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Exploring the Information Requirements for Data Visualization Tools Among Science Faculty

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Abstract : *In the digital era, the information services pattern of academic libraries has changed. The information needs of academic libraries are not only for books and reference sources; now it's beyond that. The science faculty have various types of data, for example, experimental and laboratory data, numerical data, time series data, geospatial data, image and microscopy data, simulation and computational data and biological or genomic data. The science faculty have found difficulty in visualizing this data. Academic libraries have provided these data visualization services to science faculty users with the help of data visualization tools. This research paper focuses on raising awareness of these data visualization tools among science faculty and also focuses on best practices of academic libraries regarding providing data visualization tools services.*

Key Words: Exploring the Information Requirements for Data Visualization Tools Among Science Faculty

1. INTRODUCTION

The information needs are different from library user to library user. Each subject has separate information needs in academic environments. Academic libraries always try to satisfy each user's information needs through their services and best practices. Science faculty have various types of data, such as experimental and laboratory data, numerical data, time series data, geospatial data, image and microscopy data, simulation and computational data and biological or genomic data. This data is helpful in teaching, research, decision making and the development of scientific knowledge in their respective disciplines. Academic libraries are now known as information resource centers. Academic libraries have changed their functions and services with the help of information communication tools.

II. VARIOUS TYPE OF DATA

Experimental and laboratory data

Experimental data refer to the measurements and observations collected during experiments, such as protein concentrations or gene expression levels, which are utilized to inform and validate models of biological systems. This data must be annotated with comprehensive details about the experimental context to facilitate reproducibility and integration across different studies.

Statistical and numerical data

Statistical and numerical data are dealing with the numbers. This numbers represents a measurable and countable quantity. Statistical and numerical data helps to support arithmetic's. This data easy to visualized in various forms for example histograms, dot plots, scatter plots and box plots. There are various example of statistical and numerical such as age, height, length, speed, weight, IQ score, census ete. Numerical variables were considered continuous variables.

Time-series data

Time series data is measurable and trackable data of regular intervals like second, hours day and years. In time series analysis, analysts record data points at consistent intervals over a set period of time rather than intermittently or randomly. However, this type of analysis is not merely the act of collecting data over time.

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Geospatial data

Geospatial data is any data regarding an object, event, or phenomenon relative to its location on the Earth's surface and near the earth. It can also include more details than just an address or coordinates, such as timestamps, categorization, and other attributes. In simple terms, geospatial data connects information to a physical place, allowing analysts to study how events, objects, and activities relate to specific geographic locations.

Image and microscopy data

Microscope images are visual representations obtained through a microscope, which are essential for quantitative analysis in research and critical for image processing in various scientific applications.

Simulation and computational data

Data simulation is the process of generating synthetic data that closely mimic the properties and characteristics of real-world data. Simulated data has the advantage of not needing to be collected from surveys, monitoring software, or by scraping websites—instead, it's created via mathematical or computational models, offering data scientists, engineers, and commercial enterprises access to training data at a fraction of the cost.

Biological or genomic data

Genomic data refers to information about an organism's complete set of DNA, including all its genes. This data helps in understanding genetic variations, disease predispositions, and personalized medicine approaches. Genomic data are used in medical research, personalized medicine, genetic testing, biotechnology, and ancestry tracing. They help in diagnosing diseases, developing targeted therapies, and understanding evolutionary biology.

III. SCIENTIFIC DATA VISUALIZATION TOOLS

1) OriginPro-

OriginPro Software developed by OriginLab Cooperation. Its founded in 1992 by C. P. Yang. Its basically developed for handling large data sets, perform complex statistical analysis. This software creating visualization including advanced plotting, curve fitting and statistical tests. Its enable users to create quality 2D and 3D graphs.

2) GraphPad Prism

GraphPad Software, Inc. was developed the Graphpad Prisam software. This is founded by Dr. Harvey Motulsky. This software basically developed for statistical analysis and graphing of Scientific data. This software is developed for scientists and researchers for biostatistics, curve fitting and scientific graphing.

3) R

R software basically developed by two statistician Ross Ihaka and Robert gentleman at university Auckland in 1990s. now its manage and actively developed by R Development core team. The R software developed for academics, researchers, healthcare's, bioinformatics, financers, Tech and social media users. R comes built-in with an extensive array of statistical functions. It is widely used to run classical statistical tests, linear and non-linear modeling, time-series forecasting, and data clustering.

4) MATLAB

It is programming and numeric computer platform. This platform is used for engineering and scientific application. MATLAB is used for data analysis, signal and image processing, control system, wireless communication and robotics. This tool basically used for automatically generate embedded code.

IV. BEST PRACTICES OF ACADEMIC LIBRARIES TO PROVIDE DATA VISUALIZATION TOOLS SERVICES

1) Consultation Services

Academic libraries have expanded their traditional information and reference services to include data visualization consulting, supporting researchers, faculty members and students in analyzing, interpreting and communicating complex data. These services help library users select appropriate visualization tools, prepare and organize datasets,

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develop effective charts and graphs, and present research findings in a clear and meaningful manner. Data visualization consulting also promotes data literacy and strengthens the role of academic libraries in the research process.

2) Hands-on Training and Workshops

SRM Institute of Science and Technology and NobleProg India provide hands-on training and workshop sessions to library users on various data visualization tools. These programmes help students, research scholars, and faculty members gain practical knowledge of visualization software, its features and techniques. Through demonstrations and practical exercises, users learn to create charts, graphs and dashboards, thereby enhancing their ability to analyze and present scientific and statistical data effectively.

3) Data documentation and creation of scientific data.

Scientific research generates large volumes of raw and processed data that require proper documentation and systematic file creation. Academic libraries assist researchers in organizing, labeling and managing scientific data to ensure easy identification and retrieval. Proper documentation includes recording data descriptions, collection methods, file formats and relevant metadata. This practice helps maintain data accuracy, supports research reproducibility and facilitates the effective use of scientific data for analysis and future research.

4) Awareness of Data visualization open sources software

Academic libraries create awareness among library users about open-source data visualization software through LibGuides and other online resources. These guides provide directories of freely available visualization tools, their features, and step-by-step instructions for using the software. They help students, research scholars and faculty members learn how to create charts, graphs and interactive visualizations for academic and research purposes. Such initiatives promote the effective use of open-source tools and support researchers in presenting scientific and statistical data clearly.

5) Research communication and publication

Processed scientific data and visualizations help researchers in decision-making, knowledge development, and effectively communicating research findings. The proper publication of research data through scholarly journals is therefore essential. Academic libraries can support science faculty by guiding them in selecting suitable research journals, preparing data and visualizations for publication, and following appropriate publication standards. This support helps researchers communicate their findings clearly and increases the accessibility and visibility of their research.

V. CONCLUSION

Academic libraries provide a so many specialized services to support the teaching, learning and scientific information needs of their library users. Data visualization has emerged as an important library service, particularly for science faculty and researchers who work with large and complex datasets. Several academic library institutions, such as Duke University in the United States and leading Indian institutions, including the Indian Institutes of Technology (IITs) and Indian Institutes of Management (IIMs), have developed data visualization support services for their users. In addition, numerous open-source data visualization tools are freely available on the internet. Academic libraries can utilize these tools to provide training, consultation and technical support to science faculty, enabling them to analyze, interpret and communicate scientific data effectively. Such services can strengthen the role of academic libraries in supporting research and promoting data-driven scholarly communication.

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