Research Problems That Visualization Can Uncover

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The Visual Communications of data visualization has been around for a very long time arguably from the Stone Age when primitive people were writing and depicting images on walls to our modern digit. The use of visual representations helps us explore and make sense of key metrics and data enabling us to communicate that data effectively. There are many fields closely related to data visualization such as information Graphics, statistical, and scientific visualization. Today in our modern world; companies and individuals have come to rely on data to make a detrimental business and personal decision making processes.

Today date realization is a fundamental part of scientific research there is an old saying that a picture is worth a thousand words and modern industry a picture is worth a thousand dollars, not more *(Kirk, 2012)*.

**Types of Visuals**

In the early days(and still today), the easiest and most common way to create a data visualization was to take the information from an Excel spreadsheet and transform it into a bar graph, pie chart, or table. This method is still extremely effective, but the art of data visualization has also come a long way in the past 20+ years.

**Nowadays you also have the option to create more intricate visualizations such as:**

* Bubble clouds.
* Bullet graphs.
* Heat maps.
* Radial trees.
* Infographics.
* And more…

The representation of data is the way you decide to depict data through a choice of physical forms. Whether it is via a line, a bar, a circle, or any other visual variable, you are taking data as the raw material and creating a representation to best portray its attributes .

The presentation of data goes beyond the representation of data and concerns how you integrate your data representation into the overall communicated work, including the choice of colors, annotations, and interactive features.

It helps to amplify cognition is about maximizing how efficiently and effectively we are able to process the information into thoughts, insights, and knowledge. Ultimately, the objective of data visualization should be to make a reader or users feel like they have become better informed about a subject.

Today we use intelligent Semantic Graph databases and other logical DBMS to collect and allocate petabytes (billons of data attributes) of raw data used for this purpose. The use of this graph methodology is for organizing and linking data and relational architecture is essential in making these graphs visual, data scientists can navigate the graph and dynamically uncover relationships when two nodes connect.

We can use statistical analysis to define linear relationships and dependencies of data on a massive level. Also, use the same mathematical concepts to implement and develop machines and deep learning processes and models. Transforming these mass amounts of data-points into useful graphic reports that have become part of the modern world and data-driven business. All which use this data to make important decisions.

**Here is a list of machine / deep learning statistical and linear analysis models used to process big data sets into information to be visualized.**

* Statistical fit
* Gradient descent
* Linear regression
* Logistic regression
* Linear discriminant analysis
* Classification and regression
* Naive Bayes
* Gaussian probability
* K-nearest Neighbors
* Vector quantization
* Support Vector machines
* Graphs
* Decision trees
* Random Forest
* Convolutional Neural Network
* Recurrent Neural Networks
* Long Short-Term Memory Networks
* Stacked Auto-Encoders.
* Deep Boltzmann Machine
* Deep Belief Networks

These models transform data collectively from applications and interfaces from users across the planet *(Brownlee, 2019)*. Turning data points into human-readable information.

One of the most compelling arguments for the value of data visualization is expressed in this quote from John W Tukey *(Exploratory Data Analysis).* The greatest value of a picture is when it forces us to notice what we never expected to see.

**Here are some of the steps and model’s data visualizations use to discover insight and ideas for improvement:**

**Predicting your Future Health Status**

Healthcare companies and providers are poised to benefit tremendously from uncovering connections within their data. Rather than relying on time-intensive, costly, and limited data marts, medical professionals can analyze and uncover useful connections hidden within huge amounts of data *(Langkafel, 2016).*

**Uncovering Business Tax Fraud**

Another example of using semantic graph visualization can reveal important relationships involves a tax business fraud case. In this investigation, a national tax authority recovered millions of Euros in tax fraud liabilities by using a platform consisting of a Semantic Graph database and an interactive visual navigation tool.

**Pinpoint emerging trends**

Using data visualization to discover trends – both in the business and in the market – can give businesses an edge over the competition, and ultimately affect the bottom line. It’s easy to spot outliers that affect product quality or customer churn, and address issues before they become bigger problems.

**Identify relationships and patterns**

Even extensive amounts of complicated data start to make sense when presented graphically; businesses can recognize parameters that are highly correlated. Some of the correlations will be obvious, but others will not. Identifying those relationships helps organizations focus on areas most likely to influence their most important goals.

**Communicate the story to others**

Once a business has uncovered new insights from visual analytics, the next step is to communicate those insights to others. Using charts, graphs or other visually impactful representations of data is important in this step because it’s engaging and gets the message across quickly.

Overall data visualization is responsible for the world as we know it. It is how we operate the business and personally. From applications that check our credit scores to visualizations in our bank accounts. Today board members and businesses reach milestones in growing their companies with data visualizations. Data visualization is an essential process, but before implementing data visualization new technology has to be implemented, and there are a few requirements that must be implemented *(TRAN & GINIGE, 2019).*

* Understand the data you are trying to visualize, including its size and cardinality (the uniqueness of data values in a column).
* Determine what you are trying to visualize and what kind of information you want to communicate.
* Know your audience and understand how it processes visual information.
* Use a visual that conveys the information in the best and simplest form for your audience.

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