Expound the Glory of Data with Visualisation

Ritwik Sinha
Technical Consultant at Merkle Sokrati
Pune, India
ritwiksinha53@gmail.com

***Abstract*–The distinctive approach to understand data is to visualise it in the memory, the sight to capture the expounding behaviour of data is through making raw data captivated. In the core of data science, it is really important to understand data before beginning the analysation aspects. This journal describes the trends and targets of data world, approaching towards clear data understanding and everlasting data visualisation tools that make data understanding simpler than ever.**

Keywords—trends, plots, analysis, tools, visuals

I. INTRODUCTION

Beginning from extracting the data through enormous sources to analysing it, data has to travel a lot. During this journey, the refinement of data has to be done. The raw data is not refined at all, it needs to treat well in order to make a layman understands the data completely or to the extent he needs it to be considered of. A data analyst keens to use data visualisation tools, so that the raw data shall give some beautiful insights out of it. The imagination of a data analyst also plays a vital role in data visualisation, as picking up the correct extreme end of the data is also important, that is, if the analysis begins from the wrong end, then the conclusion from the data visualisation could be failure. Thus, only tool is not needed in the process of visualisation but also the imagination of the data analyst is needed. Different visualisation methods are used inclusive of charts, graphs, plot summary, maps, dashboards etc. These methods are available in data visualisation tools like Microsoft Excel, Tableau, Power BI, Looker, Zoho Analytics, Qlik Sense, Domo etc. There are paid as well as free versions available in the industry of the above mentioned tools, we need to take the decision according to our need. Levels of data visualisation is also very important to understand, visualisation trends would become different as the data samples changes from data population. The summary is therefore needed after every visualisation, in order to conclude the descriptive pattern hidden behind the visuals. The power of data visualisation is that, it makes the best out of the tidy data. Data can have outliers, null values, missing values, unordered data, or any kind of mess inside it. But, as soon as the visualisation of it begins, the refinement of data begins. The data is treated as gold in data science industry, and making some meaningful insights from it, is a tough task, which is therefore handled by the data visualisation department. The first step of data visualisation is to clear about the objective, that is, what needs to find out, then slowly begin with basic visualisations, choose the right chart type or any other method, utilise best colour, size, scale, shapes and labels to mention key conclusions of it. The quality of data visualisation depends upon how easy it is for a layman to understand the meaning of the plots.

II. CLEAR OBJECTIVE

The visualisation requires certain objective that needs to be followed. The requirement prospects of data analysis tells what kind of objective can be framed out of the data. This objective is the result of the imagination that a data analyst draws from the data. An analyst should also take into consideration about the limitations of the company so that the value achieved from the visualisations should be more than the work done. Excessive amount of data isn't always better in order to pursue the objective, an analyst should have right data and solid approach to complete the objective. More the amount of data is, more there is risk for the data to be malicious and full of diverseness. This will create outliers also, which may be a big concern for an analyst, as if an analyst tries to remove the outliers and ends up removing the necessary information from the data, can results into wrong data visualisation. Once the objective is clear and an analyst is set to begin analysis, next step will be understanding the data along with doing simple and basic visualisations so that, the density along with the diversity of the data could be identified easily.

III. KNOW YOUR DATA WITH BASIC VISUALISATIONS

Once the data and objective is ready, initiate the data understanding by looking at the variables available in the data. Filter the categorical and numerical variables separately so that the perfect chart type could be selected to provide visualisations. Basic visualisations are must before going to deeper analysis, and this can be achieved through basic plots such as histogram, bar chart, line chart, flow chart, scatterplot, surface plot, map, networks etc. These charts gives the glimpse of the data. It marks the boundary inside which an analyst needs to move. Selecting plots out of these many plots is also a tricky chance. Sometimes, analysts keeps on shifting to different plots in order to achieve what he had imagined of, but that's not the right way to select the type of plot. The types of plots to be used depends upon the data type of the variables that needs to be plotted either individually or by grouping them. Plots like histogram, scatter plots, are used for numerical data analysis, on the other hand, bar plots, line chart are the types of plots that is basically used for categorical data analysis. As soon as an analyst finalises the type of plot to be used, the axis labels should be identified that is which variable should be present at the x-axis, y-axis or sometimes z-axis. And in the case of no axes plots, the purpose changes into the identification of the colour pallets to be used like in the case of pie charts. Choosing the right colour for the plots is also very important as the colour should be eye catching, and possess some

meaning regarding the data. For example, the heat map should have perfect colour combination, otherwise determining the density of the variables becomes very difficult. The next part is to decide the size of the data to be used. As in this step, we need to make only basic plots, so plotting complete data is also not a good option, so figuring out the sample data is the new task. An analyst needs to figure the percentage of the data to be used for basic analysis. Once the basic analysis is done, we need to visualise data more deeply which is done by identifying our audience.

