HAITI I: Human Analytics of Information & Technology Interaction, Part 1

Academic year 2023-2024

Student’s module book

Please think green, consider the environment before printing

Content

Part 1 General information

1.1 Planning group and coordination

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1.2 Introduction

In the last decades the amount of data has exploded, and at the beginning of 2020 the amount of data around the world was estimated to be around 64 zettabytes. At the same time in this fast-paced digital world we must ingest information faster and more efficiently to support decision-making. To support this decision making, the field of information visualization was developed. By transforming abstract information into easily digestible representations, we can support decision making in various fields, including physiotherapy.

In this course, students will learn how to collect, handle and analyze data. Students will also learn how to visualize this information in a meaningful and in effective way. The course covers various visualization techniques ranging from traditional charts to more immersive mediums such as VR and AR.

1.3 Content and aim of the module

- History of information visualization
- Dataset basics
- Data Manipulation & Visualization Methods
- Interaction techniques
- Programming packages: Pandas, Vedo, Dash
- Accessing documentation for code libraries and debugging visualization programs
- Other common visualization tools
- Basics of inertial and physiological data collection from wearables (Wear OS)

1.4 Educational activities

The students will study according to the study syllabus (learning outcomes), individually and in groups, completing individual assignments and attending lectures or viewing them later through recordings. The students will get acquainted on collecting and analyzing movement data from motion capture, smartphones or smartwatches and representing this data in different ways. Based on their individual assignments and experience, students will complete a final assignment for a specific physiotherapy dashboard application. Final assignments will be presented in a seminar at the end of the course. Activities are mainly completed through distance learning with Teams lectures, prerecorded lectures, homework assignments, online QA sessions and student presentations, and contact teaching for the final lecture and workshop.

1.5 Learning outcomes

Upon completion of the course, the student will

1. know the most common information visualization techniques
2. know the most common alternative techniques for information presentation
3. know the most common interaction techniques in information visualization
4. be able to design and evaluate simple visualizations for real-world problems
5. be able to design dashboards that apply common interaction and visualization techniques

1.6 Testing and grading (evaluation)

Satisfactory (1): the student knows the basics of the datasets, knows the most common data manipulation and visualization methods, and is able to apply some visualization tools in practice.
Good (3): the student has good knowledge of the various datasets, knows how to use and apply data manipulation & visualization methods in practice. Can apply the most common visualization tools in practice and can create simple dashboards that combine data sources.

Excellent (5): the student has excellent understanding of the various data manipulation and visualization methods and their applicability in different cases, demonstrates excellent skills in applying the knowledge in practice and could be trusted to create complex dashboards combining multiple different data sources.

Alternatively, the grading method for this course can be changed to *pass/fail*. To pass the course, students will have to complete a portfolio of all mandatory individual assignments and the final assignment and/or give presentations consisting of specific assignments during the course.

Part 2 Lessons

2.1 Lecture 1: Introduction to Information Visualization

Methods
Distance learning (Teams lecture, homework)

Overview
This lecture introduces the concept of information visualization (IV), a crucial aspect of the Human Analytics of Information and Technology Interaction (HAITI) course designed for postgraduate physiotherapists. Understanding IV will enable physiotherapists to interpret complex data through visual representations, improving decision-making processes and enhancing patient care.

Definition and Concepts
Information visualization is defined as the use of computer-supported, interactive visual representations of abstract data to amplify cognition. This involves reducing raw information into simpler graphical elements using spatial variables such as position, size, shape, and color to reveal visual relationships and patterns hidden within the data.

The key definitions within this field include information visualization, which is the transformation of abstract data into visual representations to enhance understanding. Knowledge visualization involves using visual representations to improve knowledge creation and transfer between individuals. Visual analytics combines automated analysis techniques with interactive visualizations to understand and make decisions based on large, complex data sets.

Information Visualization Process
The process of information visualization involves several stages. First is data collection, where raw data is gathered from various sources. Next is data transformation, converting raw data into a structured format. This is followed by visual mapping, assigning visual variables to data elements. View transformation creates visual structures and views, and finally, human interaction allows users to interact with visualizations to gain insights.

Data Foundations
Understanding data types is fundamental in IV. The main data types include nominal, which are labels without an inherent order such as types of injuries; ordinal, which are ordered values without consistent intervals such as pain levels; interval, which are ordered values with consistent intervals but no true zero such as temperature in Celsius; and ratio, which are ordered values with a true zero, allowing for comparisons of absolute magnitudes such as weight and height.

