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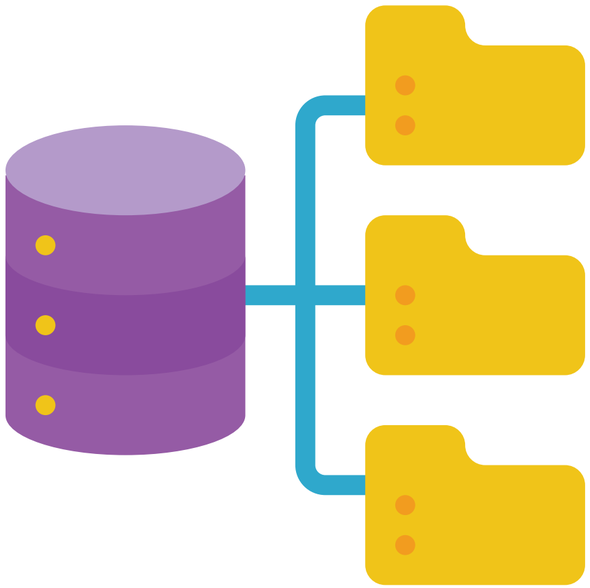
Implementación BIDS

Verónica Henao Isaza

Estandarización BIDS



1. Descargar o identificar la ubicación en el computador (path) donde se encuentra la base de datos seleccionada.
2. Evaluar la disponibilidad y distribución de la información

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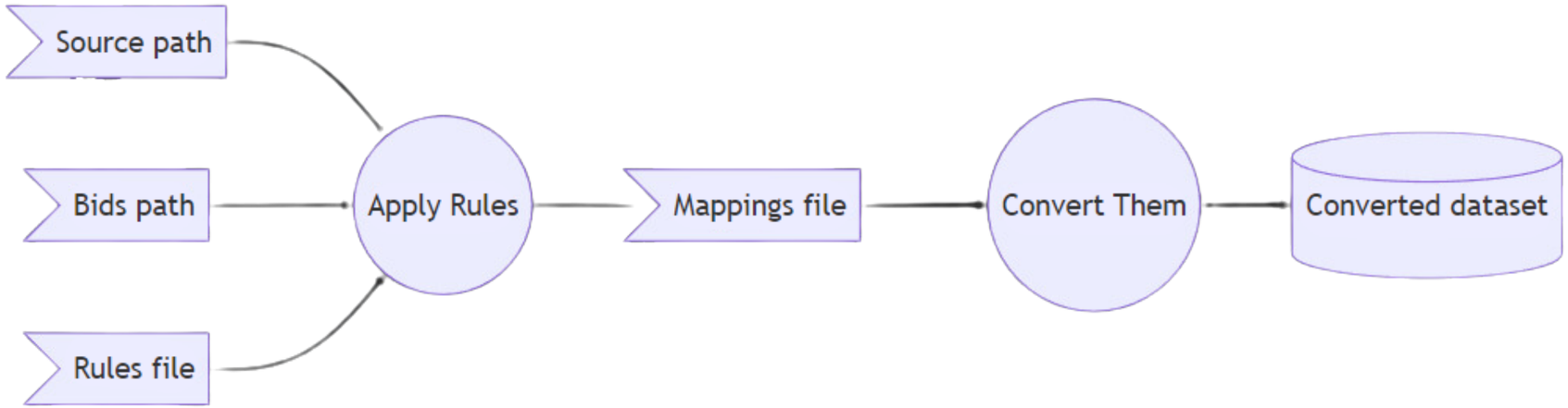
Recursos BIDS

sovabids es un paquete de python para automatizar la conversión eeg2bids .



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source_path: Ruta de base de datos sin formato BIDS a convertir
bids_path: Ruta final donde se almacenará la base de datos en formato BIDS
rules_path: Ruta del artcibo de reglas

Recursos BIDS

Welcome to sovabids' documentation!

CONTENTS:

- Intro to sovabids
- Rules File Schema
- Mappings File Schema
- Validation of bids datasets
- Examples Gallery
- API Reference
- GSoC Proposal
- GitHub Repository

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SOVABIDS

Click

SOVABIDS

EEG-to-BIDS conversion software focused on automation, reproducibility and interoperability

Mantilla Ramos Y [1–5], Hoyos Madera B [1–5], Bollmann S [2], Narayanan A [2–3], White D [4], Johnstone T [2–4], Civier O [2–4]

CONTACT

yjmantilla@gmail.com sovabids.readthedocs.io github.com/yjmantilla/sovabids

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2 The University of Queensland, Brisbane Queensland, Australia

3 Australian National Imaging Facility, Australia

4 Swinburne Neuroimaging, Swinburne University of Technology, Melbourne Victoria, Australia

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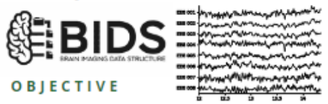
INTRODUCTION

The Brain Imaging Data Structure (BIDS) is a standard for organising the data and meta data produced by a neuroimaging experiment (Gorgolewski et al. 2016). It helps with data sharing and reusability. It has recently gained popularity within the electroencephalography (EEG) community (Pernet et al., 2019). Converting EEG data to BIDS is not technically difficult but involves substantial effort if done manually. Software options are available to assist the conversion, but they require either basic programming skills or detailed user input. The objective of this work is to develop easy-to-use software for automating EEG to BIDS conversion.



OBJECTIVE

To develop easy-to-use software for automating EEG to BIDS conversion.

METHODS

The following set of constraints were identified given the context of the problem:

- Adoption by non-technical users
- Automation and the handling of outliers
- Reproducible conversion
- Interoperability
- Broad support of formats and reusing available software

With these requirements in mind, the subsequent design decisions were made:

To maximise software adoption, step-by-step guides are provided. To decrease the need of programming skills the conversion uses human-readable YAML configuration files rather than a scripting language.

The output of most EEG experiments is multiple identically-organised data structures (one for each participant). Nevertheless, data organisation may slightly differ between participants. We leverage the generally similar organisation while still allowing for outliers by using two configuration files: 1) The Rules File, which encodes the general conversion rules for an EEG dataset; and 2) The Mappings File, which is derived from the Rules File, and holds specific conversion rules for every individual participant (Fig. 1). For increased automation, SOVABIDS also implements heuristics to exploit the common file path patterns used in EEG research.

All the parameters needed to fully replicate the conversion are saved in the configuration files along with provenance information. This allows the user to evaluate, correct and repeat the conversion in case problems are discovered during data analysis.

To increase maintainability, SOVABIDS does not include a graphical user interface (GUI), but has been provided with an API to allow interoperability with other applications, primarily GUI front ends (desktop or web-based). We used an RPC protocol as action-oriented methods naturally adjust to a conversion process.

MNE (Gramfort et al, 2013) supports a broad collection of EEG formats and MNE-BIDS (Appelhoff et al., 2019) is already capable of performing conversion albeit using detailed input and scripting from a technical user. Both packages were selected as ideal building-blocks for SOVABIDS.

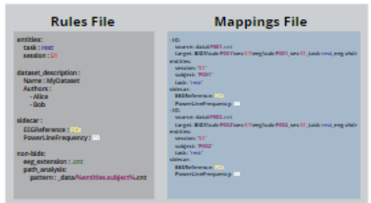


Fig 1: From a Rules File, a mapping for each file in the dataset can be generated and saved in the Mappings File. The colors illustrate how the information in both files is related.