IV. KNOWING YOUR AUDIENCE

Basic visualisations does the great start to endorse the clients at the initial stage of any commitments. But as we proceed further in order to reach to a business conclusion, we need to know the level of our audience and the complexity of the data. There are many visualisation tools available in the market, some are paid while some operate on free of cost operations with limited number of features. An analyst needs to figure out the complexity of the data. Tools like Tableau, comes with public version (Tableau Public) as well as paid version (Tableau Desktop). If the client i.e., our audience follows agile methodology and requires update of the project every day, then we should use Tableau Desktop as it allows to save the workbook in the local machine, on the other hand Tableau Public does have saving the workbook feature but the workbook is saved on tableau public server online, and not in our local machines.
Level of knowledge of the audience is also one of the factor that we should take care of. We should create the visuals that makes our client understand the complex data quite easily. Making too complex plots that does not create much sense to the client, is not a good practice. Designing the type of charts for policymakers or government officials should be different from those plots which are needed to be design for the general public. We should know what information our client already possess, and we should also know, whether our client have time and interest in exploring interactive website or should we design a one page handout that can be understood at a glance. Lots of time is needed to think about the dissemination format before we start designing the visualisation. A long back ago, 100+ page narrative reports were used for reporting, which comprises of about 80% of text data and 20% of the graphics. But, nowadays viewers want visual reports, executive summaries, live presentations, handouts and much more. The reports which are in demand in today's era should contain around 80% of graphics and 20% of textual data. One page reports are most in demand, as it is very easy for the clients to understand the report at one go, that not only saves client time but also increase the client interest towards the data which he would had thought to be a non-performing asset.
During presentations in front of the clients, we should break our charts into several slides so the chart appears to be animated. One fantastic feature named as dashboards is a very handy technique for presenting our visualisations. Dashboards can be made in any of the data visualisation tool available in the industry. We should remember the key to engage our audience towards the visuals and this key should be able to draw attention to the important sections of the presentation. If any kind of hard copy is needed for presentation, always put the 3-5 important charts in a single page. Otherwise, printing the whole presentation won't make your impression bright in front of the audience as the page later will be used as a trash. Socialising the visualisations on the social media handles is also very handy way to engage larger audiences towards our visualisation. As digital media has shown up a steep inclination in globalisation.

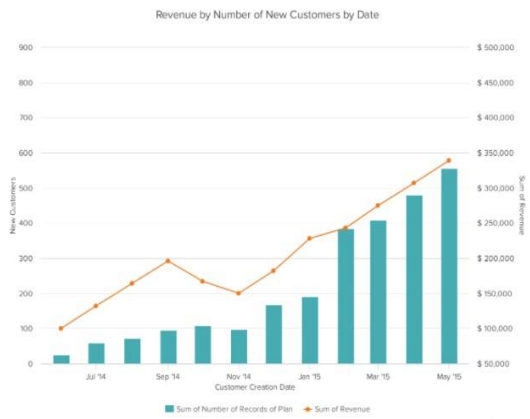
V. BUSINESS INSIGHTS

Till now, we rolled up around the steps of data visualisation beginning from understanding and defining the objective, knowing the basic graphs or plots and designing the final visualisation by understanding the needs of our audience. The last step of the visualisation is to draw business insights. Business insights means that any proclaim regarding the client need that can affect the decision making of the client. As an analyst we can predict a particular decision through our analysis that can go either ways, profitable or non-profitable. Data visualisation speaks out many key points from the data which can help our client to reach a particular decision. It is one of the part of making Machine/Deep learning models, which later gives certain accuracy according to the type of algorithm used, but meanwhile in between data modelling, the visuals can solve the direction of modelling to follow. These visualisations helps to create visual reporting, that consists of summary of the business insights which is a great way to break the mould. Some of the visual reports examples are "State of Evaluation 2012" report, "Washington Evaluators" one-page annual reports, "Datalogy Labs", "Baltimore report", and "University of Chicago's computer science report". All these reports are the evidences along with many others, that data visualisations can itself gives conclusive business insights.
As an analyst, we should work our visualisations on different tools, and try to find out which one best suits the data set. Different data visualisation tools that can be used are "Tableau", "Google Charts", "Fusion Charts", "Highcharts", "Datawrapper", "Plotly", "Sisense", "QlikSense", "Power BI". Before we discuss these tools, we will learn some of the plots.

VI. DATA VISUALISATION PLOTS

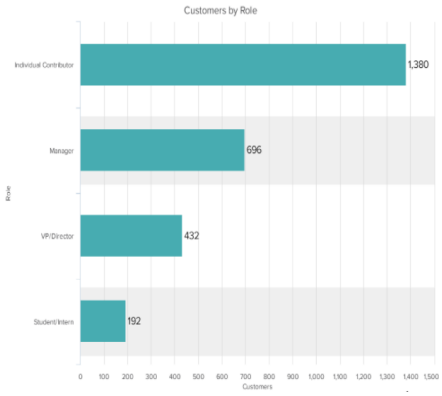
Choosing the right visual aid is the key to preventing user confusion and making sure our analysis is accurate. There are myriad different types of charts, graphs and other visualization techniques that can help analysts represent and relay important data. Let's take a look at 10 of the most common ones:

1. *Column chart:* - Comparison plays key role in data visualisation and column charts is used to show a comparison among different items, or it can show a comparison of items over time.



