TNM111-Assignment 2

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Task 1 - Basics and Interaction

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

   The InfoVis reference model - see figure 1 - is a charts an iterative workflow one can refer to when creating a visual representation. The first two steps account for preprocessing, and the two remaining steps account for the visual form.

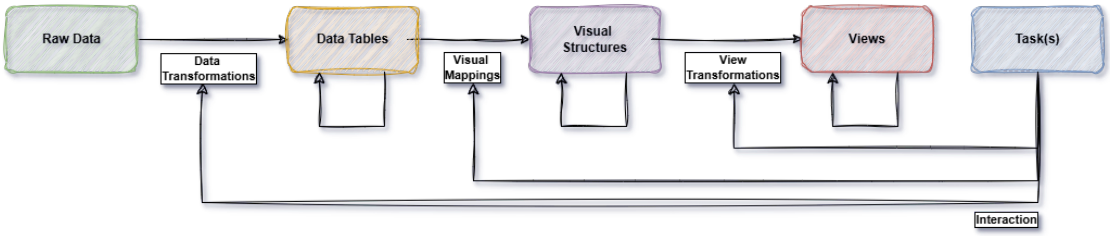


Figure 1: The InfoVis reference model

Firstly, raw data is obtained, i.e data from observations of the physical world. The raw data can thus be of any format and type, for instance spread sheets with numbers, entire documents collections or various program output.

In the next step - namely data tables - the raw data is transformed and put into tables. Transformations - depending on application - can include removing some headers, removing duplicates, organize data after data types (e.g nominal, ordinal etc.), brushing, and general clean-up. Furthermore, it is in InfoVis most often desirable to work with two-dimensional data (due to occlusion problems with n-dimensionality among other reasons), so dimension reduction may also have to be performed in this step. In addition, metadata can be added if needed, such as mean or median values.

The third step of the pipeline is Visual structures. This means that the data from the data tables is mapped to visual representations. Visual representations can be anything from simple charts and graphs (e.g bar charts) to more complex structures (e.g parallel plots). Mapping can use a variety of elements in which to encode information, such as color, shape, lines, areas, volumes etc. However, it is important to remember that only what is in the data table should be mapped to the representation(s), and that the representations require as little cognitive load to interpret as possible.

Lastly, the view is considered. This step addresses how the visual representations should be viewed and what interactive techniques there are to accomplish these. Examples of view transformations include distortions (like bifocal displays), zooming and panning, and magic lenses. The user tasks introduce requirements on the representation and the data, thus iterations over all the steps in the pipeline is necessary to fulfill initial and updated tasks.

One advantage of the InfoVis reference model is that it clearly defines the steps needed to be taken and in what order, through its pipeline structure. Isolating and optimizing steps during development and maintenance therefore becomes easier and more efficient.

The InfoVis reference model also emphasizes user needs and suitable interactions thereafter (in contrast to Munzner's Nested Model). Thus, the visual representations' ability to convey information and conform to user requirements is more efficient.

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 allow the user to dynamically select a certain (mostly discrete) range for some data set. This can for example be price ranges on online shopping pages. By tuning the slider to some range, only data objects within (or closely within) that specification are presented to the user. This dynamic interaction offers quick adjustments and immediate results, which improves user interaction experience.