Data can also be classified as one-dimensional (data with a single variable), two-dimensional (data with two variables, such as scatter plots), three-dimensional (physical objects or data with three variables), multi-dimensional (data with more than three variables, multi-variable datasets), hierarchies and graphs (data with relational structures), metadata (data that describes other data), and unstructured data (data without a predefined format, such as freeform text and multimedia).

Visualization Techniques
Various visualization techniques are employed depending on the data type and the desired insight. Geometric techniques use points, lines, and areas to represent data. Point-based techniques are suitable for identifying clusters or outliers, line-based techniques are useful for showing trends and

correlations, and area-based techniques are effective for representing volumes and proportions. Graph techniques visualize relationships and hierarchies, with hierarchical graphs representing parent-child relationships and arbitrary graphs illustrating complex networks without a predefined structure. Pixel-oriented techniques map each data value to a pixel and are often used for large datasets. Function-oriented visualization techniques are tailored to specific functions like comparisons, distributions, or processes.

Historical Context

The development of IV has evolved through several key phases. Before the 17th century, early maps and diagrams were used. The 17th century marked the initial measurement and theory. From 1800 to 1850, the beginnings of modern graphics emerged. The period from 1850 to 1900 is known as the golden age of statistical graphics. From 1900 to 1950, there was a decline, known as the modern dark ages of IV. The period from 1950 to 1975 saw the rebirth of data visualization. From 1975 to 2010, high-dimensional interactive and dynamic visualization emerged. The present and future focus on immersive visualization technologies.

Genres of Information Visualization

Different genres of IV are applied based on the context and purpose. Scientific visualization is used in fields like medicine and biology to represent three-dimensional data. Historical visualization involves visualizing historical data to support inquiry and analysis. Infographics simplify complex information into aesthetically appealing and easily understandable graphics. Interactive visualization allows users to interact with data for deeper insights. Physical and tangible visualization creates physical representations of data. Immersive visualization uses mixed reality to integrate sensory interactions with data. Aesthetic visualization combines data with art to engage audiences.

Practical Applications

For postgraduate physiotherapists, practical applications of IV include patient data visualization, which simplifies patient data to identify patterns and make informed decisions. Treatment outcome tracking visualizes treatment progress over time. Research data presentation enhances the clarity of research findings through visual representation. By mastering IV techniques, physiotherapists can improve their analytical skills and contribute to more effective patient care and research.

This lecture serves as a foundation for understanding the principles and applications of information visualization in the context of physiotherapy, offering insights into how data can be effectively represented and analyzed to enhance clinical practice and research.

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Assignment: 3D point cloud from motion capture data

Assignment Objective

This assignment introduces postgraduate physiotherapists to the practical application of information visualization by focusing on the preprocessing and visualization of motion capture data. The task involves transforming raw motion capture data into a 3D point cloud visualization, developing essential skills for interpreting complex datasets in clinical practice.

Programming Environment

The assignment is conducted in a Python environment, familiar from the TiPT-I course, and introduces the Vedo scientific visualization library for creating 3D visualizations. The open-source nature of Vedo is highlighted, ensuring flexibility and reducing reliance on proprietary software.

Required Libraries:

NumPy: For numerical operations.
Pandas: For data manipulation.
Vedo: For 3D visualization.

Task Breakdown

Data Preprocessing

- Load and clean motion capture data from a .calc file (tab-separated).
- Rename columns to more descriptive, human-readable names.
- Generate a time column based on a 120 Hz recording frequency.
- Filter the data to include only the specified time range and select the RightFoot bone's position data.
- Correct the orientation of the Z-axis values.

3D Point Cloud Visualization

- Visualize the RightFoot data as a 3D point cloud using the Vedo library, enabling the interpretation of motion during the specified time interval.

Skills Developed
This assignment enhances students' abilities to preprocess and visualize complex data, crucial for data-driven decision-making in physiotherapy. These techniques are applicable in patient data visualization, treatment outcome tracking, and research presentation.

2.2 Lecture 2: Interactivity in visualization

Methods
Distance learning (Teams lecture, homework, QA session and student presentations for previous assignment)

Introduction
Interactive visualizations are a critical component in the field of Information Analytics and Visualization, allowing users to engage with data dynamically rather than passively observing static representations. This module covers various interaction techniques, exploring how these techniques can be applied to enhance user experience and facilitate deeper insights into data. This lecture is structured around the taxonomy of interactions, providing a comprehensive understanding of the tools and methods available for crafting effective interactive visualizations.

