Annotate BI: An Intuitive Data Insights Interface

Marjan Moshfegh Gohari[1], Ria Agarwal[1], Parisa Naraei[2]

[1]Northeastern University, Canada

[2]Professor, Cestar College of Business, Health and Technology, Department of Artificial Intelligence, Lambton College Applied Researcher; Toronto Metropolitan University Alumni

*Corresponding Author: Parisa Naraei, Professor, Cestar College of Business, Health and Technology, Department of Artificial Intelligence, Lambton College Applied Researcher; Toronto Metropolitan University Alumni.

Abstract

There is an increasing need to make meaningful insights from a large amount of data available in the organizations. In this paper, we investigate, how gaining insights can be facilitated with interactive visualizations. We collaborated with a non-profit organization United Way of the Lower Mainland (UWLM) to help their employees leverage organizational data in order get the information they require for making informed and timely decisions using an interactive, intuitive, and meaningful plugin. To fulfill these requirements, we proposed "Annotate BI" as a plugin add-on to Power BI, which serves as a powerful tool for requesting and sharing insightful information. Using Annotate BI, anyone can create annotations or raise an Inquiry, which makes sharing information related to the Dashboard effortless for the Business Team.

Keywords: Data Visualization; User Interface Design; User Experience; Data Reporting; Digital Transformation; Insights; Business Intelligence; Data-driven; User Engagement

Introduction

In contemporary society, a huge amount of data is generated; "big data" is omnipresent in today's world. Accompanying it is the idea of carrying out simulation, investigation, and analysis to obtain any sort of pattern of significance from the vast quantity of data.

Visualization helps transforms data patterns into illustrations that can be more easily read and interpreted by individuals who are key to this practice. Though this method plays a significant role in obtaining insights, creating meaningful visualizations from a massive data-set is far from a simple task. In addition to recognizing the features already present in the Visualization repositories [7].

Amidst these recent efforts, data visualization has become a daunting activity that demands substantial skill. The ability to mine the commercial value hidden in the data to facilitate making the right management decisions has become key to business competitiveness [4]. In addition to this, we are interested in exploring how users can leverage the various techniques of data visualization using assisting software.

In this paper, we are interested in how insights can be best supported when interacting with overly complex data reports. To that end, we collaborated with a non-profit organization United Way of the Lower Mainland (UWLM). They are part of an international movement and have a successful record of accomplishment in supporting the needs of the community. With the launch of their strategic plan a few years ago [5], UWLM has recognized the need for a digital transformation; to transform the business model to include digital engagement in their existing practices. UWLM's aim is to be highly responsive and adaptive as an organization, to make

64

sure they can do their best work for the community. UWLM has also started to put a lens of focus on making sure their customers have highly positive experiences.

The current process used for obtaining data is long and tedious. By the time it is completed, the report loses most of its relevance.

Various stakeholders within UWLM use internal reporting to generate insights for decision-making. The primary users are senior and mid-level managers, members of the board, management team and campaign cabinet and their teams. The CRM has limited queries that cannot always be customized according to the user's needs. Using CRM is highly ineffective as this data proves dense and difficult to make sense of. The users depend heavily on the Business Team to extract the required data points and create a new report that is more readable. This helps them comprehend it better, but the process is still inefficient and time-consuming. Moreover, there is no in-built method for creating or for aiding in the consumption of data visualizations.

The new Internal Reporting solution (Power BI) built using Microsoft Azure brings data from various sources together. The tool we propose in this paper is "Annotate BI", a plugin add-on to Power BI, makes it easier for the resource development team to leverage, analyze and share information about this data to help them make decisions. This will in turn help them optimally redistribute resources to get the best results to support the current limitations: lack of insights, lack of good support of technology and lack of good customer service to ensure users have access to the most accurate and timely information through effective data visualizations to carry out informed decision-making through our solution. We focus on creating a solution that promotes user engagement. Therefore, the primary goal of the paper is to enable the employees at UWLM to leverage organizational data to not only get the information they require but also to derive insights and make informed, timely decisions through an interactive, intuitive, and meaningful tool. Here, we will discuss diverse ways in which this can be achieved.

We have worked closely with the Technical Business Analyst to gather requirements to create the right wireframe for this purpose. The wireframe should be a high-enablement, high-interaction, scalable interface that will help the teams transition from the old model (Excel reports made using CRM data) to the new one (Dashboards in Power BI) as smoothly as possible.

Related Work

Discovering insights through annotations

Facilitating the insight discovery process is one of the requirements we aim to fulfill for UWLM. Growth., *et al.* [3] provide a paradigm for documenting user exploration history in visualization environments, strengthened by the users' ability to annotate their explorations.

Ellis and Groth [2] have developed a prototype to annotate visual data in remote environments. Another research conducted by Elias and Bezerianos gives a broader view of visualization in BI [1]. In this study, annotation is proposed as an important aid in record-keeping research and recent data exploration.

Data visualization techniques

Data Visualization in the context of enterprises

There has been a recent boom in data-gathering since the advent of the information age. Naturally, this has led to a proportional need in using the data to drive decisions for greater success. [4] provides a good background to the growing interest in data viz. It further demonstrates that data visualization is becoming a central contributor to decision making in the commercial enterprise space.