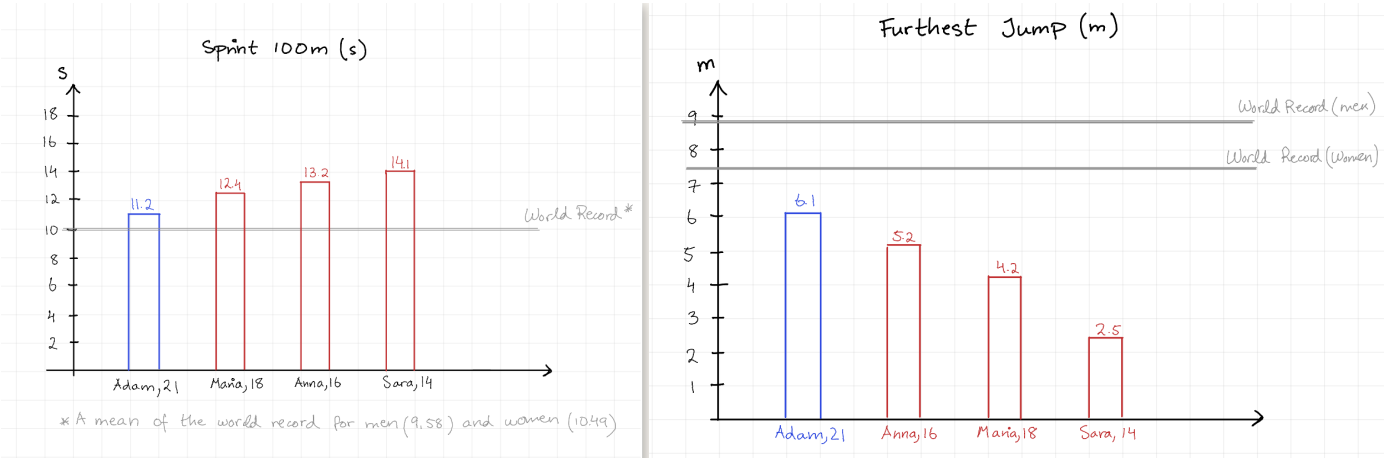
   The range sliders can either be blank, only covering a range, or they can encode some additional information. For instance, the slider can represent the entire scope the data set covers and then use color encoding to indicate where matches and/or near matches to the specified range are located, conveying a sense of context to the user. Indicating near-misses is a means of guiding the user to where options are located, especially if there are no exact matches. The user will then know how to change their queries to find what they are searching for, or simply conclude that there is no object matching their desires - i.e answer the "*what-if*"-question.

   Encoding too much information on the slider can however lead to confusion since the sliders are often relatively small. Thus, too many encodings will make the slider overcrowded and reduce visibility. The small size can also be problematic to transfer to smaller screens, like phones, since the actual range the slider covers can be indecipherable. Clear labeling of the range can amend this issue.

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?***

   The technique is called brushing and linking. The advantages are that it gives a consistent display and it is easier to search for one object in several different graphs or views. In this way you can easier distinguish trends, correlations and compare different objects with each other. The possibility to brush (highlight) over multiple points to see if they link (connect) together in more than one graph/view makes this technique specially useful. By brushing a few points the other views are usually updated dynamically and it is easier to see how one cluster relates to another. One big advantage is that it handles complex datasets very well, if one wants to find correlations in the dataset.

Task 2 - Sketching a Visual Encoding



(a) Sprint 100m

(b) Furthest jump

Figure 2: Figure a) shows the result in 100m sprint in seconds (s), whereas figure b) shows the furthest jump in meters (m).

Task 3 - Implementing a scatter plot

- Upload a CSV file using the button
- Left click: Recenter with respects to selected point (click a second time to exit)
- Right click: Show 5 nearest points to selected point (click a second time to exit)

