Information Visualization TNM111
Assignment 2

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1 Task 1: Basics and Interactions

1. Explain in detail the InfoVis Reference Model. What are the strengths of this model?

   Information visualization typically involves the visual representation of data to facilitate understanding and insight. The InfoVis Reference Model outlines a process of transforming raw data into visual representations. It contains five steps as follows:

   - **Raw Data:** This is the initial stage where you have raw, unprocessed data in some idiosyncratic format. Raw data might start as text represented as indexed strings or arrays. It could come from various sources such as databases, spreadsheets, logs, or any other data repositories.
   - **Data tables:** In this step, raw data is organized into structured data tables. Each table typically consists of rows and columns, where rows represent individual data instances or records, and columns represent different attributes or variables. This step involves cleaning, preprocessing, and structuring the data for further analysis.
   - **Visual Structure:** Once the data is in a tabular form, the next step is to define the visual structure. This involves deciding how to map the attributes of the data onto visual elements. For example, you might decide that one column should represent the x-axis, another column should represent the y-axis, and additional columns might determine the color, size, or shape of visual elements.
   - **Views** Views refer to the actual visualizations or representations of the data. This step involves creating graphical displays based on the defined visual structure. Views can take various forms, including charts, graphs, maps, or other visualizations, depending on the nature of the data and the goals of the analysis.
   - **Interaction** Although it seems that the provided steps stop at creating views, an important aspect often included in information visualization models is interaction. Interaction allows users to explore and manipulate the visual representations dynamically. Users can interact with the visualizations to gain insights, filter data, zoom in/out, and perform other operations, enhancing the exploratory and analytical capabilities. [1]

   Figure 2 illustrates all the steps included in the infoVis reference model.

   Strengths of the InfoVis Reference Model:
   The first advantage of this reference model is that it represents a systematic and organized method for transforming raw data into meaningful visualizations. The second advantage of this model would be the clarity of communication. By organizing data into visual structures

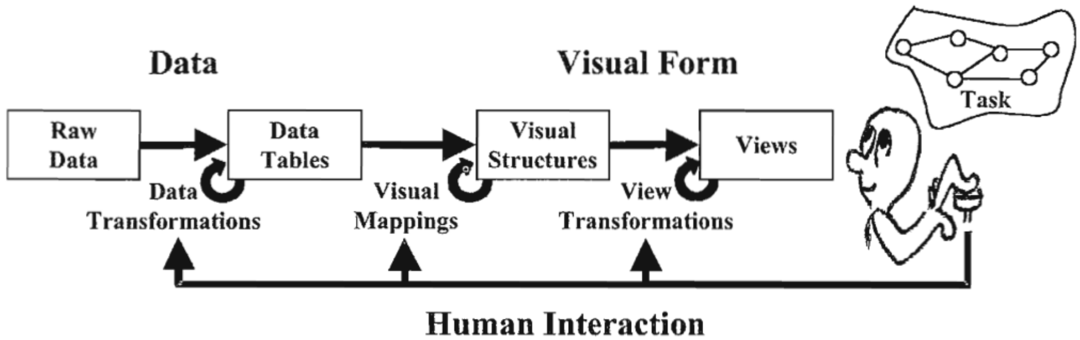

Figure 1: Refernce model for vizualisation

and creating views, the model facilitates clear and effective communication of information. Visualizations can convey complex patterns and relationships in a more digestible form. The third advantage would be that it is user-friendly. Including interaction as a part of the model emphasizes a user-centric approach, allowing the user to explore data in a more personalized and interactive manner. The last advantage would be the fact that this model applies to any kind of data and analysis goals.

2. What kind of interactions are supported by Range Sliders? Is there a way to improve them to show more information? Make a short list of pros and cons.

   Range sliders are interactive user interface elements that allow users to select a range or a range of values within a given numeric interval. They are commonly used in various applications for filtering, selecting date ranges, or adjusting numerical parameters. Some interactions that range sliders support is that users can drag the handles of the slider to select a specific range within the given interval, one also click on different points along the slider track to directly move the handles to those positions. Some range sliders allow users to input specific numeric values, either by typing them directly or through additional input fields.
   Some support function that can be added to Range Slider are for instance display tooltips that show the exact values of the selected range as users interact with the slider, providing instant feedback. Or adding labels to the slider handles or the track to indicate specific values or units, improving clarity. And allow users to define or snap to specific steps within the range, providing a more controlled selection process.

   Pros:

   - Range sliders are generally intuitive and easy for users to understand, especially for selecting numeric intervals.
   - They provide a compact user interface for selecting ranges, making them suitable for various applications with limited space.
   - Users receive real-time feedback as they interact with the slider, helping them make informed selections.
   - Range sliders can be adapted for various contexts, such as date selection, price range filtering, or any other numeric parameter.

   Cons:

- Traditional range sliders may not provide enough space for detailed information display, limiting the amount of context users can receive.
- Precise selection of a specific value within a large range can be challenging without additional controls or features.
- If a range slider has multiple handles for more complex selections, it can lead to a cluttered interface.
- Range sliders may not be the best choice for non-numeric data types or situations where a more complex selection is required.

3. In most visualization systems selecting or highlighting a data object in a specific view leads to a highlight in another view. What is this interaction technique called? What are its advantages?
Cross-View highlighting or cross highlighting:
Selecting or highlighting a data object in one view results in a corresponding highlight in another view or selecting a value in one visual highlights the related data in visuals such as column and bar charts. Cross-highlighting does not erase the the irrelevant data completely but rather makes it less visible or dimmed [2].
Advantages: The fist advantage of cross highlighting is that it enhances data exploration. By providing users with a coordinated and linked experience it improves the exploratory nature of data analysis. The second advantage is that it makes easier for the users to interact with the visualization and allows users to interactively query the data. And the third advantage would be that it helps users to get a contextual understanding of the data. By highlighting related information across multiple views, users can perceive the broader context of the selected data point or region.