RESULTS

An open-source python package (sovabids.readthedocs.io) comprising two main modules was developed:

1) A rules module to encode and interpret the rules of the conversion, and 2) a module interfacing with MNE-BIDS to execute the conversion (Fig. 2). Currently, it has been tested with BrainVision (.vhdr) and Neuroscan (.cnt) files. The user can derive the initial Rules File from a community or institutional template. A user-supervised adjustment loop is then included to allow manual input when fully automated generation of a participant-specific Mappings File is not possible. To demonstrate the usability of the API, a basic GUI was developed in Flask (see sovabids.readthedocs.io/en/latest/auto_examples/gui_example.html). Furthermore, SOVABIDS has become a part of the AEDAPT ecosystem (www.aedapt.net).

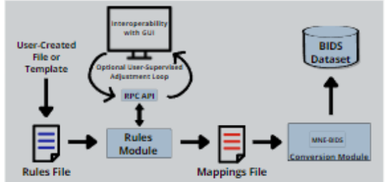


Fig 2: The architecture of SOVABIDS

CONCLUSIONS

SOVABIDS enables the reproducible semi-automatic and interoperable conversion of EEG datasets into BIDS through the use of human-readable configuration files. It makes BIDS more accessible to non-technical users and drastically reduces the human effort required for the conversion. Future work will focus on partial dataset conversion and on leveraging diverse metadata files from different vendors via the implementation of extensible heuristics, allowing for greater automation and a broader format support.

REFERENCES

- Gorgolewski, K.J. et al (2016). 'The brain imaging data structure, a format for organizing and describing outputs of neuroimaging experiments'. Scientific Data, 3 (160044).
- Appelhoff, S. et al. (2019). 'MNE-BIDS: Organizing electrophysiological data into the BIDS format and facilitating their analysis'. Journal of Open Source Software, 4:1896.
- Gramfort, A. et al. (2013). 'MEG and EEG data analysis with MNE-Python'. Frontiers in Neuroscience, 7(267):1–13.
- Pernet, C.R. et al. (2019). 'EEG-BIDS, an extension to the brain imaging data structure for electroencephalography'. Sci Data 6, 103.

ACKNOWLEDGMENTS

The project was supported by the Google Summer of Code 2021 program under the INCF organization, and by the Australian Research Data Commons (ARDC) initiative.

Google Summer of Code

ARDC Australian Research Data Commons

incf enabling open and FAIR neuroscience

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SOVABIDS

La conversión de datos de EEG a BIDS no es técnicamente difícil, pero implica un esfuerzo considerable si se realiza manualmente. Las opciones de software están disponibles para ayudar en la conversión, pero requieren habilidades básicas de programación o una entrada detallada del usuario. El objetivo de este trabajo es desarrollar un software fácil de usar para automatizar la conversión de EEG a BIDS.

SOVABIDS

P1_S0_EC.cnt
P1_S0_EO.cnt
P1_S1_EC.cnt
P1_S1_EO.cnt
P2_S0_EC.cnt
P2_S0_EO.cnt
P2_S1_EC.cnt
P2_S1_EO.cnt

EEG TO BIDS CONVERSION

- sub-P1
  - ses-S0
    - eeg
      - sub-P1_ses-S0_task-EC_channels.tsv
      - sub-P1_ses-S0_task-EC_eeg.edf
      - sub-P1_ses-S0_task-EC_eeg.json
      - sub-P1_ses-S0_task-EC_electrodes.tsv
      - sub-P1_ses-S0_task-EC_events.tsv
      - ...
  - ses-S1
    - ...
- sub-P2
  - ...

SOVABIDS

Rules File

```
entities:
   task : rest
   session : S1

dataset_description :
   Name : MyDataset
   Authors :
      - Alice
      - Bob

sidecar :
   EEGReference : FCz
   PowerLineFrequency : 50

non-bids:
   eeg_extension : .cnt
   path_analysis:
      pattern : _data/%entities.subject%.cnt
```

Mappings File

```
- IO:
   source: data\P001.cnt
   target: BIDS\sub-P001\ses-S1\eeg\sub-P001_ses-S1_task-rest_eeg.vhdr
entities:
   session: 'S1'
   subject: 'P001'
   task: 'rest'
sidecar:
   EEGReference: FCz
   PowerLineFrequency: 50
- IO:
   source: data\P002.cnt
   target: BIDS\sub-P002\ses-S1\eeg\sub-P002_ses-S1_task-rest_eeg.vhdr
entities:
   session: 'S1'
   subject: 'P002'
   task: 'rest'
sidecar:
   EEGReference: FCz
   PowerLineFrequency: 50
```

Fig 1: From a Rules File, a mapping for each file in the dataset can be generated and saved in the Mappings File. The colors illustrate how the information in both files is related.

Reglas generales

Reglas particulares

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Recursos BIDS

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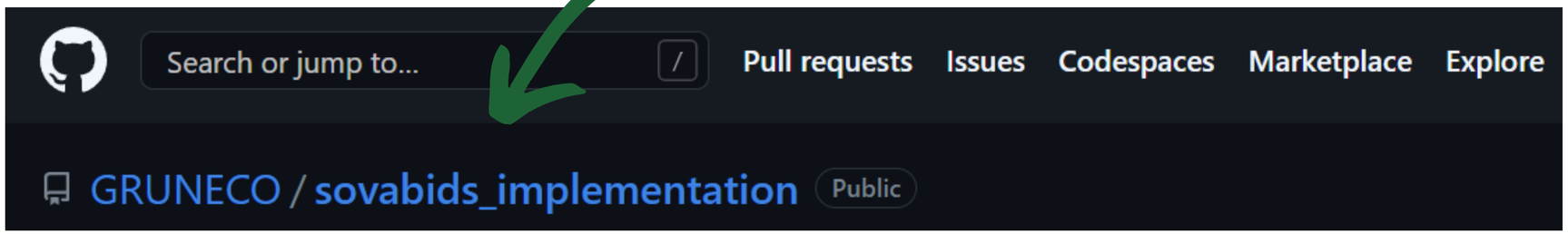

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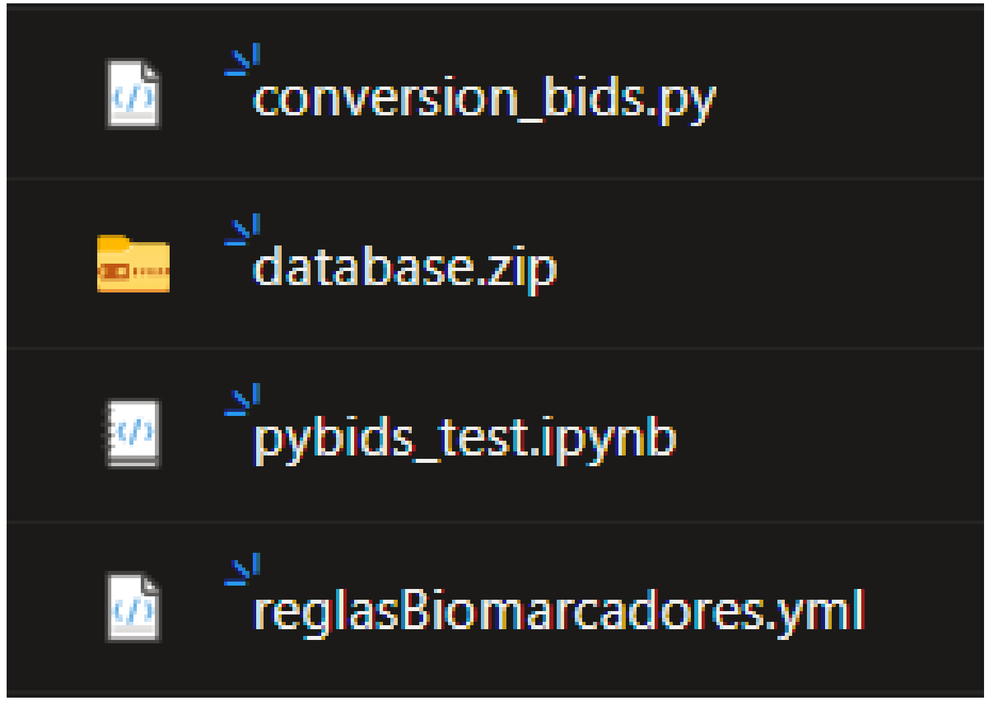

