Business Intelligence

ITD 111- Lecture 4 - Sentiment Analysis

Sentiment Analysis

Leveraging Opinion Mining to Drive Strategic Insights

• What is **Sentiment**?

• **Definition**: Sentiment refers to an emotional state or attitude expressed in text, speech, or other forms of data.

• **Types of Sentiment**: Generally classified as positive, negative, or neutral.

• **Significance**: Sentiment reveals subjective opinions and feelings, making it an essential factor in understanding customer perceptions and reactions.

• **Example**: In a product review saying, "I love this phone; the camera is amazing, but the battery drains fast," both positive ("love," "amazing") and negative ("drains fast") sentiments are present.

• What is **Sentiment Analysis**?

• **Definition**: Sentiment analysis is a process that uses natural language processing (NLP) and machine learning (ML) to detect emotions or opinions within text. It categorizes this sentiment as positive, negative, or neutral based on the language used.

• **Alternative Names**: Often called "Opinion Mining" or "Emotion AI" as it focuses on interpreting subjective information.

• **Why It Matters in Business Intelligence**: Sentiment analysis transforms large volumes of unstructured text data into actionable insights, allowing companies to understand public opinion and make data-driven decisions.

How Sentiment Analysis Adds Value in Business

• Key Value Drivers:

• **Enhanced Customer Understanding**: Identifies customer needs, preferences, and pain points.

• **Real-Time Brand Monitoring**: Tracks public perception and addresses issues quickly.

• **Personalized Customer Service**: Helps prioritize responses based on the intensity of customer sentiment.

• **Informed Strategic Decisions**: Shapes marketing, product development, and customer retention strategies.

Sentiment Analysis Use Cases

• **Retail**: Understanding product reviews to improve features and customer satisfaction.

• **Finance**: Using sentiment from news and social media to predict investor reactions and stock trends.

• **Telecommunications**: Monitoring customer service sentiment to optimize support efforts.

Types of Sentiment Analysis in Detail

• **Fine-Grained Sentiment Analysis**

  o **Objective**: Classifies sentiment on a scale (e.g., very positive, positive, neutral, negative, very negative).
  o **Example Use Case**: Product review analysis to identify overall satisfaction levels and specific complaints.

• **Aspect-Based Sentiment Analysis**

  o **Objective**: Focuses on sentiments related to distinct product features or aspects.
  o **Example Use Case**: Restaurant review analysis where feedback is divided into specific aspects such as food quality, service, and ambiance.

• **Multilingual Sentiment Analysis**

  o **Objective**: Processes sentiment in multiple languages, retaining accuracy without translation.
  o **Example Use Case**: Global brand monitoring to understand opinions from diverse language groups on platforms like Twitter.

• **Emotion Detection Analysis**

  o **Objective**: Goes beyond positive/negative to capture complex emotions (joy, frustration, anger, excitement).
  o **Example Use Case**: Analyzing customer responses to a product recall, capturing emotions such as frustration or relief.

Key Steps in Conducting Sentiment Analysis

• **Tokenization**: Dividing text into words or phrases.

• **Stop-Word Removal**: Filtering out non-informative words (e.g., "the," "and").

• **Lemmatization & Stemming**: Reducing words to their base forms for consistency (e.g., "running" to "run").

• **Feature Extraction**: Identifying key terms with strong sentiment relevance (e.g., "happy," "frustrated").

• **Business Relevance**: Improves data quality, accuracy, and interpretability, making sentiment analysis results more actionable for business use.

The Role of Sentiment Analysis in Business Intelligence

• **Customer-Centric Decision-Making**: By understanding customer attitudes, businesses can tailor products, marketing, and services to meet customer expectations.

• **Reputation Management**: Continuous monitoring of customer feedback helps address issues before they escalate, maintaining a positive brand image.

• **Operational Efficiency**: Systems can prioritize critical customer issues based on sentiment, allowing teams to respond faster to dissatisfied customers.

• **Example**: Banks use sentiment analysis in customer support to detect dissatisfied customers, providing a mechanism to quickly address complaints.