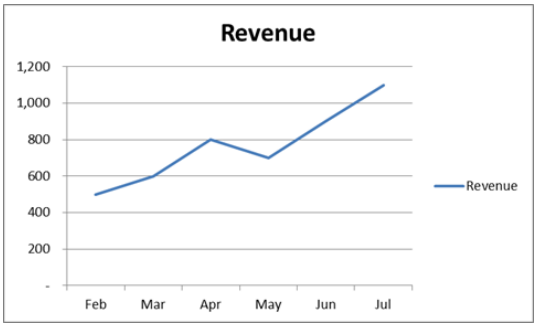
For instance, the above graph is a column chart which shows comparison between numbers of customers joining a company at the end of different closing dates.

2. *Bar Graph:* - When we have more than 10 items to compare or we wish to avoid clutter when one data label is quite long, we should prefer making horizontal column chart which is known as Bar Graph. Sometimes we need to plot negative values on a plot, there also, bar graphs are preferred.



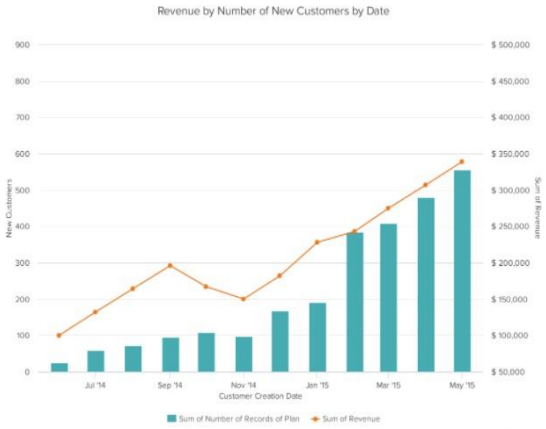
The above graph is an example of a bar graph plot, which has comparison between different customers falling into different roles. Since y-axis contains lots of intervals to be plotted, we preferred making bar graph and not column chart.

3. *Line Graph:* - Often we come across continuous data set, and we need to plot trends or progress of certain thing over a period of time. Line graph is preferred to fulfil this need. A line graph can be drawn using several points which are connected by a line.



The above graph is a demonstration of line graph which shows revenue obtained in different months by a certain organisation.

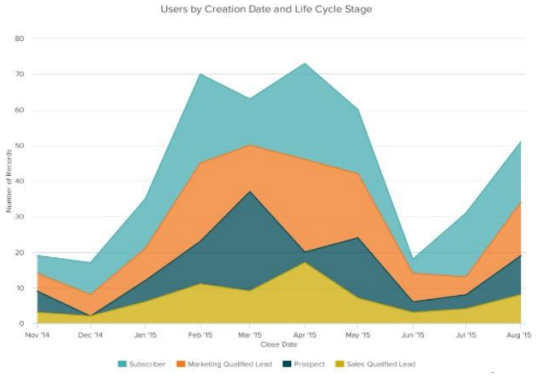
4. *Dual Axis Chart:* - When we have three data sets to plot, dual axis chart allows to plot data using two y-axis, and a shared x-axis. One of the feature is based on a continuous sets of data and another which is better suited to being grouped by category. There is also an advantage of dual axis chart, that it is used to visualize a correlation or the lack thereof between three data sets. It is obvious to use two different graphing styles so as to illustrate two data sets. Use contrasting colours for two data sets as well.



The above plot uses shows revenue of new customer on the basis of number and date. It means it depicts revenue of number of new customers on particular date. As mentioned above, column chart is used to plot sum of number of records of plan and line graph is used to plot sum of revenue. This graph has dual y-axis and single x-axis.

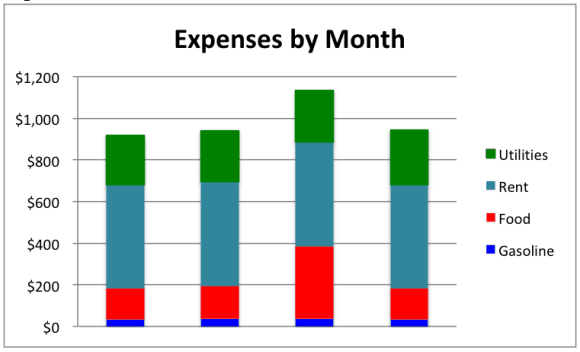
5. *Area Chart:* - It is quite similar to line chart, the difference exists in terms of space between the x-axis and the line, this space is empty in case of line chart whereas in area chart it is filled with a color or pattern. The quality of showing trends is similar to the line chart, as area chart help us to visualise and anlyse both individual and overall trend information. It can be analysed as it shows part-to-

whole relations. Prefer using transparent colors for the pattern of area chart as information isn't obscured in the background. Data sets which needs to display more than four categories need not the services of area chart so as to avoid clutter. Make sure to organize highly variable data at the top of the chart otherwise low variable data will get hidden behind the highly variable data and it becomes difficult to read the plot.