An organization such as UWLM constantly attempts to enhance its strategic decision-making. Shenhsieh and Schindl [6] conducted research to understand how we can help the organization to make critical decisions through the design of information interfaces. In this research paper, a web-based interface has been used to build metaphors for data.

About the stakeholders

An individual's position in the organization is not indicative of how they are using the reports or data. It varies from person to person. Technology use in the organization is in the initial stages. A large chunk of the organization is interested in having a better way of data reporting and are very embracing of the modern technology. This is due to the frustration that accompanies the current reporting system through CRM.

What do the stakeholders need?

Stakeholders at UWLM would need a different kind of information depending on their role, they all obtain the data

through the same process that is currently being handled by the business team. This dependency on the Business Team needs to be eliminated, and the users need to be able to answer their own questions by looking at the data.

- **Ease of use:** Most of the users are not tech-savvy. Hence the solution should not be unnecessarily complicated. They should especially be able to easily find the data they were earlier requesting the Business team for.
- **Efficiency - Quick access:** They should be able to access the data immediately whenever they need it. They should not have to wait for weeks at a time to be able to access it.
- **Access to the latest data:** The data that the user's access, should be up to date, live data. They should not have to resort to using old, outdated data.
- **Access to accurate data:** All the data that they have access should be accurate and reflect the ground reality.
- **A sole source of Truth:** Everyone should have the same data. There should be no inconsistencies between the data that is accessible to any two different users.
- **Ability to draw insights:** They should be able to look at the data and detect patterns so that they can draw insights from it and make decisions based on those insights.
- **Navigation:** They should be able to intuitively navigate through the data with simple actions. They should have the ability to dynamically perform sorting, filtering, and other operations on the data.
- Since the process of getting data is so long, people in the organization cannot make the best use of it. There are several side-effects of this time gap:
- Employees do not request for data unless it is a necessity to do their jobs.
- If there is no urgent requirement, employees wait until they have a large enough request to make so that they get all the data at once instead of making different reports and waiting for each of them.
- Employees do not explore the data enough because it is not easily accessible, which is why potential areas of opportunities are easily missed.
- Relations with customers and other external clients could be better, as communicating the answers to their questions takes a long time.

- When an employee is in a time-crunch, they might depend on an existing report instead of requesting a new one because it would take a long time to arrive. The existing report might not have all the relevant information, compromising their work's credibility and relevance.
- Because their data-related questions cannot be answered quickly, employees are used to doing things out of habit, not being creative or inclined to explore possibilities.

Using microsoft power BI

How it works

As part of the digital transformation, UWLM has invested in the full Microsoft-stack. This includes a range of Azure tools, using which the Business Team can bring together data from the different systems that have no way of communicating with each other to transfer data between themselves. The relevant data connections have been made between data models in Azure using the data from these systems. Now that the data is being replicated in Azure, the next step is visualization. The Azure offering relevant to us for this purpose is Power BI. The Business Team has already created a few basic reports using it. Most of these are updated once a day, and two to three are updated multiple times a day, depending on the need. If a visualization is not effective enough, the reports are also changed to show data more intuitively in a way that the end users expect it.

The impact on users

There is not necessarily any functionality in Power BI that benefits the Basic Users (1), except automation of the data request process. However, the Explorers (2), can navigate and find information relevant to their work; they see the benefit of using this platform. Now, they are using the dashboards to answer some of their questions themselves and anticipate what the clients are going to ask them to have those questions prepared before a meeting. They use the dashboard multiple times throughout the day to see what has changed or what has been updated.

Our window of opportunity

Our goal is to design a tool that bridges the gap between the users and the new Power BI dashboards. To accomplish this task, we keep in mind the users' comfort with technology and the kind of technology they use in their daily lives. We also focus on using ideas from existing products that can make our tool intuitive and easy to use.

System design description

Initial prototype

Our prototype provides two features that help resolve some issues faced by the employees at UWLM. The initial prototype comprises of two key features, namely Annotations and Search. The BI team receives a substantial number of questions (related to the reports they created) once the reports are shared. We added Annotations, where the BI team member can add brief descriptions about the charts to the dashboard to resolve this issue. They can also search annotations by entering the keywords in the Search bar.

We highlighted the following features in our prototype:

- **Help:** The help button is on the options bar; it is an icon. Clicking it opens a text pop-up. The business team can populate it with relevant information for the dashboard.

- **Add Annotations:** People can add a text description or question to any part of the dashboard. The options bar contains the '+' icon. Clicking on it will take them to the blank screen. Here, they can start adding annotation by clicking on any part of the screen. The annotation includes a title and a description. Synchronized.

- **Timeline:** There is a timeline at the bottom of the screen on the home view. Hovering over it shows the name of the author, the date, and the time at which the annotation was created.

- **Search:** There may come a situation when the timeline is full of markers, which makes it difficult for the users to navigate and find the annotations they are interested in. To resolve this issue, we added the search option. The user can search annotations by entering the keywords in the Search Bar.

