DATA VISUALIZATION TECHNIQUES

(Professional Elective - III)

Course Code: KG21CD615

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B. Tech. III Year II - Semester

Prerequisites: A course on "Statistics with R"

Course Objectives: The objectives of this course for the student are to:

1. Understand various data visualization techniques.
2. Gain skills on both design and critique visualizations.
3. Understand role of visualization in data analysis.
4. Understand the components involved in visualization design.
5. Learn the data impacts in the type of visualization.

Course Outcomes: After completion of this course, the students will be able to

CO1: **Examine** and visualize the objects in different dimensions using visualization techniques.

CO2: **Design** and process the data for Virtualization.

CO3: **Apply** the visualization techniques in physical sciences, computer science, applied mathematics and medical science.

CO4: **Design** the virtualization techniques for research projects and applications.

CO5: **Solve** Problems by using visualization techniques.

UNIT-I

Introduction and Data Foundation: Basics - Relationship between Visualization and Other Fields - The Visualization Process - Pseudo code Conventions - The Scatter plot. Data Foundation - Types of Data - Structure within and between Records - Data Preprocessing - Data Sets.

UNIT-II

Foundations for Visualization: Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables - Historical Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson's Affordance theory – A Model of Perceptual Processing.

UNIT-III

Visualization Techniques: Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three Dimensional Data - Dynamic Data - Combining Techniques. Geospatial Data: Visualizing Spatial Data - Visualization of Point Data -Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial.

Data Visualization Multivariate Data: Point-Based Techniques - Line-Based Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks-Displaying Arbitrary Graphs/Networks.

UNIT-IV

Interaction Concepts and Techniques: Text and Document Visualization: Introduction - Levels of Text Representations - The Vector Space Model - Single Document Visualizations -Document Collection Visualizations – Extended.

Text Visualizations Interaction Concepts: Interaction Operators - Interaction Operands and Spaces - A Unified Framework. Interaction

Techniques: Screen Space - Object-Space -Data Space -Attribute Space- Data Structure Space - Visualization Structure - Animating Transformations - Interaction Control.

UNIT-V

Research Directions in Virtualization: Steps in designing Visualizations – Problems in designing effective Visualizations- Issues of Data. Issues of Cognition, Perception, and Reasoning. Issues of System Design Evaluation, Hardware and Applications.

TEXT BOOKS:

1. Matthew Ward, Georges Grinstein and Daniel Keim, "Interactive Data Visualization Foundations, Techniques, Applications", 2010.
2. Colin Ware, "Information Visualization Perception for Design", 2nd Edition, Margon Kaufmann Publishers, 2004.

REFERENCE BOOKS:

1. Robert Spence "Information visualization – Design for interaction", Pearson Education, 2nd Edition, 2007.
2. Alexandru C. Telea, "Data Visualization: Principles and Practice," A. K. Peters LTD, 2008.