Data Visualization Techniques – A Survey

Faiza Nazeer[1], Nadia Nazeer [2] and Iqra Akbar[3]

[1]Faiza Nazeer, CS&IT Department, Govt. College Women University Sialkot, Sialkot Pakistan

[1]Faiza.nazeer@gcwus.edu.pk

[2]Nadia Nazeer, CS&IT Department, Govt. College women University Sialkot, Sialkot Pakistan

[2]nadianazeer5@gmail.com

[2]Iqra Akbar, CS&IT Department, Govt. College women University Sialkot, Sialkot Pakistan

iqraakbar7@gmail.com

ABSTRACT

Data Visualization is a newly area in Information technology. It is presented by Human computer Interaction field. Data visualization has many gains in technologies because it is an easy way to represent more complex data in the form of graphics. Data visualization is used to show the relationship among datasets. Data Visualization makes it potential for psychoanalyst, novice consultation, researchers, and the technologist to get in sight in these data in an effectual and good manner, the special potentialities of the human optical system, which allow to find fascinating characteristic and clog in less time. There are wads techniques to represent data in the form of graphics such as Graphs, Charts, Maps and Images etc. This paper proposes a review of data visualization basic concept, effectiveness of data visualization, techniques, limitation of techniques and comparison of techniques and research on the New Data Visualization techniques.

Index Term— Data visualization, Techniques, Datasets, Graphics, Effectiveness and Comparison.

1. INTRODUCTION

In the mid-1980s the area of visualization separate from computer graphics to discern graphics added from scientific and engineering data. A foster partition took place in the early 1990s to discern scientific, or physically established, data from intellectual "information visualization. The leading publishing locales for research in visualization are the IEEE Visualization [1]. Visual theatrical performance can help figuring out problem and find by rendering a structure for showing and conveying intending of extremely abstract data [8]. Speaking about graphics, we ought to cue graphical attributes and entities. While visualizing, usually we only get the complying graphical attributes and entities to choose from (while not fixed to). Entity: line (curve), glyph, solid, surface, point, image, polyline, text Attribute: strength/color, style, size, location, and corresponding position/motion. In reality "data" have approximately particular type [2]. To produce visual images visualization utilize computer graphics which support in the translating of composite, frequently theatrical performance of data [3]. Data Visualization: Visualization-founded data find answer that provide extremely interactive and graphical user interfaces, are constructed on in-memory architectures. By a broader range of employees than traditional business analysis tools these answer generally enable users to search data without practically training and making them reachable [4]. Data visualization usual techniques are

Line Charts, Bubble Charts, Bar Charts, Scatterplots, Pie Charts, Images and maps [3].

2. LITERATURE REVIEW

To understand data by diagrams and maps visualization used in china as early as 1137. In all fields there has been vast Development in visualization techniques. To examine information and data visualization help to visualize and express ideas in architecture. With the coming of computer simulation visualization pertinence has been foster

strengthened. A wide assortment of computer based tool in constructing design into CAD (Computer Aided Design) design is provided by T. Hong et al. (2000). The use of CAD for seeing design has been adopted exceedingly quickly by Professional throughout the world. Information visualization used to present design data with the aid of drawings and diagrams and data is usually conceptual or special, we require scientific visualization techniques like charts and graph etc. An unlined transfiguration from manual to digital technique in the erect design visualization has followed the presently dominating norms of visualization. There is a conterminous motive to further inquire the subsisting and new methods of visualization that efficaciously present multidimensional data. The visualization scheme should gain from manual methods where potential to aid designers make a conversion from their practice. Visualization should have power to present multidimensional data and it must be synergistic and permit efficacious communication. Using color coding and layering site analysis data is presented on the drawing with the power of controlling the visibility of layers as craved by the designers [5].