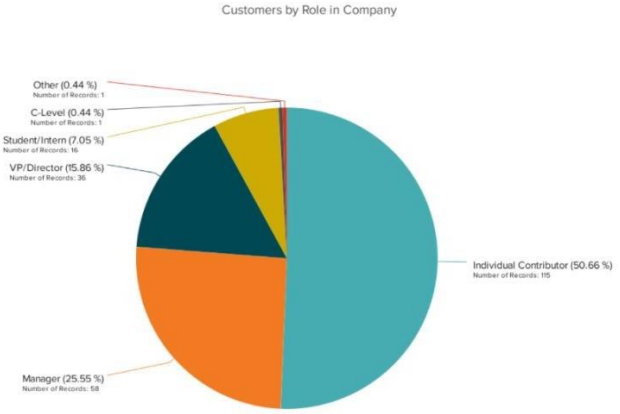
The above area chart shows users on the basis of creation date and life cycle stage. It is clearly visible thar "Subscriber" variable has the highest variance, hence it is plotted at the top of the chart so that the lowest varied "Sales Qualified Lead" is also fully visible.

6. *Stacked Bar Chart:* - It is also one of the chart that is used to show comparison by using bars. This comparison happens between different categories of data. But, it is needed to take care that, these categorical variables should have ability to break down and compare parts of a whole. Each bar in the chart represents a whole, and segments in the bar represent different parts or categories of that whole. Stacked bar chart has the flexibilty to get plotted in both horizontal and vertical graph components. It consists of one categorical axis and upto two numerical axes. Numerical axes represents the value of the data.



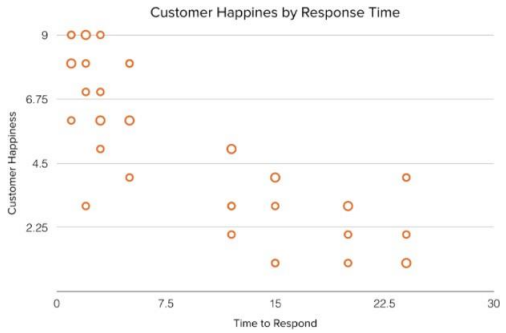
The above graph shows expenses of different different fields of lifestyle in different months. It is observed that, Rent comprises of maximum expenses in every month and Gasoline comprises of least expenses in each month.

7. *Pie Chart:* - Whenver we needs to plot percentage distribution of the data set, pie chart is preferred always. Pie chart usually depicts a static number or number in percentages, where the sum of all segments needs to equal 100%. It is advised to plot few categories i.e., upto 8 only in a pie chart in order to ensure differentiation between segments. Similar to area chart, pie chart should also order the segments according to ascending order or descending order of their sizes.



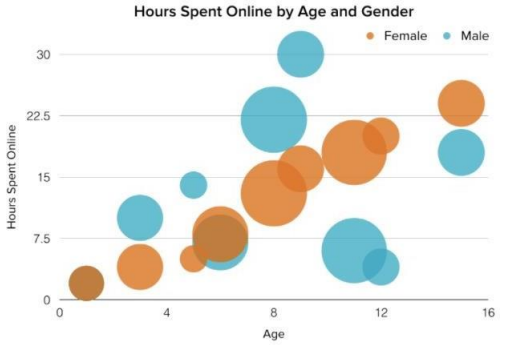
The above pie chart illustrate a situation of a company, regarding different roles of customers which are plotted according to the percentage distribution of all. It is observed that, Individual contributor, contributes to the company the most as its percentage distribution sums up to 50.66%. On the other hand C-Level and Other customers contributes the minimum summing up to just 0.44% contribution in the company.

8. *Scatter Plot:* - Scatter Plot is also known as scattergram chart, used to illustrates the relationship between two different variables. Scatter plot is also useful in case of revealing the distribution trends inside the data. Scatter plot has a great advantage that makes it one of the prestigious plots to be used, and that is it can be used easily to plot many number of different data points alongwith we can highlight the similarities in the data set. It has a hidden feature of making an analyst understand the distribution of the data by analysing and treating the outliers further. We can make trend lines in the scatter plot also for easy understanding of it.



The above graph depicts customer happiness with regards to the response time. It is basically an example of certain call center or customer care center. As the time to respond to the call increases, the customer happiness level decreases. It gives an important business insight that, company needs to ensure that their customer care center employees should respond to the complaints call at the earliest everytime so the customer could not churn from the company and will remain their customer for pretty long period of time.