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Descripción de los recursos

database.zip\database - archivo ZIP, tamaño descomprimido 16,266,104 bytes

database.zip

Nombre	Tamaño	Comprimido	Tipo	Modificado	CRC32
..			Carpeta de archivos		
CTR_001_V0_CE.cnt	2,033,263	619,474	Archivo CNT	1/04/2023 4:24...	2FF32D68
CTR_001_V0_OE.cnt	2,033,263	619,474	Archivo CNT	1/04/2023 4:24...	2FF32D68
CTR_001_V1_CE.cnt	2,033,263	619,474	Archivo CNT	1/04/2023 4:24...	2FF32D68
CTR_001_V1_OE.cnt	2,033,263	619,474	Archivo CNT	1/04/2023 4:24...	2FF32D68
CTR_002_V0_CE.cnt	2,033,263	619,474	Archivo CNT	1/04/2023 4:24...	2FF32D68
CTR_002_V0_OE.cnt	2,033,263	619,474	Archivo CNT	1/04/2023 4:24...	2FF32D68
CTR_002_V1_CE.cnt	2,033,263	619,474	Archivo CNT	1/04/2023 4:24...	2FF32D68
CTR_002_V1_OE.cnt	2,033,263	619,474	Archivo CNT	1/04/2023 4:24...	2FF32D68

Descripción de los recursos

pybids_test.ipynb

```python
from bids import BIDSLayout

def test_bids():
    #sourcePath = input('Ingrese el Path: ')
    sourcePath = '/content/drive/MyDrive/eeg2bids/database'
    try:
        layout = BIDSLayout(sourcePath)
        eegs = layout.get(extension='.edf', task='CE',suffix='eeg', return_type='filename')
        eegs += layout.get(extension='.edf', task='OE',suffix='eeg', return_type='filename')
        print('BIDS format OK')
    except:
        print('Try to convert of Dataset in BIDS format using "conversion_bids"')

if __name__ == '__main__':
    test_bids()
```

Descripción de los recursos

conversion_bids.py

```python
import os # For path manipulation
#import shutil # File manipulation
from sovabids.rules import apply_rules # Apply rules for conversion
from sovabids.convert import convert_them # Do the conversion
#from sovabids.datasets import lemon_prepare # Download the dataset
from sovabids.settings import REPO_PATH

current = os.getcwd()
sourcePath= os.path.join(current,'database')
bidsPath = os.path.join(current,'database_bids')
os.makedirs(bidsPath,exist_ok=True)
rulePath= os.path.join(current,'reglasBiomarcadores.yml')

source_path = os.path.abspath(sourcePath) # For the input data we will convert
bids_path= os.path.abspath(bidsPath) # The output directory that will have the converted data
rules_path = os.path.abspath(rulePath) # The rules file that setups the rule for conversion
mapping_path = os.path.abspath(os.path.join(bids_path,'code','sovabids','mappings.yml')) # The mapping file that will hold the results of applying the rules to each file


print('source_path:',source_path.replace(REPO_PATH,''))
print('bids_path:', bids_path.replace(REPO_PATH,''))
print('rules_path:',rules_path.replace(REPO_PATH,''))
print('mapping_path:',mapping_path.replace(REPO_PATH,''))

with open(rules_path,encoding="utf-8") as f:
    rules = f.read()
    print(rules)

apply_rules(source_path,bids_path,rules_path,mapping_path)
convert_them(mapping_path)
```

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Descripción de los recursos

reglasBiomarcadores.yml

```yaml
dataset_description:                    # Configuring the dataset_description.json file
  Name : Biomarcadores                  # Name of the dataset, set up as a fixed string
  Authors:                              # Here I put the personnel involved in the acquisition of the dataset
    - Veronica Henao Isaza

sidecar:                                # Configuring the sidecar eeg file
  PowerLineFrequency : 50               # Noted from the visual inspection of the eeg spectrum
  EEGReference : Mastoide derecha       # As mentioned in https://www.nature.com/articles/sdata2018308

channels:                               # Configuring the channels tsv
  type :                                # This property allow us to overwrite channel types inferred by MNE
    VEOGR : VEOG                         # Here the syntax is <channel name> : <channel type according to bids notation>
    HEOG : HEOG                          # Here we set the type of F3, it was already correctly inferred by mne but it is included to illustrate retyping of vario
    LEFT_EAR : MISC
    NA1 : MISC

non-bids:                               # Additional configuration not belonging specifically to any of the previous objects
  eeg_extension : .cnt                  # Sets which extension to read as an eeg file
  path_analysis:
    pattern : database/%ignore%_%entities.subject%_%entities.session%_%entities.task%.cnt      # Some bids properties can be inferred from the path
    #pattern : database/(.+)_(.+)_(.+)_(.+).cnt                                                 # For example here we extract from the path the "sub
    #fields :
    #  - ignore
    #  - entities.subject
    #  - entities.session
    #  - entities.task
```

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Recursos modo desarrollador

```
git clone https://github.com/<gh-username>/sovabids.git
cd sovabids
pip install -r requirements-dev.txt
```