Future Advancements in Sentiment Analysis

• **Emotion-Sensitive Models**: Advancements in deep learning (e.g., RoBERTa) for recognizing nuanced emotions.

• **Real-Time Sentiment Analysis**: Developments in live analysis for instant customer feedback responses.

• **Applications in Emerging Fields**: Sentiment analysis applied to mental health monitoring, AI-driven assistants, and personalized marketing.

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Data Visualization

ITD 112- Lecture 7 - Interactivity

Interactivity

• **Definition**: An essential feature in data visualizations that allows users to engage with the data in real-time, adapting the view and revealing new information through user actions.

• Why Interactivity Matters:

- o Enhances **user engagement** and makes data exploration **user-driven.**
- o Encourages deeper **insight discovery** by allowing users to filter, zoom, or sort information.
- o **Personalization**: Users tailor data views to their specific questions or needs
- o

Core Purposes of Interactivity

• **Data Exploration**: Allows viewers to uncover trends, patterns, or anomalies on their own.

• **Decision Support**: Interactive elements like filters and tooltips assist in informed decision-making.

• **Engagement**: Dynamic, interactive content increases engagement over static content.

• **Educational Value**: Users can self-learn through exploring how data points relate to each other.

Types of Interactivity in Data Visualization

• **Tooltips**: On-hover text boxes reveal additional information about a data point.

• **Filtering**: Enables users to select specific data segments based on categories or timeframes.

• **Sorting**: Allows ordering of data by value or category to show different perspectives.

• **Drill-Down**: Clicking on a data point reveals more granular details.

• **Zooming and Panning**: Provides detailed views by zooming into maps or timelines.

• **Highlighting and Linking**: Highlights related data points and shows connections across visual elements.

Levels of Interactivity

• **Basic Interactivity**:

- o Examples: Tooltips, simple hover effects, basic filters.
- o Purpose: To add minimal dynamic elements without overwhelming users.

• **Advanced Interactivity**:

- o Examples: Drill-downs, dynamic animations, complex filtering, and linking cross multiple charts.
- o Purpose: For audiences that need deep data exploration, often in specialized or analytical contexts.

Designing Effective Interactive Systems

• **User-Centered Design**: Understanding who the users are and tailoring interactivity for their skill level and needs.

• **Progressive Disclosure**:

- o Reveal information progressively to avoid overwhelming users
- o Example: Show an overview first, with drill-down options to see details.

• **Feedback and Responsiveness**:

- o Include feedback (e.g., visual changes) when users interact with elements.
- o Ensure interactive elements respond quickly for a seamless experience.

Key Principles for Interactive Design

• **Purpose-Driven Design**: Only include interactions that support the visualization's purpose.

• **Intuitive Controls**: Use familiar icons and controls for interactive elements (e.g., zoom icons, drop-down menus).

• **Clarity and Accessibility**:

- o Ensure that interactivity is understandable and usable for all, including keyboard navigation and screen reader support for accessibility.

• **Responsiveness**:

- o Design interactivity for different devices and screen sizes to ensure smooth interaction.

Examples opf Interactive Visualizations

• **COVID-19 Dashboards**: Interactive maps with drill-downs to local levels, date filters, and case count hover tooltips.

• **Financial Reports**: Interactive line charts with time-based animations or customizable date filters.

• **Retail Data Dashboards**: Use of sorting and filtering to compare products, regions, and sales figures.

LINKS:

• https://visme.co/blog/best-data-visualizations/

• https://coronavirus.jhu.edu/map.html

• https://covid19.gov.ph/health/epidemiological-data-analytics

• https://www.tableau.com/10-dashboards-every-retailer-should-use

• https://www.qlik.com/us/dashboard-examples/financial-dashboards

User Experience and Interactivity Challenges

• **Avoiding Overload**: Too much interactivity can be overwhelming or confusing.

• **Device Compatibility**: Ensuring elements work well on mobile, desktop, and tablet screens.

• **Accessibility Concerns**: Interactive visualizations must be navigable for all users, including those with disabilities.