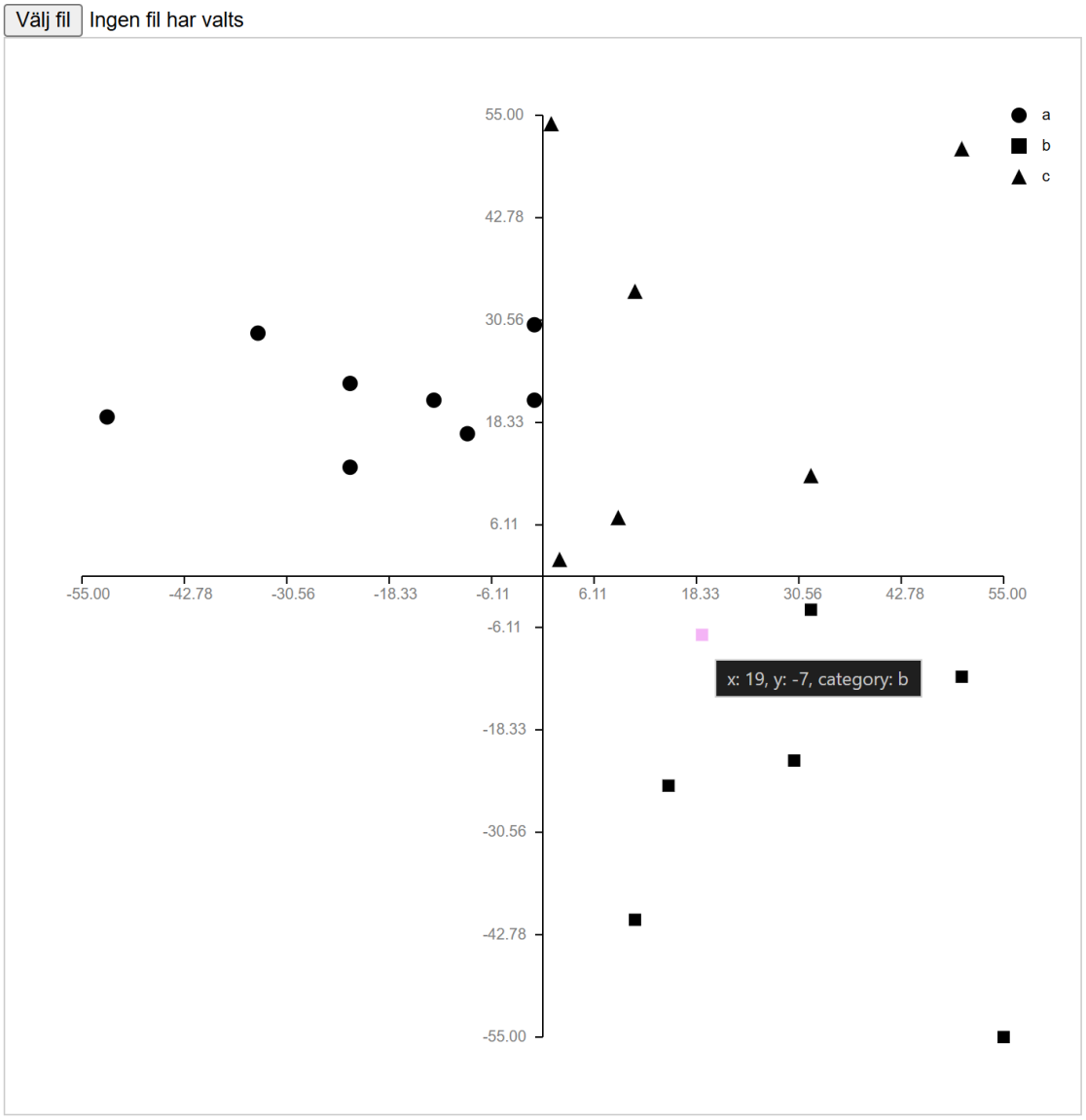


Figure 3: Hovering a point highlights it and displays a simple tooltip

- Upload a CSV file using the button
- Left click: Recenter with respects to selected point (click a second time to exit)
- Right click: Show 5 nearest points to selected point (click a second time to exit)