- **Comment:** When an annotation is added, anyone can use the facility to comment on it.

- **Notification:** This feature notifies the user when someone mentions them in a comment.

Keeping in mind the points from the discussion with UWLM, we produced a revision to the initial prototype. The changes are listed below:

- **A single panel:** To make the interface simpler, we removed the panel on the left-hand side, and moved the features it contained to the top panel.

- **Replacing the timeline:** The timeline feature did not appeal to our clients. We needed to replace the timeline with something that would not encapsulate information but display it readily. To this end, we decided to remove the timeline and instead, have a scroll-able panel on the left side of the screen. like

- **The Search Bar:** Instead of keeping the search bar a part of the heading, it is now at the top of the panel containing the annotations.

- **Keeping annotations relevant:** After clicking on "Add Annotations", the user can click anywhere on the screen to create an annotation. When the user clicks, a screenshot of the current dashboard is taken, and tied to the annotation that is being created to retain context.

- **Adding more context:** On creating annotations or adding comments, the user has an option to attach a file through an upload button. The attached files can later be downloaded when the annotations are being viewed.

- **Differentiating annotations by type:** In the creation process, they can now choose to "Ask a Question" or "Annotate". This was required to differentiate the two types of annotations that the users would create using the plugin. By choosing "Ask a Question", they can assign a severity to the request, and the Business Team or other concerned individuals would respond accordingly. Such requests are marked as "Inquiry". On the other hand, when the user chooses "Annotate", they can also choose to mark it as an "Insight".

- **Filtering the annotations by type:** Not only can the annotations be filtered using the Search function, but also Date Selection and through the selection of filter buttons for "Insight" and "Inquiry" which leverage the diverse types of annotations explained above.

- **Viewing the annotations in the main screen:** As mentioned above, all the annotations are listed in a scroll-able panel on the left-hand side. Each annotation in the list displays a title, creator's name, date created and annotation description.

Evaluation Results

During meeting with United Way, we presented our High-Fidelity prototype explaining the features in the context of various scenarios, followed by a discussion about the usability of the features. We received the comments like, our design fulfilled all

their requirements. Our idea was well received, and they added feedbacks on what can be improved to maximize the usability. Improvement areas are as below:

- The header bar in our design was too big for some smaller screens and needs to be made thinner.

- Most of the end users from United Way are non-tech savvy and initially for them it might be difficult to use our design. Therefore, they suggested adding a video tutorial on how to use the plugin. This will be extremely helpful for first-time users.

- The graphs on the dashboard do not have a definition for the legend which is confusing for the employees in understanding what the graph depicts. So having the feature that shows a brief description about them hovering over it, seems to be beneficial.

To calculate the score using the System Usability Scale, we sent the participants a satisfaction survey, which consists of 10 questions after our meeting. Based on the responses, we calculated the score displayed in table 1. Our design received a high score.

Question No.	User 1 Score	User 1 Score Calculated	User 2 Score	User 2 Score Calculated
1	5	4	4	3
2	1	4	1	4
3	5	4	5	4
4	1	4	2	3
5	4	3	5	4
6	1	4	1	4
7	4	3	4	3
8	1	4	1	4
9	5	4	4	3
10	1	4	1	4
Total		95		90

Table 1: Score based on System Usability Scale.

Conclusion

Some limitations in our work lead us to produce some possibilities for future work. The current plugin can already keep the annotations relevant, and it can retain context by taking the current dashboard's screenshot; However, it could be enhanced with a technique to automatically track changes over time in the current dashboard so that capturing a screenshot is not required for each annotation. Moreover, our plugin could be expanded by implementing a technique to generate annotation automatically. In a way that users can upload an image with its textual description and generate a series of well-annotated animations.

Bibliography

1. Micheline Elias and Anastasia Bezerianos. "Annotating BI Visualization Dashboards: Needs Challenges". In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '12). Association for Computing Machinery, New York, NY, USA (2012): 1641-1650.

2. Sean E Ellis and Dennis P Groth. "A Collaborative Annotation System for Data Visualization". In Proceedings of the Working Conference on Advanced Visual Interfaces (AVI '04). Association for Computing Machinery, New York, NY, USA (2004): 411-414.

3. D P Groth and K Streefkerk. "Provenance and Annotation for Visual Exploration Systems". IEEE Transactions on Visualization and Computer Graphics 12.6 (2006): 1500-1510.

4. Sun Jun. "Business Intelligence Visualization Technology and Its Application in Enterprise Management". In Proceedings of the 2020 2nd International Conference on Big Data Engineering and Technology (BDET '20). ACM (2020).

5. United Way of the Lower Mainland. "Strategic Plan - United Way of the Lower Mainland" (2017).

6. Angela Shen-Hsieh and Mark Schindl. "Data Visualization for Strategic Decision Making". In Case Studies of the CHI2002|AIGA Experience Design FORUM (CHI '02). Association for Computing Machinery, New York, NY, USA (2002): 1-17.

7. Chenglong Wang., *et al*. "Visualization by Example". In Proceedings of the ACM on Programming Languages. ACM (2019).