Friday, January 31, 2025

Knowing BIDS and Getting Familiarized

What is BIDS?

Brain Imagining Data Structure
Standardize Format that ensures data from **neuroimaging** (fMRI, ECG) is **stored consistently**

Perks - helps share and **analyze data more easily** by providing well **defined structure** and **clear metadata**

VR Motion Data : - **sensor based** and **Time-Series Data** which is similar to brain imaging

Key Components of BIDS : -

1. Directory Structure

- BIDS organized data into a set of directories, with a clear Hierarchy which helps us unsure data is stored logically. (We can store VR- Data into similar Structure)

Example

dataset (.json (preferred), .csv, .tab) - > mostly MetaData about the dataset
people (.tsv (preferred), .csv, .tab) -> information about participation (**eg- ID, age, gender, etc**)

```
raw_data/
    sub-01/
        ses-1/
            eeg/
                sub-01_ses-1_task-xyz_eeg.bdf
            anat/
                sub-01_ses-1_T1w.nii.gz
            motion/
                sub-01_ses-1_task-sorry_motion.csv   # Motion capture data
```

ses-2/
motion/
sub-01_ses-2_task-hey_motion.csv

In this Case

- **raw_data/ :** This folder contains raw motion data, Such as sensor data from VR devises (headsets and hand controllers).
- **sub-_ _/ :** unique ID for each person or subject.
- **ses- _ _/ :** session or conditions within the study (eg., multiple sessions for each person / subject or different experimental conditions).
- **motion/ :** A folder for motion-related data which could be **time-series data** (**position, hand_speed, Walking_speed, etc**) form VR motion Capture systems.
- **anat/ :** This is for neuroimaging data (eg brain scans) this won't be necessary for us since we are not going to work on it but for future reference.

2. Metadata

- This are key since this will describe our data, provide us context about experimental setup.

- For our Data this can be

- **Device Info :** The VR device used (eg. meta Quest, Vision Pro, Oculus)
- **Experimental Condition :** Info about each session
- **Person information :** Demographics such as age, Gender, and previous VR experience Link
- **Task Descriptions :** Small description about the VR task being performed (eg: - facial expresions, distance measurement etc)

Example:

- dataset_desciption.json : This File includes overall dataset level metadata such as description of dataset, authors and device / software used

- participants.tsv : A tab delimited file that describes each person participated (eg. participant ID, age, sex, etc)

- motion_data.json : Each motion capture file can have a corresponding .json file that details the parameters of the motion tracking system , task description etc.

3. Time Series Data

Due to continuous tracking of motion data it is stored as Time Series Data (In .CSV or .TSV format)

- **Time :** Timestamps of motion data
- **x , y , z coordinates :** 3D Spacial data of the subject positions (head or hand movements)
- **Speed / Acceleration :** Other motion attribute can be stored based on the data

Example Motion Data File.csv
time, x_position, y_position, z_position, speed, acceleration
0.0, 0.02, 0.04, 0.03, 1.2, 0.3
0.1, 0.03, 0.05, 0.04, 1.3, 0.35
0.2, 0.04, 0.06, 0.05, 1.4, 0.4

4. PyBids

A Python Library that makes it easier to work with data in BIDS format.

step 1 : Loading and Accessing Data
step 2 : Extracting Meta Data
step 3 : Managing Time Series Data
step 4 : Automating Data Preprocessing
step 5 : Querying and Filtering Data

DATASETS : - https://github.com/bids-standard/bids-examples

RESEARCH PAPERS : - https://www.nature.com/articles/s41597-024-03559-8

-