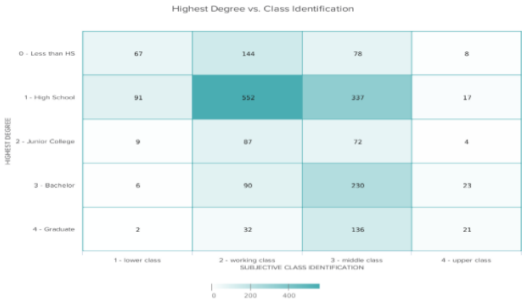
9. *Bubble Chart:* - Similar to the scatter plot, bubble chart is also used to show the distribution and relationship between the variables of the data set. The only addition to this type of chart is the bubble or circle. This bubble is used to indicate the third data set, through the size of the bubble. As the value or variability of the third data ser increases, the size of their respective bubble alos increases. One thing to be taken care of is the scaling of the bubble, scale the bubble according to the area and not to the diameter. Give labels to each bubble clearly. Although, certain data visualisation tools gives different shape of bubbles that can be plotted, but prefer making the bubble only in circular shapes.



The above graph shows the hours spent online by different age people and differentiated according to their gender. Like in the case of bar graph, the size of the bar increases as the value of that particualr variable increase, similarly here also, as the value of particular increases or decreases the bubble will increase or decrease in it shape. It is clearly visible from the graph that, below 4 years of age, there are lots of females who spent lots of hours online and there is no amount of male people having spending their time online, but as the age increases, the distribution for both genders increases or decreases quite similarly.

10. *Heat Map:* - Quite often we need to plot the data according to some rating scale such as high to low or poor to excellent. A heat map fulfils this situation. It also shows relationship between the two items or variables. The rating information is displayed using varying colors, saturation or pattern. The outline of the heat map should be basic and not dark so that the map is clear and there should not be any distraction from the data.

It is preferred to use a single color in varying shades to show changes in data. Also, use single patterns only.



The above graph shows the relationship between highest degree and subjective class identification. There is scale indicator provided below, which indicates the rating information, such as light blue color indicates rating between 0 to 200, this section is considered as poor. Rating between 200 to 400 shows moderate section which is illustrated with medium blue color. Lastly, the dark blue color ranges the best section between 400 and above. Lets take an example to understand the relationship between highest degree and subjective class. Since lower class people can't afforde their children to educate till graduate level, thus only 2 children is graduated belonging to lower class people. It is concluded that, lower class people and graduate level education does not have good relationship between them. On the other hand, a working class can afford their children to learn till high school, so a maximum of 552 students belonging to working class has their education till high school, which concludes that there is strong relationship between the working class and high school level education.

This comes to the end of understanding 10 most used plots or charts or graphs in data visualisation. Now, will shift our

focus to different data visualisation tools avaialable in the market. Let's dive into these tools one by one:-

1. Tableau
2. Power BI
3. Qlik Sense

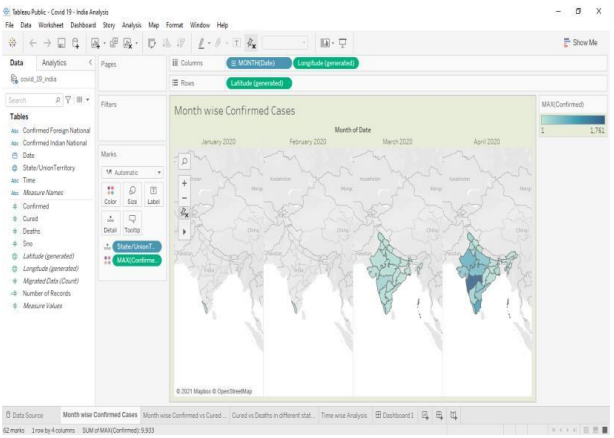
Let's begin with Tableau which includes Tableau Public, Tableau Desktop and Tableau Reader.

TABLEAU

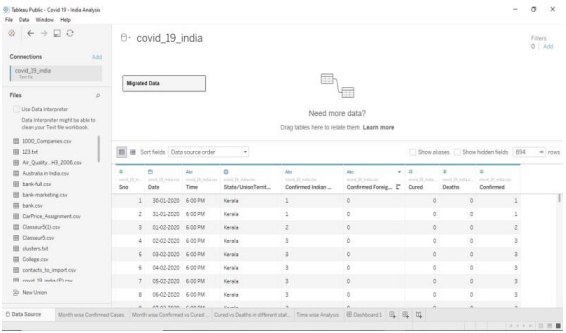
Tableau is basically a data visualisation tool that solves our data visualisation problems. Tableau comes in three types, public, desktop and reader. The first thing to look for before choosing the right type is to analyse whether we want to create a visualisation or a view to interact with it. If we want to create through developing tools, then look for whether we want to connect data with a Database or not, if yes then use "Tableau Desktop Professional" and if no then think whether we wish data to be publically available or not, if yes then use "Tableau Public" and if no then use "Tableau Desktop Personal". Now, let's go back to the first step, and move with the steps in which we can view the visualisation to interact with it via view sharing tools. Again, if we want to connect data with a database then we should analyse whether we want frequent data update or not, if yes, then we analyse whether we need to maintain our own server or not, if yes, then we should use "Tableau Server" and if no, then we should use "Tableau Online". If we don't want frequent data update, then we need to think whether we need to view vizzes on web/phone or not, if yes, then go to step of deciding our own server step and if no, then we should use "Tableau Reader". If we don't want to connect the data with a database then we should think whether we can make our data public or not, if yes, then we should use "Tableau Public" and if not, go to the step where we take the decision of frequent data update or not. We will now discuss tableau on the basis of the following parameters:-