Disadvantages:

- Highlighting in multiple views simultaneously can lead to overlapping information, especially in dense visualizations. This may make it challenging for users to interpret and understand the highlighted patterns.
- In systems with large datasets or complex visualizations, cross-view highlighting can have performance implications. Real-time coordination across views may lead to delays, impacting the user experience.

2 Task 2: Sketching a Visual encoding

Figure 2 shows the athlete information represented for this task. The green colors illustrates female contestants and the red color represents male contestants.

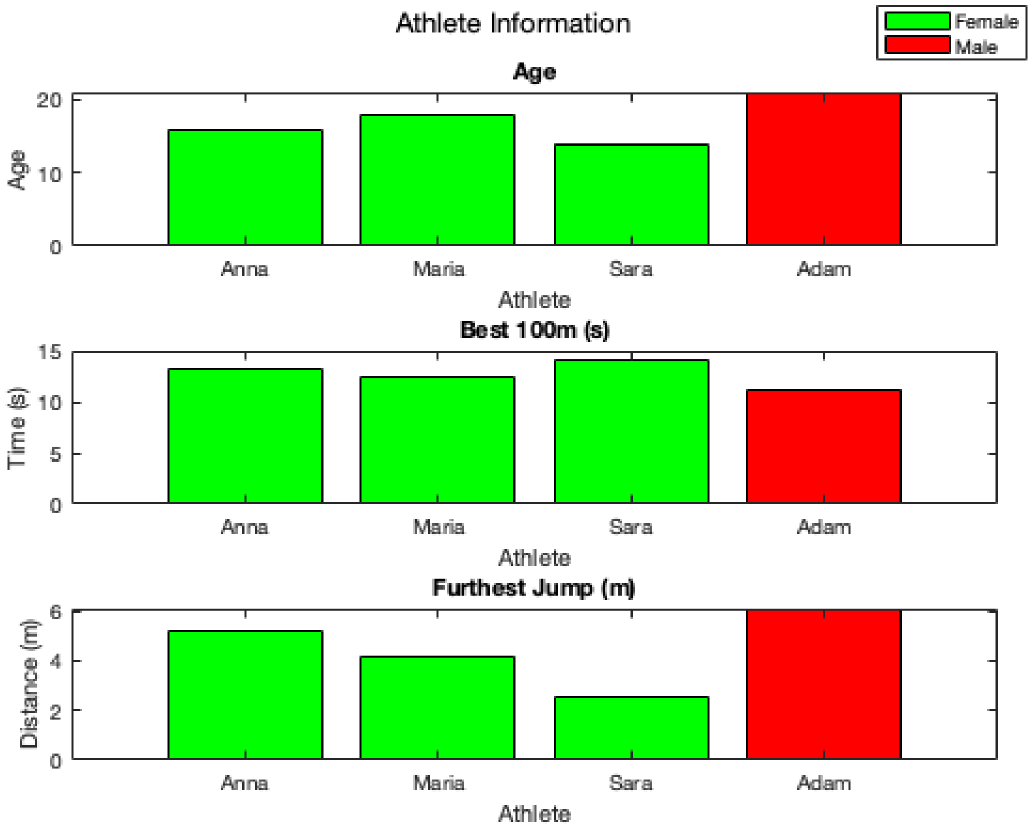

Figure 2: Caption

3 Task 3: Implementing a scatter plot

4 References

References

[1] Card SK, Mackinlay JD, Shneiderman B. Readings in Information Visualization: Using Vision to Think; 1999. Online. Available from: http://www.ifs.tuwien.ac.at/ silvia/wien/vu-infovis/articles/card$_2$007$_h ci - handbook_i nfovis.pdf$.

[2] Microsoft. Power BI - Reports, filters, and highlighting; 2024. Online. Available from: https://learn.microsoft.com/en-us/power-bi/create-reports/power-bi-reports-filters-and-highlighting.

A Source code

Listing 1: MATLAB code for athlete information.

```
% Sample data
names = {'Anna', 'Maria', 'Sara', 'Adam'};
ages = [16, 18, 14, 21];
best_100m = [13.2, 12.4, 14.1, 11.2];
furthest_jump = [5.2, 4.2, 2.5, 6.1];
sex = {'Female', 'Female', 'Female', 'Male'};

% Create a bar chart
figure;

subplot(3, 1, 1);
bar([1:3], ages(1:3), 'FaceColor', [0 1 0]); % Green color for the
    first three bars
hold on;
bar(4, ages(4), 'FaceColor', [1 0 0]); % Red color for the fourth
    bar
hold off;

title('Age');
xlabel('Athlete');
ylabel('Age');
set(gca,'xticklabel',names);

subplot(3, 1, 2);
bar([1:3], best_100m(1:3), 'FaceColor', [0 1 0]); % Green color for
    the first three bars
hold on;
bar(4, best_100m(4), 'FaceColor', [1 0 0]); % Red color for the
    fourth bar
hold off;
title('Best 100m (s)');
xlabel('Athlete');
ylabel('Time (s)');
set(gca,'xticklabel',names);

subplot(3, 1, 3);
bar([1:3], furthest_jump(1:3), 'FaceColor', [0 1 0]); % Green color
    for the first three bars
hold on;
bar(4, furthest_jump(4), 'FaceColor', [1 0 0]); % Red color for the
    fourth bar
hold off;
title('Furthest Jump (m)');
xlabel('Athlete');
ylabel('Distance (m)');
set(gca,'xticklabel',names);
```

```
legend('Female','Male');
sgtitle('Athlete Information');
```