• **Performance Optimization**: Interactivity can strain resources if not optimized, leading to slow or lagging experiences.

Interactive Data Visualization Tools

• **Programming Tools**:

- o **D3.js**: Customizable and powerful for web-based interactivity.

- **Plotly**: JavaScript library that integrates well with Python, R, and other languages.

- **Non-Coding Platforms:**

  - **Tableau**: User-friendly, drag-and-drop, ideal for business applications.
  - **Power BI**: Robust for enterprise-level data visualization, supports advanced interactive dashboards.
  - **Google Data Studio**: Quick to use for interactive reports and sharing

Practical Example Walkthrough

- **Example**: Sales Performance Dashboard

- **Interactive Elements**: Date filter, regional filter, tooltips with sales data, drilldown to product categories.

- **Value**: Enables users to assess sales by time, location, and category, facilitating insights into regional and seasonal trends.

- **User Feedback**: Include response highlighting (color or bold changes) when filters or drill-downs are applied to improve clarity.

Interactive Visualization Design Tips

- **Start with a Clear Goal**: Define what questions or tasks the interactivity should address.

- **Balance Complexity and Simplicity**: Provide only the necessary interactive features.

- **Guided User Actions**: Help users understand available actions with tooltips, icons, or instructions.

- **Test with Real Users**: Gather feedback to see how easily users can engage with and understand the interactivity.

Avoiding Common Pitfalls in Interactive Visualization

- **Pitfall**: Overuse of Animations - Can detract from the clarity of data.

  - **Solution**: Use subtle transitions and minimize animation unless it enhances comprehension.

- **Pitfall**: Poorly Designed Tooltips - Too much text or cluttered formatting.

  - **Solution**: Keep tooltips concise, and only include essential information.

- **Pitfall**: Non-Intuitive Controls - Users don't understand how to interact with the data.

  - **Solution**: Ensure controls are easy to find, clearly labeled, and use familiar icons.

Key Takeaways

- Interactivity in data visualization turns static data into dynamic, user-driven experiences.

  - It requires thoughtful design to enhance clarity and usability without overwhelming users.
  - Prioritize purpose-driven design, test for usability, and ensure accessibility.

- Purposeful interactivity can drive meaningful insights and empower users to make data-informed decisions.

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Annotation

- **Definition**: Annotation refers to the use of text, labels, and symbols in a visualization to clarify, guide, or emphasize aspects of the data.

- Purpose of Annotation:

  - Provides essential context (e.g., explaining trends).
  - Highlights key data points (e.g., marking peaks or troughs).
  - Assists viewers in understanding complex information (e.g., definitions or explanations)

Why Annotation is Essential

- **Clarity and Interpretation**: Annotations help interpret data by explaining complex points (e.g., marking a significant increase in sales).

- **Focus**: Directs viewers' attention to critical data points or trends (e.g., emphasizing a particular year in a time series).

- **Context**: Supplies background information to prevent misinterpretation (e.g., including sources of data).

- **Engagement**: Encourages viewers to interact more deeply with the data (e.g., by prompting questions).

Types of Annotations in Data Visualization

- **Labels**: Add specific details to data points (e.g., bar chart value labels).

- **Titles and Subtitles**: Describe the overall visualization purpose (e.g., "Sales Growth Over Time").

- **Captions**: Offer additional context or explanations below the chart (e.g., noting a data collection method).

- **Highlights and Callouts**: Emphasize important areas or outliers (e.g., using arrows to point out extreme values).

- **Source Annotations**: Reference data origins or methods used (e.g., "Data from the Bureau of Economic Analysis").

Annotation Placement and Design

- **Consistency**: Use consistent fonts, colors, and sizes to maintain a clean look (e.g., all labels in the same font style).

- **Hierarchy**: Establish an information hierarchy with titles larger and subtitles smaller (e.g., main findings in bold).

- **Placement**:

  - Position annotations to avoid overlapping data (e.g., placing labels above bars).
  - Align labels for enhanced readability (e.g., left-align text for consistent presentation).