1) *Creating a visualisation:* - Using Tableau Desktop and Tableau Public we can create beautiful visualisations but we cannot create/edit visualisations using Tableau Reader app.
2) *Connection to sources:* - In Tableau Desktop, all listed data sources can be connected with it. In Tableau Public, only excel and text files can be connected with this app. While Tableau Reader does not need to connect to a data source.
3) *Securing the data:* - In Tableau Desktop and Tableau Reader, nobody can see our visualisations until we provide an access to someone. But in Tableau Public, all the visualisations are public once they're published.
4) *Amount of data that can be stored:* - Unlimited rows of data can be stored, processed and shared in Tableau Desktop, only 1 Million rows of data can be stored, processed and shared in Tableau Public and Unlimited rows of data can be read in a static view in Tableau Reader app.
5) *Cost of the software:* - The desktop application of Tableau Public and Tableau Reader is completely free of cost while Tableau Desktop costing is categorised in two ways, for Personal Desktop, it costs around $999 and for Professional Desktop, it costs around $1999.
6) *Place to store the data:* - The data or visualisations are stored in the local drive as well as on the Tableau Server for Tableau Desktop app, whereas for Tableau Public, data are stored only on the Tableau Server. While there is no scope of publishing or storing the data in Tableau Reader.
7) *Target Demographic:* - Tableau Desktop is used by Data Scientists, Business Intelligence Developers, and Business Intelligence professionals. Tableau Public is preffered for beginners in the field of Data Analysis and BI Enthusiasts. Tableau Reader is basically for CxO level professionals, who only need to read data and visualisations.

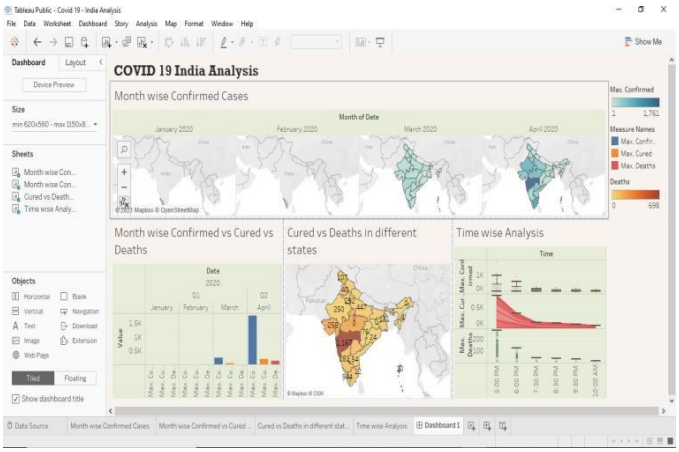
Tableau's basic structure looks like:



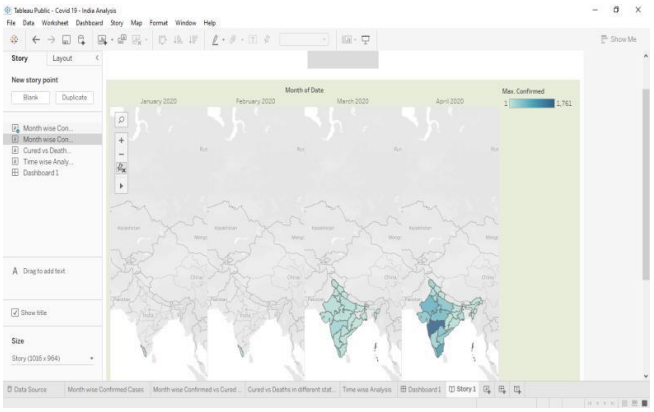
Here, all the visuals are plotted in the middle, the attributes are present at the left side, scaling markers are present at the right side, toolbar is given at the top whereas scrolling to data source, different sheets, dashboards and Stories are present at the bottom. The above image show a view of a Tableau worksheet. Let's look at the data source tab.



This tab shows the preview of the data that is imported in the Tableau, here we can merge or join or blend multiple workbooks alltogether. Now, let's look at the view of a dashboard.



Dashboard is nothing but a place where we structure and drag all the worksheets, so that we can get one single frame to look at all the sheets. Now let's look at the story view.