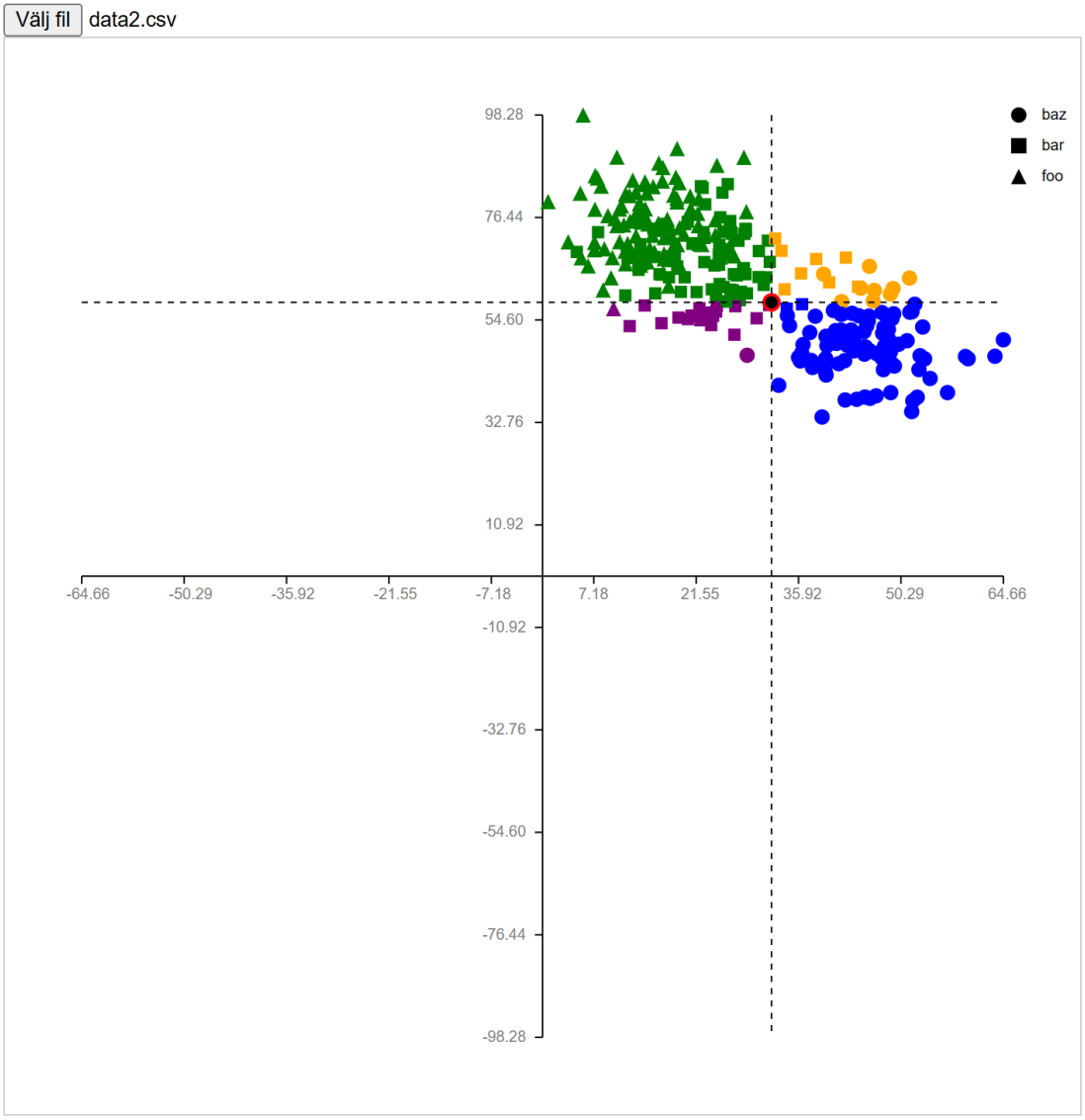


Figure 4: (Left)-clicking a point highlights it, assigns colours to points after quadrant and draws a new grid system originating from selected point

- Upload a CSV file using the button
- Left click: Recenter with respects to selected point (click a second time to exit)
- Right click: Show 5 nearest points to selected point (click a second time to exit)