Effective Use of Labels

- **Data Labels**: Show values directly on bars, points, or lines for clarity (e.g., displaying exact sales figures).

- **Axis Labels**:

  - Ensure labels are descriptive yet concise (e.g., "Monthly Sales in USD" rather than just "Sales").

- o Use rotated or angled labels to avoid clutter if necessary (e.g., slanted text for densely packed data).

• **Legend Labels**: Group data into easily recognizable categories (e.g., using colors consistently across the chart).

The Role of Titles and Subtitles

• **Titles**: Concise, descriptive titles help viewers quickly grasp the visualization's purpose (e.g., "2023 Quarterly Sales Overview").

• **Subtitles**: Provide additional context or clarify the title, aiding understanding (e.g., "Comparison of Q1 to Q2 Performance").

• **Best Practices**:

- o Use simple language and avoid jargon (e.g., "Sales Performance" instead of "Sales Metrics Analysis").
- o Make titles insightful, not just descriptive (e.g., "How Seasonal Trends Affect Sales").

Using Callouts and Highlights

• **Purpose**: Callouts draw attention to important insights or outliers (e.g., noting a significant drop in revenue).

• **Design Tips**:

- o Use contrasting colors or shapes (e.g., circles or arrows) for callouts to ensure they stand out.
- o Keep callout text concise and relevant (e.g., "Peak sales during holiday season").

• **Examples**: Highlighting a sudden trend change in a line chart to emphasize a shift.

Contextual and Explanatory Annotations

• **Explanatory Text**: Adds background information on complex data points (e.g., explaining why sales dipped in a certain month).

• **Annotations for Context**:

- o Contextualize unusual trends or outliers (e.g., linking a dip in sales to external factors like economic conditions).
- o Examples: Notes on significant events impacting data trends (e.g., "COVID-19 lockdown impact in March 2020").

Balancing Annotations with Data Integrity

• **Avoid Overloading**: Too much annotation distracts from the data (e.g., too many callouts can make the chart busy).

• **Simplicity**: Focus on annotations that enhance comprehension without clutter (e.g., only annotate critical data points).

• **Prioritizing**: Only highlight data points or trends that are essential for interpretation (e.g., only mark major events).

Best Practices in Annotation Design

• **Conciseness**: Keep annotations brief but informative (e.g., 1-2 sentence maximum).

• **Strategic Placement**: Position annotations thoughtfully to minimize overlap with data (e.g., place below a graph).

• **Readability**: Use legible fonts and avoid excessive abbreviations (e.g., "thousand" instead of "K" unless common).

• **Visual Consistency**: Match annotation style with the rest of the design (e.g., color schemes and font choices)

Common Pitfalls to Avoid

• **Crowding and Clutter**: Too many labels can overwhelm viewers (e.g., cluttered bar graphs).

• **Redundancy**: Avoid repetitive annotations that don't add value (e.g., multiple callouts on the same data point).

• **Overly Technical Language**: Make annotations accessible to all audience levels (e.g., avoid industry jargon).

Key Takeaways

• Annotations add depth, clarity, and context to visualizations.

• Thoughtful annotations enable audiences to gain insights efficiently without overwhelming them.
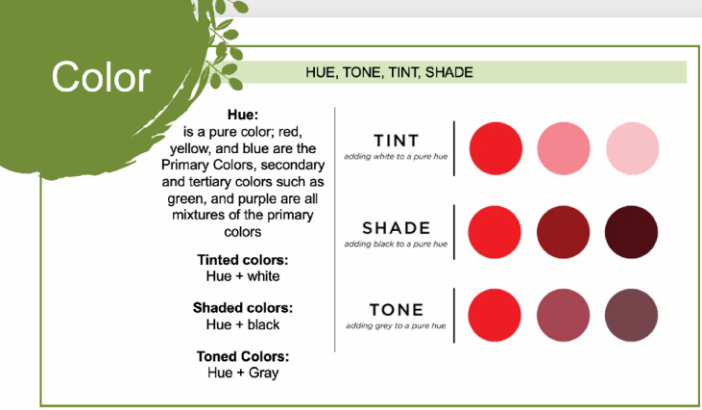
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Data Visualization

ITD 112- Lecture 9 – Colour

Importance of Colour in Data Visualization

• **Role of Colour:**

- o Helps differentiate and categorize data (e.g., blue for one category, orange for another).
- o Draws attention to specific information (e.g., highlighting trends).
- o Enhances visual appeal and understanding (e.g., attractive visual representations improve retention).