Test BIDS

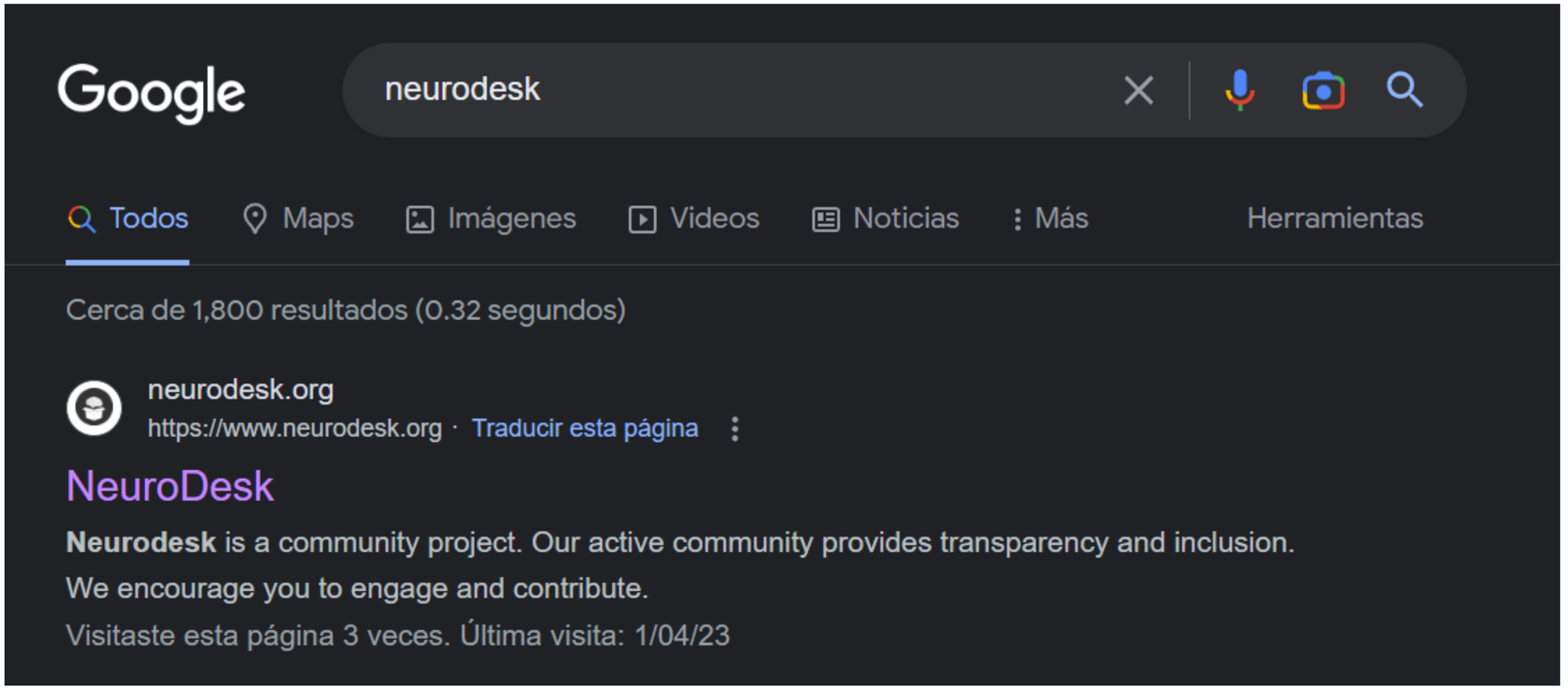
Podemos comprobar si la base de datos que tenemos esta o no en formato BIDS ejecutando las siguientes líneas:

```python
from bids import BIDSLayout

def test_bids():
    #sourcePath = input('Ingrese el Path: ')
    sourcePath = '/content/drive/MyDrive/eeg2bids/database'
    try:
        layout = BIDSLayout(sourcePath)
        eegs = layout.get(extension='.edf', task='CE',suffix='eeg', return_type='filename')
        eegs += layout.get(extension='.edf', task='OE',suffix='eeg', return_type='filename')
        print('BIDS format OK')
    except:
        print('Try to convert of Dataset in BIDS format using "conversion_bids"')

if __name__ == '__main__':
    test_bids()
```

Implementación BIDS



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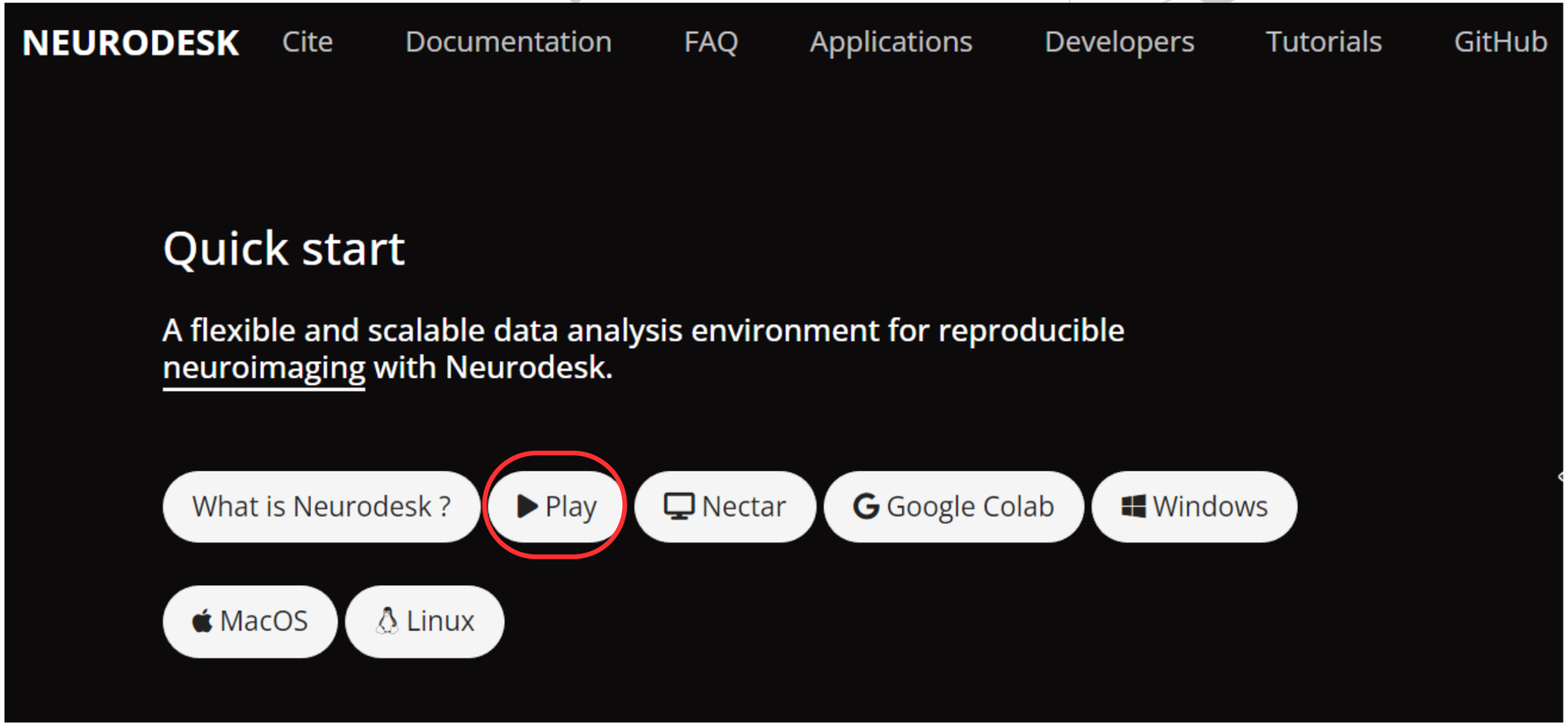