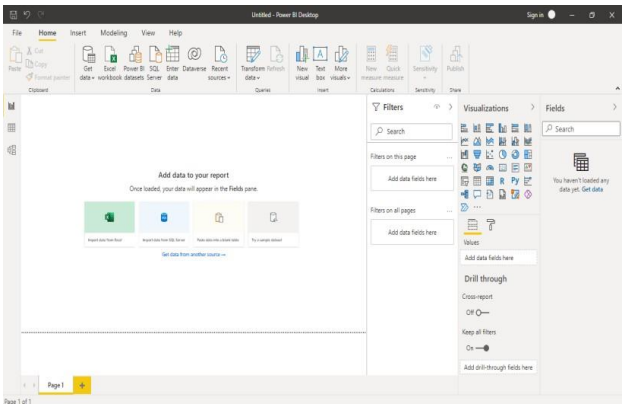
Story is quite similar to dashboard, but here we cannot place all the worksheets at a single time, we can replace one by one all the worksheets, to get a broader view and it is basically used for the presentation purpose.

POWER BI

Power BI is a data visualisation from Microsoft, which is treated as business intelligence tool as well. It is quite similar to Tableau, as it is also used to create visualisations in the form of charts, graphs, dashboards, reports etc. but the advantage of business intelligence feature in Power BI makes it quite different from Tableau. In the real world industry, data is gathered from different sources such as Spreadsheets, CRM, API's etc., so for these sources business intelligence tools work as data connectors and help in centralizing data for viewing. Downloading and installing free version of Power BI is easy while we need to purchase the licence for the paid versions. Power BI comes in different editions including Power BI Free, Power BI Pro, Power BI Premium Per User, Power BI Premium Per Capacity. Let's discuss key difference between these editions on the basis of certain number of parameters:-

1) *Mobile App access:* - This access is provided in all the editions of Power BI.
2) *Publishing reports to share and collaborate:* - It is possible in Power BI Pro and Power BI Premium Per user.
3) *Paginated (RDL) reports:* - It is provided in Power BI Premium Per User and Power BI Premium Per Capacity.
4) *On-premises reporting with Power BI Report Server:* - It is available only in Power BI Premium Per Capacity.
5) *Model size limit:* - 1 GB is size limit for Power BI Free and Power BI Pro. 100 GB is size limit for Power BI Premium Per user and 400 GB is size limit for Power BI Premium Per capacity.
6) *Refresh Rate:* - It is not applicable in Power BI Free. It is 8 per day for Power BI Pro. It is 48 per day for Power BI Premium Per User and Power BI Premium Per Capacity.
7) *Connection to more than 100 data sources:* - It is possible in all the editions of Power BI.
8) *AI visuals:* - It is available for all the editions.
9) *Advanced AI:* - It includes text analytics, image detection, automated machine learning and it is available in Power BI Premium Per User and Power BI Premium Per Capacity.
10) *Data security and encryption:*- It is provided in all the editions of Power BI.
11) *Autoscale add-on availability (preview):* - It is possible only in Power BI Premium Per capacity.
12) *Dataflows:* - It is provided in Power BI Premium Per User and Power BI Premium Per Capacity.
13) *Embed APIs and controls:* - Except Power BI Free, all other editions of Power BI has this ability.
14) *Metrics for content creation, consumption, and publishing:* - It is avialable in all the editions of Power BI.
15) *Multi-geo deployment management:*- It is only available in Power BI Premium Per Capacity.

Let's see how Power BI Desktop looks like and understand the view of the app.



On the left hand side, there are three options namely, Report View, Data View and Model View. The frontend view of visualisation which contains our dashboards comes inside

Report View. Any modifications required in the data such as creating additional rows and columns using any method inclusive of Query, Measure, or columns for arranging our data can be done inside Data View. Third view is known as Model View, where we decribe a relationship of various tables available. This relationship can be created in the form ofone-to-one, one-to-many, and many-to-many relationships.
On the right hand side, we have three sections namely, Filters, Visualisations and Fields. Filter section is basically used for filtering or searching anything that is present in the single page which is present at the middle or from the complete workbook i.e., all the pages. Visualisation section contains different types of visual graphs, tables, trees, slicers and cards. We just need to select any visual, drag the table column in the Values and we have our graph ready. There is one Format tab also, present adjacent to Value tab, it is responsible for formatting procedures like font size, color, background etc. The Fields section contains all the columns and measure from the data which was earlier loaded and transformed.