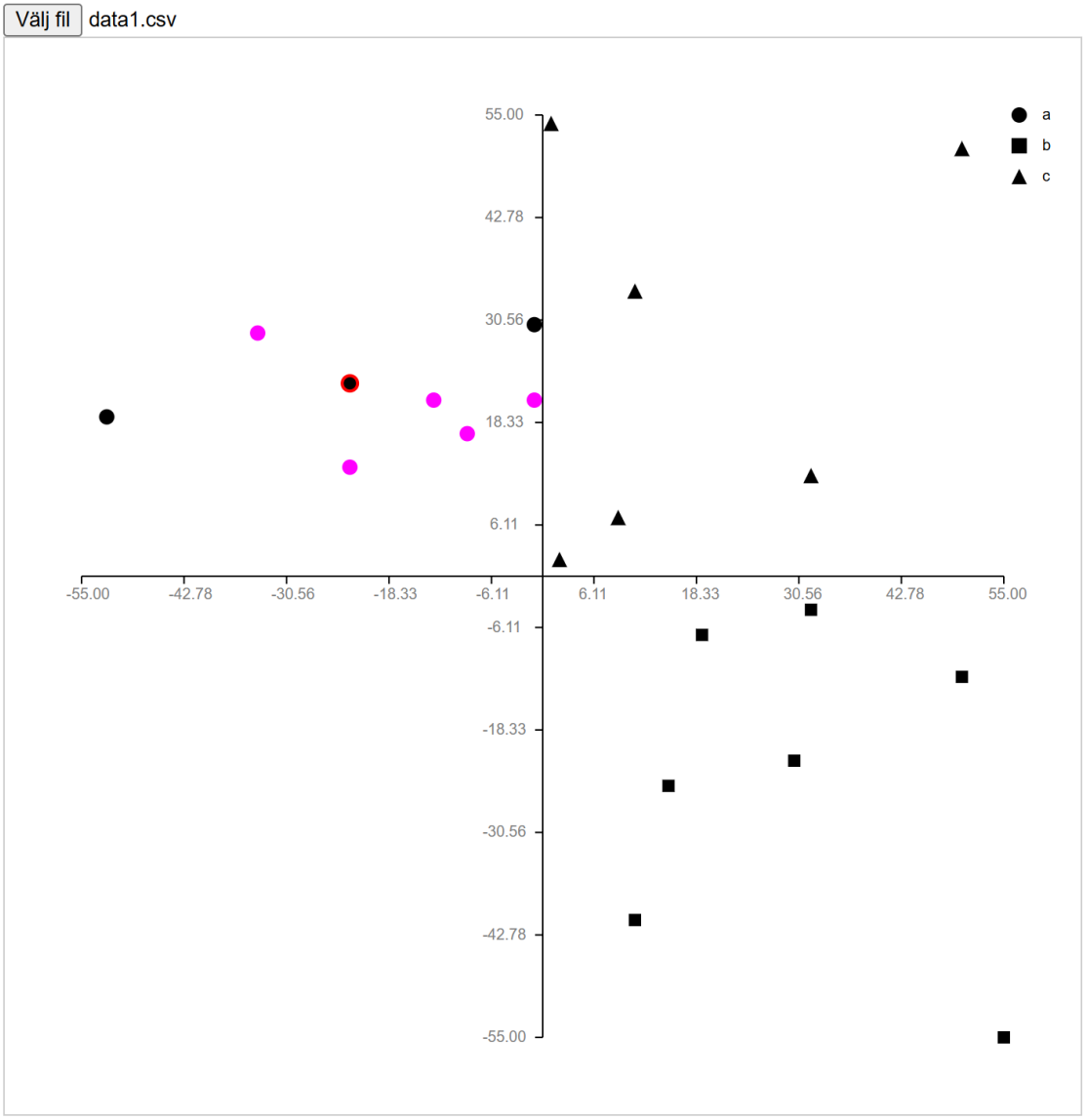


Figure 5: Right-clicking a point highlights it and colours the 5 geometrically nearest neighbours