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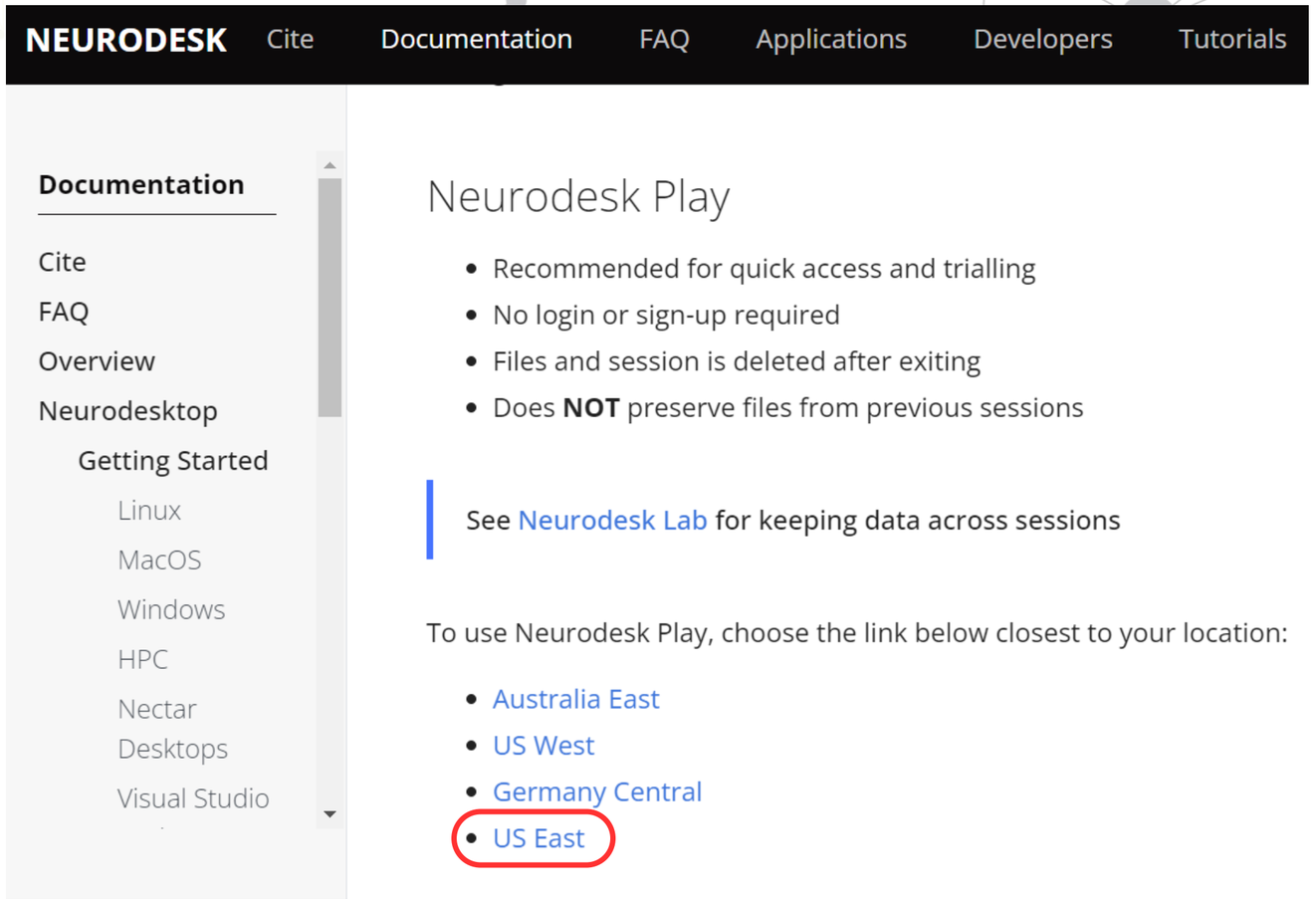

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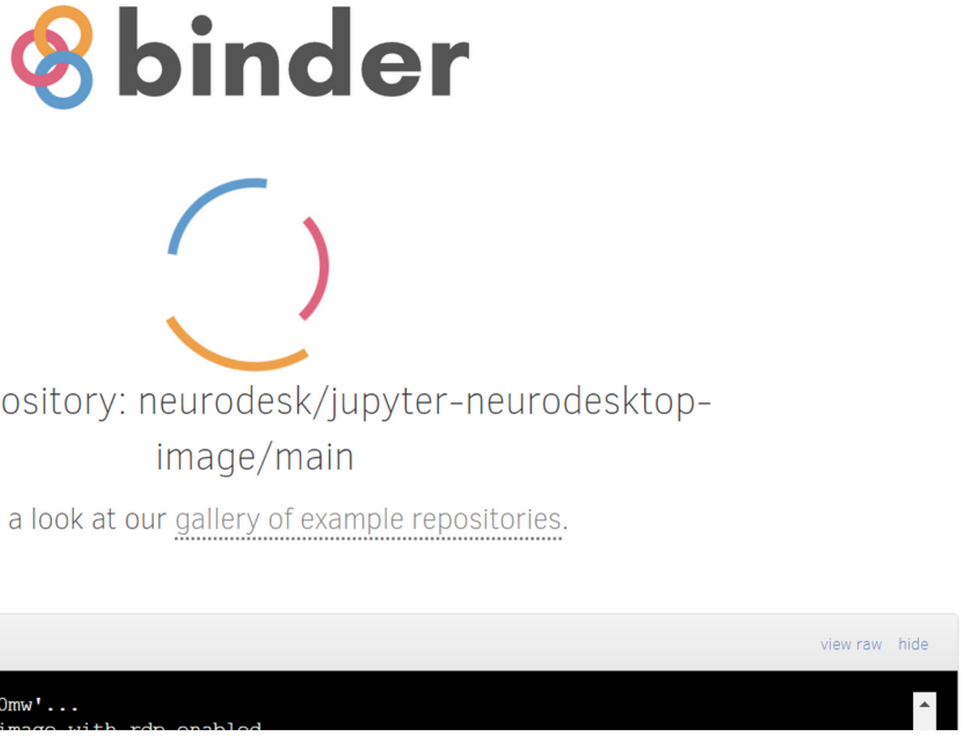

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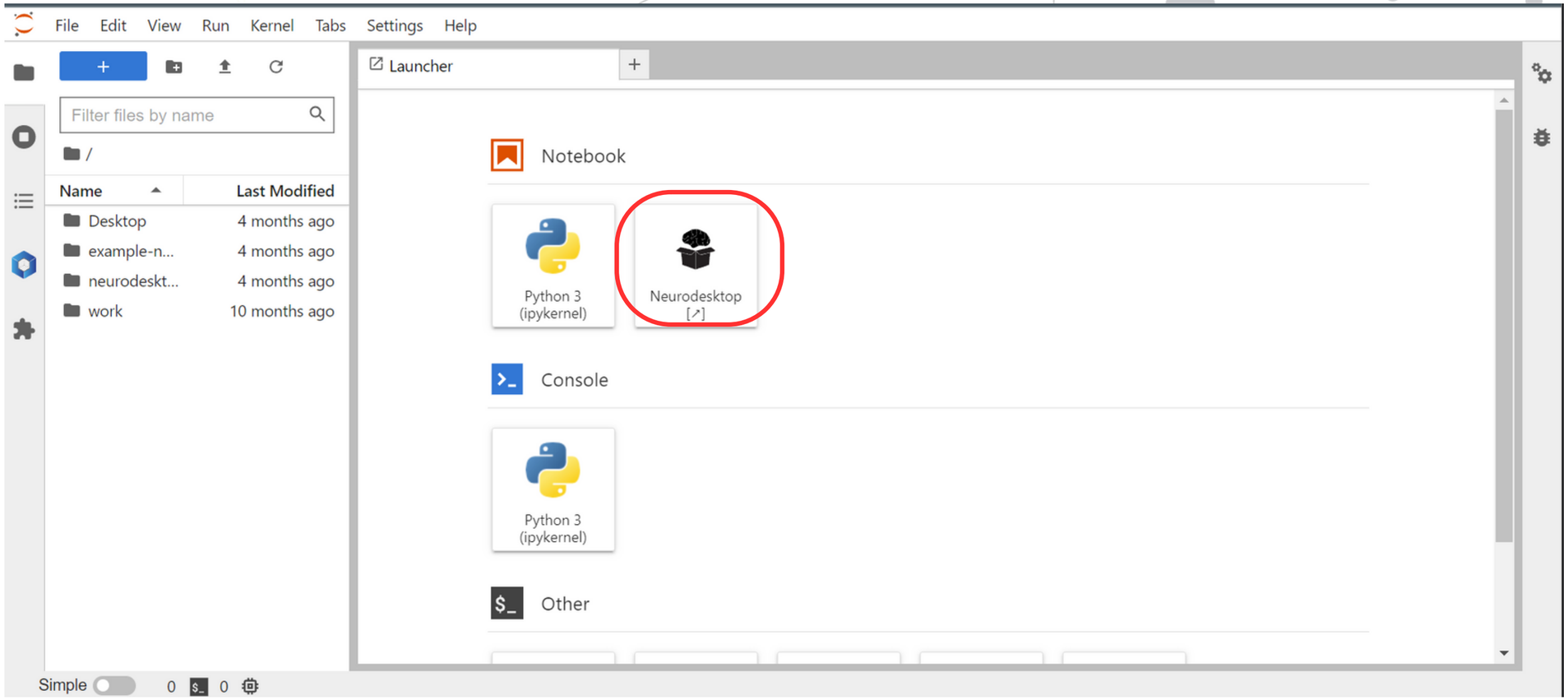