Principles of Colour Theory

• **Colour Properties:**

- o Hue: The color itself (e.g., blue, red).
- o Saturation: Intensity of the color (from dull to vibrant).
- o Brightness: Lightness or darkness of the color (e.g., pastel vs. dark colors).

• **Colour Harmony**: Combinations that are visually pleasing (e.g., complementary colors, analogous colors).

Color — HUE, TONE, TINT, SHADE

Hue: is a pure color; red, yellow, and blue are the Primary Colors, secondary and tertiary colors such as green, and purple are all mixtures of the primary colors

Tinted colors: Hue + white

Shaded colors: Hue + black

Toned Colors: Hue + Gray

TINT — adding white to a pure hue

SHADE — adding black to a pure hue

TONE — adding grey to a pure hue

Types of Colour Schemes

• **Categorical**: For distinct groups (e.g., different product categories).

  o **Example**: Each category is assigned a unique color.

• **Sequential**: For ordered data (e.g., light-to-dark for low-to-high values).

  o **Example**: Temperature maps where lighter colors represent lower temperatures.

• **Diverging**: For data with a midpoint or two extremes (e.g., profit vs. loss).

  o **Example**: Using red for losses and green for profits

Choosing Effective Colours
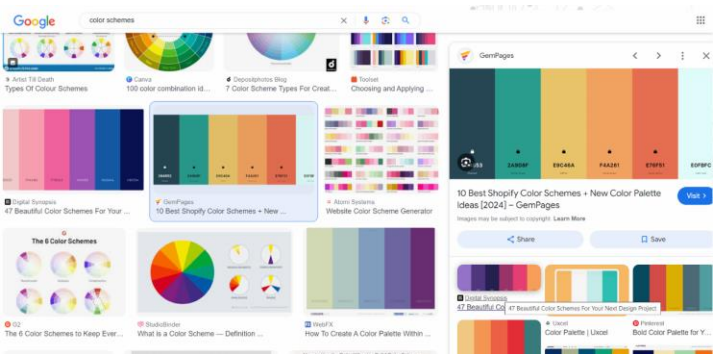
Choosing Effective Colours

• **Contrast and Legibility**: Ensure readability with contrasting colors (e.g., light text on dark backgrounds).

• **Avoiding Red-Green**: Consider colorblind accessibility; avoid red-green schemes for critical information.

• **Cultural Sensitivity**: Colors may have different meanings across cultures (e.g., white for purity in some cultures, but mourning in others).

Colour for Highlighting and Emphasis

• **Using Accents**: Use bright or contrasting colors to draw attention (e.g., bright yellow to highlight key figures).

• **Subtle Background Colors**: Use muted colors for background elements to enhance data visibility (e.g., light grays behind charts).

• **Consistency**: Maintain a consistent color scheme throughout the visualization to avoid confusion.

Accessibility in Colour Choice

• **Colour Blindness**: Use tools to check for accessibility (e.g., Color Oracle) and select colors that work well for all viewers.

• **High Contrast**: Especially important for text and small data points (e.g., black text on white background).

• **Alternative Textures or Shapes**: Use patterns or shapes to differentiate data when color alone isn't enough (e.g., stripes vs. dots).

Using Colour Effectively in Different Contexts

• Charts and Graphs: Use a limited color palette for clarity (e.g., no more than 4-5 colors in a pie chart).

• Maps: Sequential or diverging schemes work well for geographical data (e.g., using gradients to represent population density).

• Dashboards: Use color sparingly for readability across multiple visualizations (e.g., limit to 2-3 primary colors).

Common Colour Pitfalls

• **Overuse of Bright Colors**: Can make visuals hard to read (e.g., neon colors everywhere).