Interaction Techniques
Interaction Techniques refer to the methods by which users can interact with data visualizations. These techniques are pivotal in transforming data from mere information into actionable insights. The lecture categorizes these techniques into several tasks: selection, exploration, reconfiguration, encoding, abstraction/elaboration, filtering, and connecting. Each of these tasks represents a different way in which a user might engage with a dataset, offering various methods to manipulate and interpret the data presented.
Selection: This task involves marking data elements as interesting or noteworthy. It can be implemented through techniques like hovering, clicking, querying, and linking. For example, in a dataset of baby names, users might hover over different names to see their popularity over the years or click on a particular name to view more detailed trends.
Exploration: Exploration allows users to navigate through the data space to discover new insights. Techniques such as panning, zooming, scrolling, and direct manipulation (direct-walk) fall under this category. For instance, a user might zoom into a geographical map to explore population changes in Europe or scroll through a timeline to observe the progression of a historical event.
Reconfiguration: Reconfiguring data involves altering the arrangement or structure of the visualization to provide a different perspective. Sorting, moving data elements, and manipulating axes are common techniques. A clustergram might be sorted to group similar items together, or axes might be reconfigured in a scatter plot to highlight different correlations.
Encoding: This technique changes the visual representation of the data. Encoding can involve altering colors, shapes, or other visual properties to represent data differently. For instance, a bar chart might be transformed into a heatmap to emphasize areas of high activity.
Abstraction/Elaboration: Abstraction involves reducing the amount of detail shown, while elaboration adds more detail. Zooming in or out of a visualization, hovering to see additional information, and drilling down into the data are ways to manage the level of detail presented. This allows users to focus on either the big picture or specific details as needed.
Filtering: Filtering involves showing or hiding data based on certain conditions. Dynamic queries, such as sliders to select a range or checkboxes to include/exclude categories, are typical filtering techniques. This helps users focus on specific subsets of data that are relevant to their current inquiry.
Connecting: Connecting shows relationships between data elements, which might otherwise seem isolated. This can be particularly useful in network visualizations or when trying to understand the

linkages between different data points. For example, a user might explore how different cultural heritage practices are related across various geographical regions.

Taxonomy of Interactions

The taxonomy of interactions provides a framework for understanding the different ways users can interact with data visualizations. Each interaction type serves a specific purpose and can be combined with others to create a richer, more engaging experience for the user.

Data and View Specification: Involves tasks like filtering and sorting that allow users to specify which data should be displayed and how it should be presented in a view.

View Manipulation: Allows users to adjust the perspective or focus on the data. This includes tasks such as selecting, exploring, and reconfiguring.

Process and Provenance: Refers to the ability to record, annotate, and share visualizations. This is particularly useful in collaborative settings where insights need to be communicated among team members.

Examples of Interaction Techniques

Throughout the lecture, several examples are presented to illustrate how these interaction techniques can be applied in real-world scenarios. These examples include:

Hovering and Clicking: Interactive maps and charts that reveal more information when a user hovers over or clicks on elements. For instance, in a project visualizing baby names, users can hover over different names to see trends over time.

Panning and Zooming: These techniques are often used in geographic visualizations, allowing users to zoom into specific areas of interest or pan across different regions to compare data.

Sorting and Filtering: Sorting might be used in visualizations that display economic data, allowing users to reorder items based on different metrics. Filtering could be applied in health data visualizations to focus on specific categories of supplements and their scientific backing.

Linking and Brushing: Techniques like linking and brushing are used to highlight connections between different datasets or visual elements, helping users to draw correlations and better understand relationships within the data.

Alternative Interaction Methods

Beyond traditional interaction techniques, the lecture also explores alternative methods influenced by emerging technologies and interfaces. These include:

Input Types: Various input methods such as touch, pen, speech, and gestures are discussed, highlighting their applicability in different visualization contexts.

Output Devices: The lecture touches on different output devices ranging from mobile screens to large wall displays and haptic devices, each offering unique opportunities and challenges for interactive visualizations.

Embodiment: The discussion also covers the embodiment, exploring how tools like finger proxies, sticky tools, and touch projectors can enhance interaction with visualizations.

Conclusion

Interactive visualizations are a powerful tool for making complex data more accessible and understandable. By leveraging various interaction techniques, users can explore, manipulate, and derive insights from data in ways that static visualizations cannot offer. This lecture provides a foundational understanding of these techniques and their applications, equipping students with the knowledge to create more effective and engaging visualizations.