The domain of visualization grows, the instrument are striving users originate in our research laboratories. In dictate to confront accomplishable manifest of assessable gain that will promote more far-flung acceptance of visualization in which the serviceability ascertained experiments and studies reports are useful merely there is an arising want as substitute method of rating [6]. Information visualization commonly part of some originative action that needs user to construct hypotheses, searches patterns and exclusion, and the polish their hypothesis. User frequently require to view the similar data from dissimilar linear perspective and above a years. They might require a kind of instruments to attain their aims, insistently importing and exportation of data. Researchers depict egressing research which appears easily accommodated to examine the originative actions that user of information visualization pursue in. To help the goals of visualization of information the ethnographic methods visualized. To determine the advantages and disadvantages of their new visualization of information tool the developer or investigator are keen [7].

The visualization community has latterly found dissever above the measures and effect of inordinate graph decoration and notation. Visualization experts such as Stephen Few and Edward Tufte encouraged the conventional view, contains that the visualization should present the data clearly without any perturb and should not include chart junk [8, 9]. Psychology lab studied has also been supported this view, which present that simple and clear visualization are easy to interpret. Memorability experiment result shows that visualization are as such memorable with consistency over people. Visualization are less unforgettable than instinctive scenes but like to pictures of faces, which might clue at general nonfigurative, characteristics of human retention. Not astoundingly, ascribes such as comprehension and color of a human recognizable aim increase memory power. Creating a visualization unforgettable intends creating the visualization “stick” in the spectator minds. We require the most significant applicable facets of data the writer is attempting to transmit to stick [10].

The expedition of big data band is significant but hard trouble. Visualization of information technic might assist to figure out the trouble. Expedition of visual data has lots of applications like data mining and fraud detection utilize visualization of information technique for mended data analysis. Expedition of visual data commonly permits a quicker data expedition frequently supplies more beneficial result, particularly in instances where reflex algorithms flunks. In the determinations of the exploration visual data expedition technics furnish an often higher level of assurance. This information extends to an eminent requirement for visual expedition technics and constructs them essential in colligation with automatic expedition technics. Information visualization concenters on data sets deficient underlying Two-Dimensional (2D) or Three-Dimensional (3D) substance and therefore as well as deficient a measure representation of the nonfigurative data onto the forcible screen. For visualization there a lot of long-familiar methods for data sets are x-y plots, histograms, and line plots. These methods are utile for data expedition but are restricted to comparatively minor and small dimensional data bands. [11].

Data visualization instantly gain from development in technology that extend innovational ways of showing complex data. Data visualization cover geographical information system, graphical user interface, digital images, graphs, multidimensional tables, virtual reality and three-dimensional

animation. By furnishing a system for showing and conveying proposing of extremely précis data visual representations can help problem licking and finding. Visualization possibly permits decisiveness makers to feat their born visual power. The visualization utilized suitably, can permit the decisiveness maker to determine the information in that data. Visualization is a procedure for translating data into figure that permit various exploiter to perceive and act with data more efficaciously. New data is piece of an information realism surroundings that increase seeing of any visual representation. The graphical representation of data should not permitted to become too 'clever' for the user to understand. The use of three-dimensional representation is the main pertain. This restraints that necessity spatial part of 3D display and therefore the related information. There is known restriction of the exploiter in existing capable to absorb and litigate the data when constituted in this way. There is a want to bring in a substantial degree of interaction which arouse the stage of tech that would be needed to data visualization to deal with these emerges [12].

Visualization technique construct vast and complex information understandable. Information visualization is an ocular interface that allow for insight of information to the exploiter. To construct things easy to translate and construe and easy to use. In order to accomplishing the visual representation all serviceability emerge are significant to think about. The access of contriving substantially visualization the procedure can be classified into dissimilar steps such as selection, presentation, mapping, usability, evaluation and interactivity, which describes main actions regarding visualization to direct exact and perfect design. Visualization techniques are classified differently, there is three classes of visualization i.e. scientific visualization, information visualization and software visualization. There are many formal data visualization techniques such as table, pie chart, bar chart, histograms, bubble chart, area chart and line chart. To start the basic of visualization for the next generation, keeping in mind the meaning of visualization. The business sector even generally dismiss misinterpret, utilized in ineffective data and information visualization, which extends to the overall less output. To transmit the determination of vast or very vast data set that is not easy to interpret under custom approaches animated and interactive visualization is more advantageous [13].