• **Inconsistent Color Use**: Confuses viewers; use a defined color key (e.g., blue always representing sales).

• **Ignoring Accessibility**: Leads to readability issues for colorblind users (e.g., relying solely on color to convey meaning).

Colour Tools and Resources

• **Online Tools**: Adobe Color, Colors for choosing palettes (e.g., creating color schemes based on mood).

• **Accessibility Checkers**: Sim Daltonism, Color Brewer for colorblind-friendly schemes (e.g., visualizing accessibility options).

Key Takeaway

• Effective use of color makes visualizations more engaging and easier to interpret.

• Thoughtful color choices can emphasize key insights and make data accessible to diverse audiences.

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Data Visualization

ITD 112- Lecture 10 – Composition

Understanding Composition

 • **Definition**: Composition refers to the layout and structure of elements within a visualization.

 • **Importance**: A well-composed visualization enhances understanding and engagement, guiding viewers through the data intuitively.

Key Principles of Composition

 • **Balance**: Even distribution of visual weight for a stable look (e.g., symmetrical vs. asymmetrical balance).

 • **Alignment**: Arrange elements neatly for readability (e.g., left-aligning text).

 • **Hierarchy**: Guide viewers by emphasizing key information (e.g., using larger fonts for headings).

 • **Proportion and Scale**: Relative sizes reflect data importance (e.g., a larger circle indicating more significant data).

Layout Types in Data Visualization

 • **Single-Page Layout**: Simplifies by presenting all information at once (e.g., a one-page infographic).

 • **Multi-Page Layout**: Useful for complex data; organizes into sections (e.g., a report divided into chapters).

 • **Dashboard Layouts**: Combines multiple visualizations; ideal for interactivity (e.g., showing KPIs on a dashboard).

Using Space Effectively

 • **White Space**: Provides breathing room and reduces clutter (e.g., space around charts enhances focus).

 • **Grouping Related Elements**: Aids in logical organization (e.g., grouping similar charts together).

 • **Margins and Padding**: Enhances readability by separating elements (e.g., consistent padding around graphs).

Hierarchy and Flow

 • **Establishing Visual Flow**: Guide viewers from most to least important elements (e.g., left to right, top to bottom).

 • **Using Scale and Contrast**: Make critical data points stand out (e.g., larger figures attract more attention).

 • **Logical Arrangement**: Group similar data points together for better comprehension (e.g., chronological data in a timeline).

Typography in Composition

 • **Font Choices**: Select legible fonts; avoid overly decorative styles (e.g., use sans-serif for digital readability).

 • **Size Hierarchy**: Use different sizes for titles, headings, and body text to establish importance (e.g., larger titles with smaller subtitles).

 • **Contrast**: Ensure text stands out against the background (e.g., dark text on light backgrounds).

Colour and Composition

 • I**ntegrating Colour with Composition**: Use color to enhance hierarchy and guide viewers (e.g., using red for critical alerts).

 • **Consistent Colour Usage**: Avoid distracting color schemes that conflict with composition (e.g., stick to a palette).

 • **Using Colour to Group Elements**: Helps in understanding relationships between data points (e.g., using similar colors for related data).

Testing and Iterating

 • **User Testing**: Gather feedback on composition effectiveness (e.g., asking users about their visual experience).

 • **Iterative Design**: Continuously refine layouts based on user interactions (e.g., revising based on feedback).

 • **A/B Testing**: Test different compositions to see what works best for users (e.g., comparing two dashboard designs).

Common Composition Pitfalls

 • **Overcrowding**: Too many elements can overwhelm viewers (e.g., cluttered visuals).

 • **Inconsistent Alignment**: Disorganized layouts can confuse interpretation (e.g., misaligned text).

 • **Neglecting White Space**: Leads to visual clutter and fatigue (e.g., no space around charts makes it hard to focus).

Key Takeaways

 • Composition is crucial in creating effective, user-friendly visualizations.

 • A well-planned composition enhances user comprehension and keeps viewers engaged.