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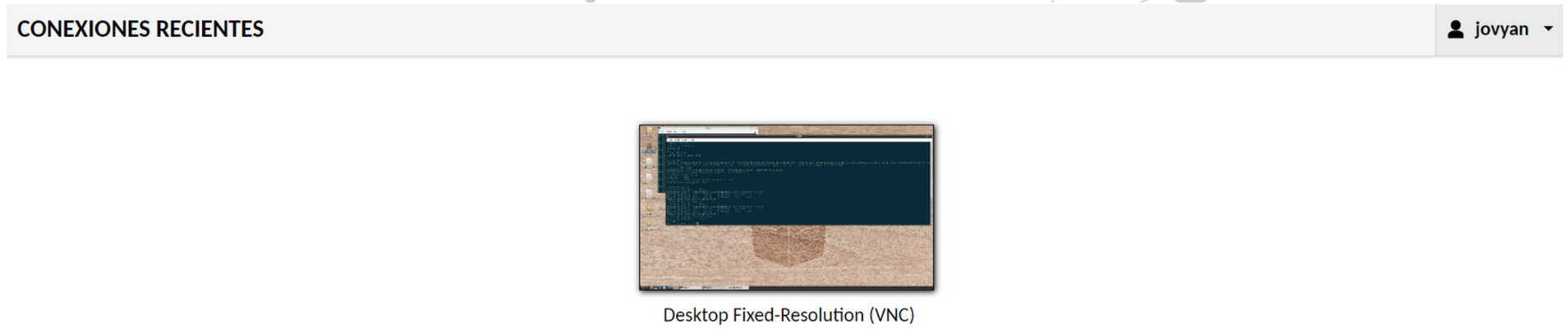

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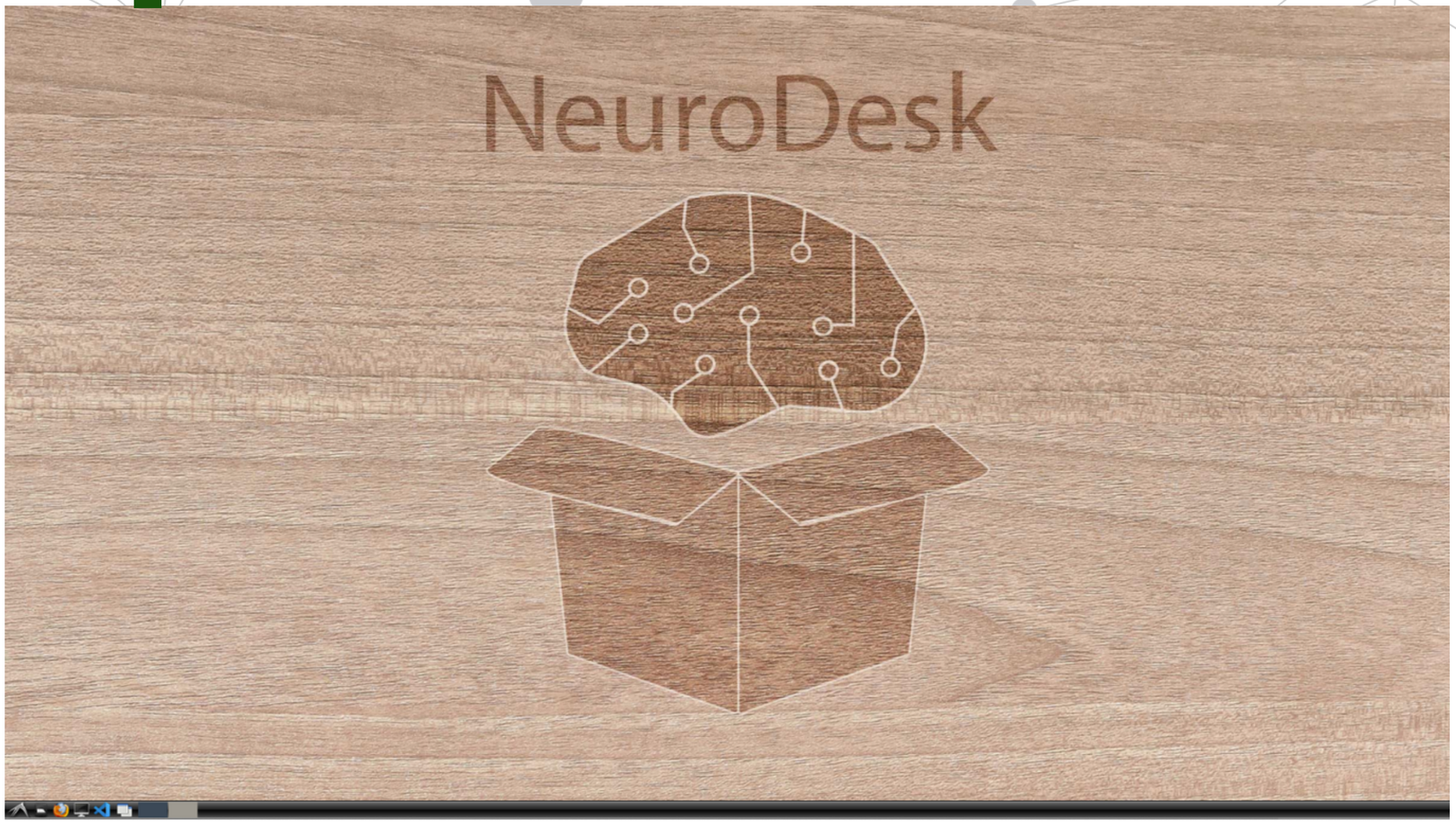

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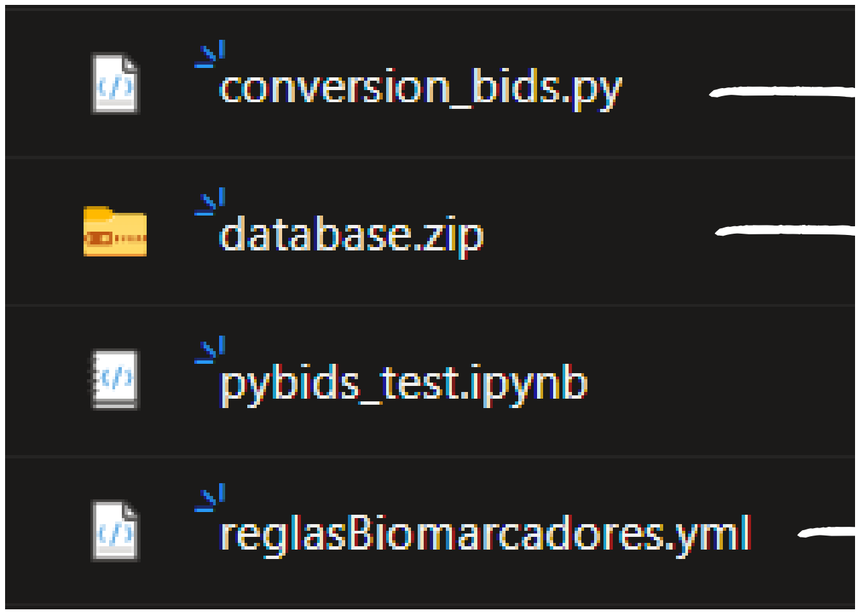

