data, workflow and real time analysis.

VII. Proposed Solutions In Literature

Both the literature and existing commercial solutions for visual analytics offer potential solutions for sense making of big data. However, it is the author's impression that the field is divergent with a multitude of different approaches, and no unified direction exists at the time of writing. Workflow, interaction, novel view hierarchies, novel dimensionally reduction techniques and collaborative analysis are some of the areas covered in the literature for enabling sense making of big data with visual analytics. By looking at these and the commercial solutions that are available the current state of the field becomes clearer.

VIII. Conclusion

This paper has examined the emergent technological trend big data and looked at how it challenges the traditional methods for sense making from a human perspective. Furthermore it explores visual analytics, a promising method for sense making of big data, and examines how the challenges apply to it and how they are being dealt with. The paper summarizes and explores literature dealing with both fields and their intersection

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