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Assignment 2: Adherence Tracking

Objective

This assignment focuses on the application of interactive visualization techniques to process and visualize data recorded from a Wear OS smartwatch. The primary objective is to track adherence to prescribed exercises, specifically assessing how well exercises performed during supervised therapy sessions are replicated at home. This data will be analyzed to complement adherence diaries, providing insights into both the quality and quantity of exercises performed.

Task Breakdown

Data Import and Preprocessing

The first step involves importing the sensor data recorded by the smartwatch. This data includes readings from various sensors, such as the accelerometer, gyroscope, magnetometer, and heart rate monitor. The data for each exercise session is stored in multiple .csv files, with each file corresponding to a specific sensor. The task requires loading this data into Pandas dataframes, with careful attention to the data format, such as handling semicolon-separated values and managing incomplete rows.

Selection of Variables

After the data is imported, the next task is to select the most relevant variables for visualization. This involves choosing which sensor data (e.g., gyroscope or accelerometer) will be most useful for tracking exercise adherence. It is also necessary to determine which axes or derived values, such as the magnitude of acceleration, are most appropriate for analysis.

Processing for Repetition Counting

Following the selection of variables, the data will be processed to count the number of repetitions for each set of each exercise. This step involves using signal processing techniques, such as peak detection, to identify distinct repetitions within the data. The scipy.signal.find_peaks function will be used to detect these peaks, with specific parameters adjusted to suit the characteristics of the exercise data.

Visualization with Plotly

The final task involves creating a faceted line plot to visualize the exercise data. Each set of exercises will be represented as a separate facet, allowing for a clear comparison of repetitions across sets. Detected peaks will be marked on the plot to indicate where each repetition occurs, providing a visual confirmation of the data processing steps.

Skills developed

This assignment provides an opportunity to apply interactive visualization techniques to real-world data, enhancing the students' implementation skills and understanding of how visualizations can be used to monitor and improve adherence to prescribed exercises.

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2.3 Lecture 3: Advanced visualizations

Methods

Distance learning (prerecorded lecture, homework, QA session and student presentations for previous assignment)

Overview

In this lecture, we will delve into advanced techniques and technologies that push the boundaries of data visualization, emphasizing the integration of cutting-edge tools such as Extended Reality (XR), real-time interaction, and multimodal control. These advanced visualization methods enable more intuitive and immersive experiences, making complex data more accessible and comprehensible.

Key Concepts

Integration with Extended Reality (XR)

The future of data visualization lies in the seamless integration with XR environments. This involves a synergy of data mining, neural networks, machine learning, and signal processing to create visual analytics that users can interact with in real time.
XR allows users to navigate through 3D spaces, manipulate data objects, and gain insights through a multimodal interface that combines visual, auditory, and haptic feedback.

Real-Time Interaction

Real-time interaction is crucial for advanced visualization systems, particularly in environments requiring immediate decision-making. New tools and equipment facilitate multimodal interactions, enhancing user engagement and the effectiveness of the visualization.

New Interactive Systems

Advanced interactive systems support users in scaling and navigating 3D visualized spaces, selecting specific subspaces or groups of objects, and manipulating visual elements. These systems also assist in planning routes, generating data, and enabling intuitive control through gestures and speech recognition.

Trends in Advanced Visualization

Application Development Integration

Optical and video see-through head-mounted displays (HMDs) are becoming integral to visualization, particularly when dealing with 3D data or virtualized physical objects. The inclusion of haptic feedback frameworks that allow for intuitive gestures and systems with hand-tracking capabilities are on the rise.

Equipment and Virtual Interface

To avoid mismatches between physical and virtual realities, dynamic tracking of virtual items, along with head gestures and gaze tracking, is essential. These advancements ensure that users have a consistent and immersive experience across different realities (when combining the virtual and physical world, extended reality).

Tracking and Recognition Systems

Advanced visualization systems face challenges such as lack of precision, complex layouts, and user fatigue. Solutions include spatial input methods, standards for interaction, and innovative interface designs that reduce user strain while enhancing engagement.

Decision-Making and Visualization

Role of Visualization in Decision-Making

Visualization plays a critical role in decision-making by enhancing a user's ability to process information. Visual representations extend cognitive capabilities, allowing for better understanding and faster identification of optimal solutions.
Application scenarios include scientific research, environmental planning, mission planning, business

and financial analysis, and criminological analysis, where visualization aids in making informed decisions.