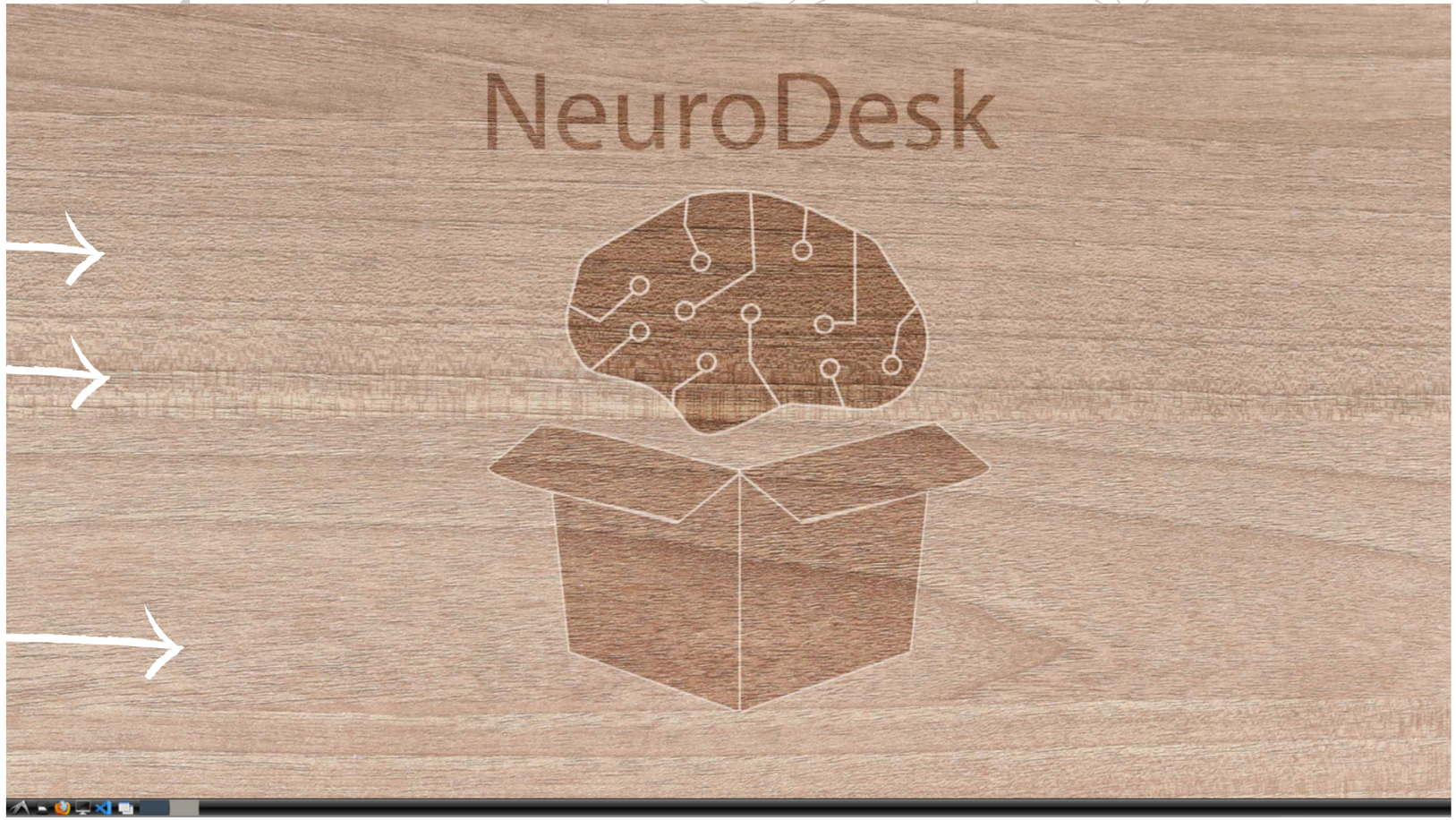

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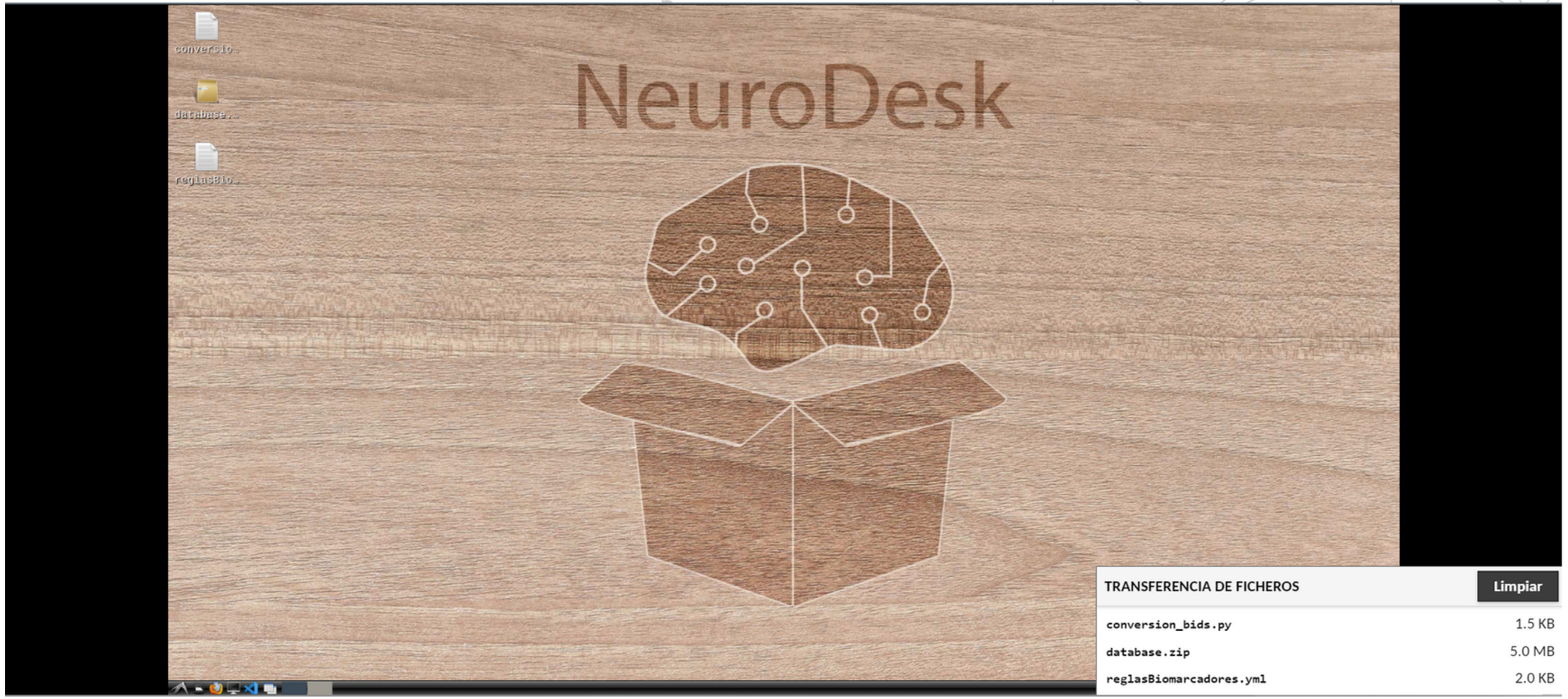