Position of visualization, right direction of field, all possible way to display data and best way to understand the visualization field. When the NSF report on the VISC come out in 1987, there were high expectations and the visualization was took for the scientific process as an essential. But now visualization has become more advance. Define problems divided in to 7 section. In the 1 section, importance of visualization which is measured by the efficiency and effectiveness is defined. In the 2 section, background of the visualization discussed. In the 3 section, a model is proposed for the cost estimation of visualization. In the 4 section, various aspects of visualization discussed, in the section 5, visualization applied on different classes and understand some classes of method have not success on this. In the 6 section, alternative views of visualization are discussed. In the section 7, there is conclusion [14].

Visualization can be used for decision making and data analysis. People interaction with visualization tool has strongly effect on the understanding of data and system functions. Therefore human interaction contribute significantly role in the valuation and design of visualization tool. Visualization help human to display data as a graphics. And this can also called cognitive support. In a table there are different mechanisms summarized which explore the advantages of perception of human such as increased resources, reduced search, enhanced recognition, perceptual monitoring and manipulate medium. The first one is a review on the recognized methodology of human factor especially focused on visualization research. Second, described the review on the current human factor in visualization research that provide base for the future research. In the third one describe the area in which future research is possible [15].

While there are number of frameworks exist of information visualization, different visualization techniques and data analysis strategies, but still data visualization is difficult process. A new framework that is create for analysis and for user to visualize snort result by using data visualization techniques. The new framework propose PHP and CSS as visualize technique [16].

Navigation techniques and graph visualization which are used in information visualization. Information demonstrate by the graph visualization. It handling the information visualization

by using graph visualization techniques. This survey especially focused on key issues in the graph visualization and graph layout in which include background of graph drawing, traditional graph layout, spanning trees, 3D layout and hyperbolic layout [17].

3. RESEARCH METHOD

This research will conduct by following few steps. Firstly fill questionnaire, secondly comparison of data visualization techniques and at the last define new data visualization technique. A survey is conducted to propose a new data visualization technique. And for this purpose design a questionnaire. Through from this questionnaire large amount of data was collected about Data Visualization. Questionnaire is filled by different fields of people such as students, software engineer, assistant professor, uneducated people and Govt. officer. The questionnaire is provided here:

https://docs.google.com/forms/e/1FAIpQLSdtpCrGSgm97i12jRvU7McYf7KCHu6O1P2cF6Gkeh1tUPeQ/viewform

In this survey 90% participants are in the favor of Data visualization. They prefer visualization best to understand rather than text because it is easy to understand and our brain grasp quick attention to it. It helps to understand data well at a glance. Data should be visualized in image form rather than charts. Text with the image increase the effectiveness of visualization. And it is best if animated Table-1: Result

New visualization techniques should be more attractive, better quality and in high resolution image form. And text should also be included with the image to help complete understanding.

Visualization used for data visualization. The result of this survey is as follows:

Questions	Result
Data is Communicated more conveniently with	Visuals
Best Visualization Technique	Image
Visualization color should be	Dark
Effectiveness of visualization increase with	Text
Vector increase effectiveness of visualization	Yes
Resolution matter	Yes
Illusion occur	Yes
Visualization Size should be	Large
Understanding Increase with	Animated Visualization
Our brain respond well to visuals because	It's easy to understand and remember, grasp our attention
Design of visualization should be	As an image with text, animated visualization
Commonly techniques used in visualization	Image
Better chart type	Pie chart
Visualization is better medium for communication	Yes
Better tool for visualization	Adobe Photoshop
New visualization technique should be	More attractive, better quality and high resolution image form

4. CONCLUSIONS

Data visualization is displaying data in the graphics form so that it can be easily understandable. Different data visualization techniques are used to display data in visual form. This paper define the literature review on data visualization techniques. This research was made by filled questionnaire. This research study provide best knowledge to the beginners who are willing to work on data visualization techniques. This paper provide best understanding about the concept of data visualization techniques. This paper define which visualization techniques is best. The result of research study is that new visualization technique should be an image form.