Collaborative Visualization

Collaborative visualization involves multiple users interacting with the same visualized data to achieve a shared understanding. This is particularly important in fast-paced environments, where quick decision-making is key. The integration of real-time analytics into these systems is crucial for supporting the fast pace of change and the need for immediate insights.

Accessibility in Visualization

Understanding Accessibility

Accessibility goes beyond usability, ensuring equal access and opportunity for all users, including those with disabilities. This involves designing visualizations that accommodate various impairments and providing alternative means of interaction.
Tools like screen readers, haptic devices, and adaptive strategies play a crucial role in making visual content accessible.

Color and Contrast in Visualizations

Approximately 300 million people worldwide experience color blindness. Effective visualizations should not rely solely on color to convey information but should incorporate appropriate contrast levels and alternative text descriptions.

Assistive Technologies

Assistive technologies, such as screen readers, hearing aids, and voice recognition, are essential for making digital content accessible. These technologies, originally developed for people with disabilities, have now become mainstream, benefiting a wider audience.

Advanced Visualization Techniques

Visual Indicators

Visual indicators such as subtitles, textual labels, and data point annotations enhance the accessibility of visualizations, especially in XR environments where users may have limited visual acuity

Spatialized Audio

Spatialized audio provides an additional layer of interaction, guiding users through visualizations by associating audio cues with specific data points or user interface interactions.

Motion Alternatives

Customization options such as locomotion type (teleportation, smooth movement) and adjustable movement speeds in XR environments cater to users with different needs (sensitivity to motion sickness, different abilities for movement), ensuring a more inclusive experience.

Haptic feedback

Stylus- or glove-based force feedback systems and traditional vibrotactile feedback (vibration) may complement or even replace visual indicators and audio feedback.

Conclusion

Advanced data visualization is an evolving field that leverages the latest technologies to create immersive and accessible experiences. By integrating XR, real-time interaction, and accessibility considerations, these visualizations not only enhance user engagement but also support better decision-making and collaboration. As we move forward, a focus on accessibility and inclusivity will ensure that these advanced tools are available to all, regardless of physical or cognitive limitations.

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Assignment 3: Dashboard design

In this assignment, students are tasked with designing a dashboard that visualizes data related to exercise adherence, building upon the work completed in a previous assignment. The focus of this task is not on programming but rather on conceptual design and layout. Students are expected to use tools such as PowerPoint, diagrams.net, or even pen and paper to create mockups of the dashboard. Students can use insights and material from the adherence tracking use case in Assignment 2 as a base to extend the previous design to a full dashboard or design a dashboard for a different use case.

Objective

The primary goal is to design a dashboard that presents data in a way that is useful and informative for clinical, business, or patient use. The dashboard should provide clear insights into exercise adherence by utilizing the dataset, which includes various exercises, their prescribed repetitions, and other relevant variables.

Key Requirements

Visualizations

Students are required to design three different visualizations or views within the dashboard. One of these can replicate the visualization implemented in the previous assignment, which involved showing gyroscope data with detected peaks.
The visualizations should offer different perspectives on the data, such as overall adherence over time, aggregate measures (e.g., weekly or monthly views), or other relevant metrics like heart rate or exercise intensity.

Interaction Techniques

The assignment also requires students to integrate interaction techniques into their dashboard designs. These techniques might include filtering, selection, scrolling, or hovering to display detailed information. The chosen interaction techniques should enhance the user's ability to explore the data effectively and gain meaningful insights.

Dashboard Layout

Students must combine their selected visualizations and interaction techniques into a cohesive dashboard layout.
The layout should consider the placement of visualizations and any auxiliary information, ensuring that the design is intuitive and user-friendly.
Additionally, students are to prepare a short presentation, consisting of no more than 10 slides, which includes mockups or wireframes of the proposed dashboard layout. These visual representations should clearly illustrate the design and any transitions between views if applicable.

Deliverables

A dashboard design that integrates the visualizations and interaction techniques into a coherent layout.
A short presentation (maximum of 10 slides) detailing the proposed solution, including visual mockups or wireframes and any transitions between views.
This assignment challenges students to think critically about data presentation and user interaction, requiring them to apply principles of design and visualization to create a functional and insightful dashboard.