QLIK SENSE

Qlik sense is another tool in the field of business intelligegnce used for data visualisation. QIX engine is responsible for all the operations happening inside Qlik Sense. It gives user a privelge to link data coming from different data sources and results out in dynamic searching and selections. It contains augmented graphics which means displaying of data-driven graphics along with the real images, where real footage or live videos are mixed with virtual backgrounds, chroma, and data driven 3D graphics. It gives an attractive environment for the audience. The collaborative nature of Qlik Sense capables a user to draw creative inferences from the data. When we are using Qlik Sence in our business, our clients get an additional benefit of sharing data applications and reports on a common centralised hub between us and the client. This hub allows us to share data models, export data stories between each other. It results into better future of the business. Let's discuss some of the best Qlik Sense features:-

- It helps its user to have self-service capability.
- It has a great feature of creating augmented visualisations and allows smart exploration.
- It works upon the principle of associative model.
- Due to presence of the hub, it has centralised sharing option available.
- The multi-cloud architecture is hybrid.
- Wheather data is big or small Qlik Sense can solve the problem of data integration.
- It is best in case of security due to its robust security features.
- It has Artificial Intelligence supported Qlik Insight Advisor.
- It is scalable across on-premise, private, and public cloud environments
- It supports mobility feature and is accessible on multiple devices.

Qlik Sense has three editions and let's go through to each of them one by one: -

1) *Qlik Sense Desktop:* - It is only available on Windows operating system. We can create visualisations by loading the data into it and can also save the visuals on the local file system as well. We can also export the visuals created to the cloud for enterprise support and storytelling. It is basically used by individuals and it comes free of cost.
2) *Qlik Sense Cloud:* - It is the deployed edition of Qlik Sense. We can create applications and reports and share among our community online. We can access Qlik Sense Cloud on multiple devices. One of the great of quality of it is it's expanded storage and unlimited data feature. It comes into two versions: Cloud Basic and Cloud Business version. Cloud Basic edition is free of cost and can be shared among 5 users only. On the other hand, Cloud Business version costs about $15 per month and can be used by unlimited users. Cloud business version has the capability of providing functionalities like data governance and collaborative group analysis.
3) *Qlik Sense Enterprise:* - It is the only premium version of Qlik Sense. As it provides full versions and speicifically used for enterprises. It is very good in making reporting, visualisation, exploration, multi-platform cloud deployment, collaboration, data integration, API for custom analytics, enterprise governance and scalability. It costs on the basis of a token model costing $1500 for one token.

CONCLUSION

Data visualisations is a process being so important, is quite often treated not so important by many beginners, but the power of visuals to make a layman understand the data and bring some meaningful insights from it is beyond excellence. We need to be more concise and to the point whenever we have to present the analysis in front of our audience, and bringing all the necessary infromation from the whole messy and tidy raw data to just one report, or one dashboard, or just one story, is very positive signs of understanding things by saving lots of time. The another advantage of data visualisation is that, even if our audience does not have any knowledge of data visualisation, can understand the visuals because visuals make impactful impression on their minds, more than the traditional text reports. Data visualisation includes plots, charts, reports,

videos, Graphics Interchange Format, and much more, and all these can be developed using different visualisation tools such as Tableau, Power BI, Qlik Sense etc.

ACKNOWLEDGMENT

I wish to acknowledge my motivator Dr. Chiranji Lal sir from Amity University, Greater Noida to guide and motivate me throughout writing this article. His assistance is greatly appreciated on finishing the journal.

REFERENCES

[1] Healey C. G., Choosing effective colors for data visualization. In Proceedings of Seventh Annual IEEE Visualization'96 (pp. 263–270). IEEE, October 1996.
[2] Evergreen, S. D., Effective data visualization: The right chart for the right data. Sage Publications., 2019.
[3] Kelleher, C., & Wagener, T., Ten guidelines for effective data visualization in scientific publications. Environmental Modelling & Software, 26(6), 822–827, 2011.
[4] John McAllister, blog on "My Tableau dashboards sucked - until I started drawing them first", Towards Data Science, June 2020.
[5] Sara A. Metwalli, blog on "Data Visualization 101: 7 Steps for Effective Visualizations", Toward Data Science, September 2020.
[6] Ritwik Sinha, journal on "Adopting Analytics With Big Data", Amity Journal of Computational Sciences, June 2021.
[7] Georgin Lau and Lei Pan, blog on "A 5-step guide to data visualization", Elsevier Connect, Janurary 2015.
[8] Ann Emery, blog on "Why Your Audience Matters in Data Visualization", Techchange, May 2015.
[9] Upasana, blog on "All You Need To Pick The Right Tableau Product!", Edureka, November 2020.
[10] Jami Oetting, blog on "Data Visualization 101: How to Choose the Right Chart or Graph for Your Data", HubSpot, Originally published Nov 9, 2020 10:27:00 PM, updated June 09 2021.
[11] Bernard Marr, article on "The 7 Best Data Visualization Tools Available Today", Forbes, July 2017.
[12] Abhishek Dand, article on "Power of Visualization and Getting Started with PowerBI", Data Science Blogathon, Analytics Vidhya, May 2021.
[13] Data Flair Team, blog on "Qlik Sense Tutorial For Beginners – Features and Architecture", Data Flair, Janurary 2019.
[14] Daniel Cohen-Dumani, blog on "Free Vs. Paid Power BI: Which One Should You Choose?", Withum, July 2021.