5. ACKNOWLEDGMENT

This research has been completed by the co-operation of various

persons to whom credit is given. Responders of the questionnaire gave their precious time and proper information by filling this questionnaire which helps in getting the required information for this paper.

REFERENCES

[1] Maureen Stone, "Information Visualization: Challenge for the Humanities"

[2] Matthew Ward, "Overview of Data Visualization", from www.cs.wpi.edu

[3] Jerzy Stefanowski, Instytut Informatyki, "Data Visualization or Graphical Data Presentation".

[4] Paul kent, data visualization: "Making Big Data Approachable and Valuable".

[5] Shweta Srivastav, Simon Lannon, Donald k. Alexander, and phil jones, "A Review and Comparison of Data Visualization Techniques Used in Building Design and in Building Simulation", Eleventh international Ibpsa conference Glasgow, Scotland, 2009

[6] Plaisant, C. "The Challenge of Information Visualization Evaluation", Proc. of Conf. on Advanced Visual Interfaces, ACM, New York (2004), 109-116.

[7] Ben Shneiderman, Catherine Plaisant, Strategies for Evaluating Information Visualization Tools: "Multi-dimensional In-depth Long-term Case Studies", Proceedings of the BELIV'06 workshop Advanced Visual Interfaces Conference 2006, Venice

[8] S. Few. Benefitting infovis with visual difficulties? Provocation without a cause. "Visual Business Intelligence" Newsletter, 2011.

[9] S. Few. The chartjunk debate: "A close examination of recent findings. Visual Business Intelligence" Newsletter, 2011.

[10] Michelle A. Borkin, Student Member, IEEE, Azalea A. Vo, Zoya Bylinskii, Phillip Isola, Student Member, IEEE, Shashank Sunkavalli, Aude Oliva, and Hanspeter Pfister, Senior Member, IEEE, "What Makes a Visualization Memorable?", Manuscript received 31 March 2013; accepted 1 August 2013; posted online 13 October 2013; mailed on 4 October 2013.

[11] Daniel A. Keim, "Information Visualization And Visual Data Mining", "Ieee Transactions On Visualization And Computer Graphics", Vol. 7, No. 1, January-March 2002

[12] P. J. Sackett†, M. F. Al-Gaylani†, A. Tiwari*† And D. Williams, "A review of data visualization: opportunities in manufacturing sequence management", International Journal of Computer Integrated Manufacturing, Vol 19, Is 7 October 2006, pg. 689-704

[13] Muzammil Khan, Sarwar Shah Khan, Data and Information Visualization Methods, and Interactive Mechanisms: "A Survey, International Journal of Computer Application" (0975-8887), Volume 34– No.1, November 2011

[14] Jarke J. van Wijk∗, "The Value of Visualization, IEEE Visualization" 2005 October 23-28, Minneapolis, MN, USA 0-7803-9462-3/05/$20.00 ©2005 IEEE.

[15] Melanie Tory And Torsten Moller, Human Factors In Visualization Research, "Ieee Transactions On Visualization And Computer Graphics", Vol. 10, No. 1, January/February 2004

[16] Alaa El - Din Riad, Ibrahim Elhenawy, Ahmed Hassan and Nancy Awadallah, "Data Visualization Technique Framework for Intrusion detection".

[17] Ivan Herman, Member, IEEE Computer Society, Guy MelancËon, and M. Scott Marshall, Graph Visualization and Navigation in Information Visualization: "A Survey, Ieee Transactions On Visualization And Computer Graphics", Vol. 6, No. 1, January-March 2000.