2.3 Lecture and Workshop 4: Visualization tools and motion capture data collection

Methods

Contact teaching (in-person lecture, workshop on collecting data with smart watch or inertial motion capture suit, QA session and student presentations for previous assignment, hands-on assistance with any previous assignment)

Introduction

In data visualization, choosing the right tool is essential for effectively communicating insights. Visualization tools transform complex datasets into intuitive visual formats, making it easier to understand patterns, trends, and outliers. This lecture provides an overview of the different types of visualization tools available, categorizing them based on their features, target users, and typical use cases.

Categorization of Visualization Tools

Visualization tools can be broadly categorized into three main types: Proprietary Tools, Web-Based Solutions, and Programming Libraries. Each category has its own strengths and is suited to different users based on their technical expertise, data privacy needs, and the complexity of the visualizations required.

Proprietary Tools

Proprietary tools are commercial software solutions designed for users who prefer a more user-friendly interface and do not require extensive programming knowledge. These tools often provide powerful visualization capabilities out-of-the-box and are equipped with features that cater to business users and data analysts.

Ease of Use: These tools are designed to be intuitive, with drag-and-drop interfaces and pre-built templates that allow users to create visualizations quickly without needing to write code.
Integration with Data Sources: They support a wide range of data sources, making it easy to import data from spreadsheets, databases, and other formats.
Examples: Common examples of proprietary tools include Tableau, Power BI, and QlikView. These tools offer extensive support and resources for users, though they often come with licensing costs, especially for versions that handle private data.

Web-Based Solutions

Web-based solutions are typically free or low-cost tools that are accessible through a browser. These tools are ideal for creating interactive visualizations that can be easily shared and embedded into websites or reports. They are particularly useful for projects that require live data or real-time updates.

Accessibility: Being browser-based, these tools do not require installation and can be accessed from any device with an internet connection.
Real-Time Data Handling: Web-based solutions are often used for integrating dynamic content, making them suitable for dashboards and interactive reports.
Examples: Google Charts, Data Studio, and various JavaScript libraries (such as D3.js) fall into this category. They provide flexibility in design but may require some coding knowledge for more advanced customizations.

Programming Libraries

Programming libraries for visualization are designed for users who are comfortable with coding and need full control over the creation and customization of visualizations. These libraries are typically part of broader programming ecosystems and are highly customizable, making them suitable for complex and specialized visualizations.

Flexibility: Programming libraries offer unparalleled flexibility, allowing users to tailor every aspect of the visualization to their needs.
Integration with Analytical Workflows: These tools are often used in conjunction with data processing libraries, enabling seamless integration into data analysis pipelines.
Examples: Python libraries like Matplotlib, Seaborn, and Plotly, as well as JavaScript libraries such as D3.js, are popular choices in this category. While they offer powerful features, they require a good understanding of programming, which may be a barrier for non-technical users.

Choosing the Right Tool

When selecting a visualization tool, it is important to consider the following factors:

User Skill Level: Proprietary tools and web-based solutions are generally easier to use and require less technical expertise, while programming libraries are best suited for users with a strong background in coding.
Data Privacy Needs: If data privacy is a concern, particularly when working with sensitive information, proprietary tools with private licensing options might be necessary. Free versions of these tools, or certain web-based solutions, may not offer sufficient privacy controls. Open source programming libraries are a free alternative when working with sensitive information, because they typically do not depend on external services.
Complexity of Visualizations: For highly customized or complex visualizations, programming libraries are the best choice due to their flexibility and depth of functionality. In contrast, simpler visualizations can be effectively created using proprietary or web-based tools.
Budget Constraints: Web-based solutions and programming libraries are generally free or low-cost, making them attractive for projects with limited budgets. However, proprietary tools often require significant financial investment, particularly for enterprise-level use.

Conclusion

The right choice of visualization tool depends on various factors including user expertise, data privacy, and the complexity of the task at hand. Proprietary tools are well-suited for users who need robust, easy-to-use solutions, while web-based tools offer accessibility and flexibility for creating interactive visualizations. For those with coding skills, programming libraries provide the most control, customization and data privacy.

Understanding these categories and their respective strengths will help you choose the most appropriate tool for your specific needs, ensuring that your data visualizations are both effective and efficient.

Workshop

After the lecture, a workshop demonstrating inertial and physiological data collection from a smart watch (output data compatible with assignment 2) or inertial motion capture suit (output data compatible with assignment 1). Students have the opportunity to get hands-on experience with inertial motion sensing devices and associated software, with the possibility to visualize and analyze the collected data using program code from assignments 1-2. Hands-on assistance is provided for any problematic parts in previous assignments.