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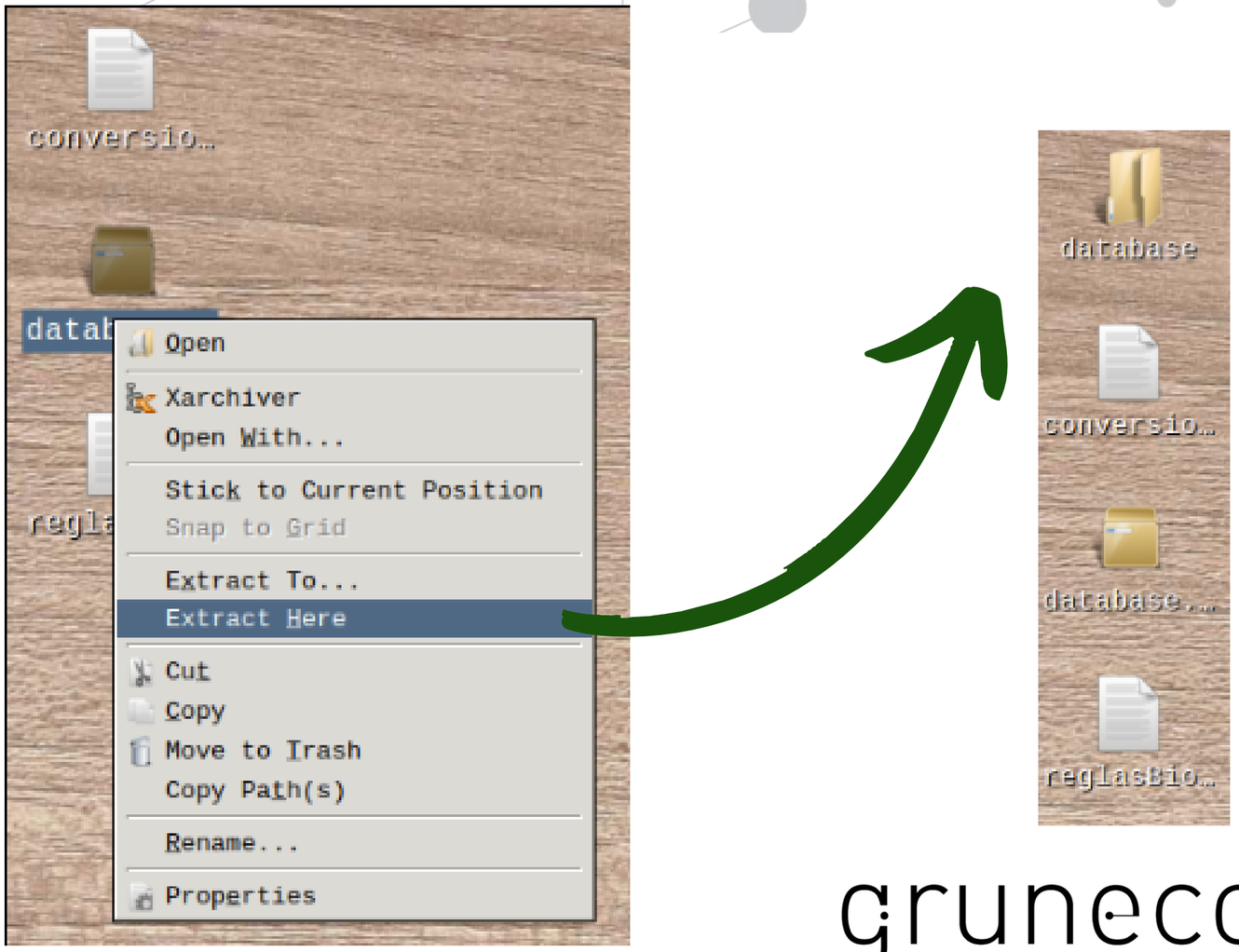

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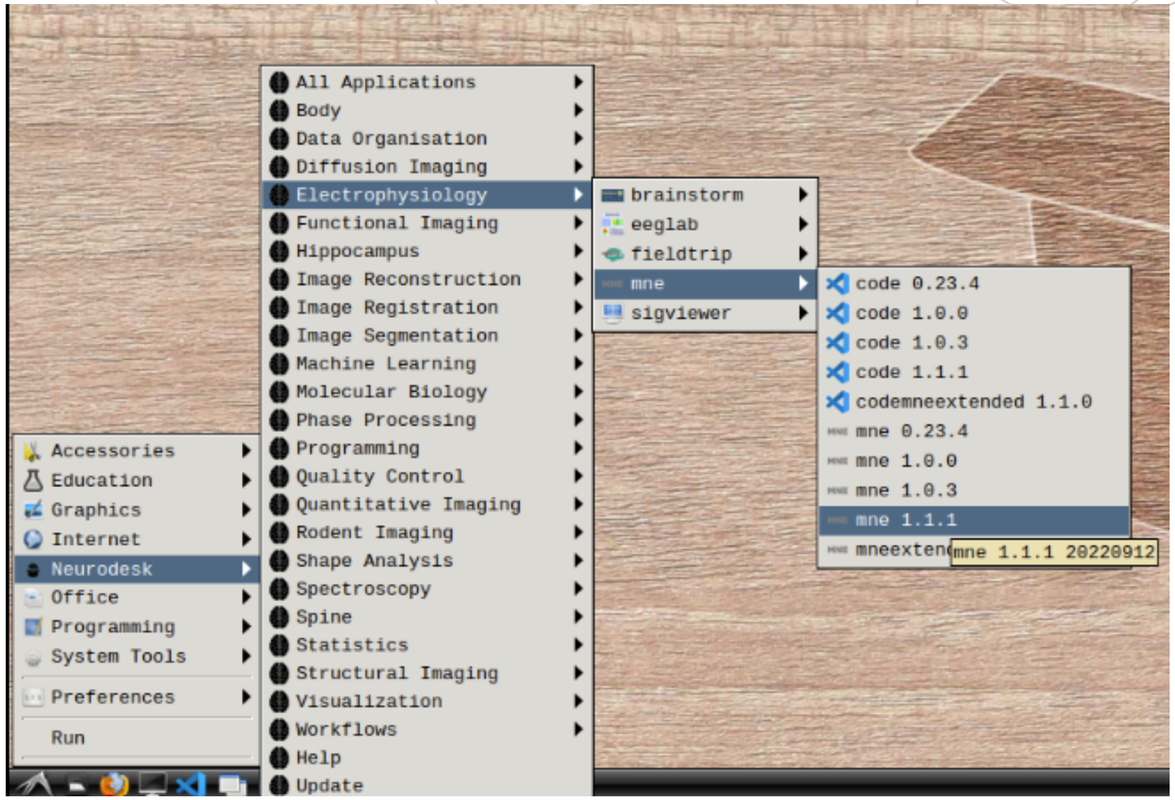
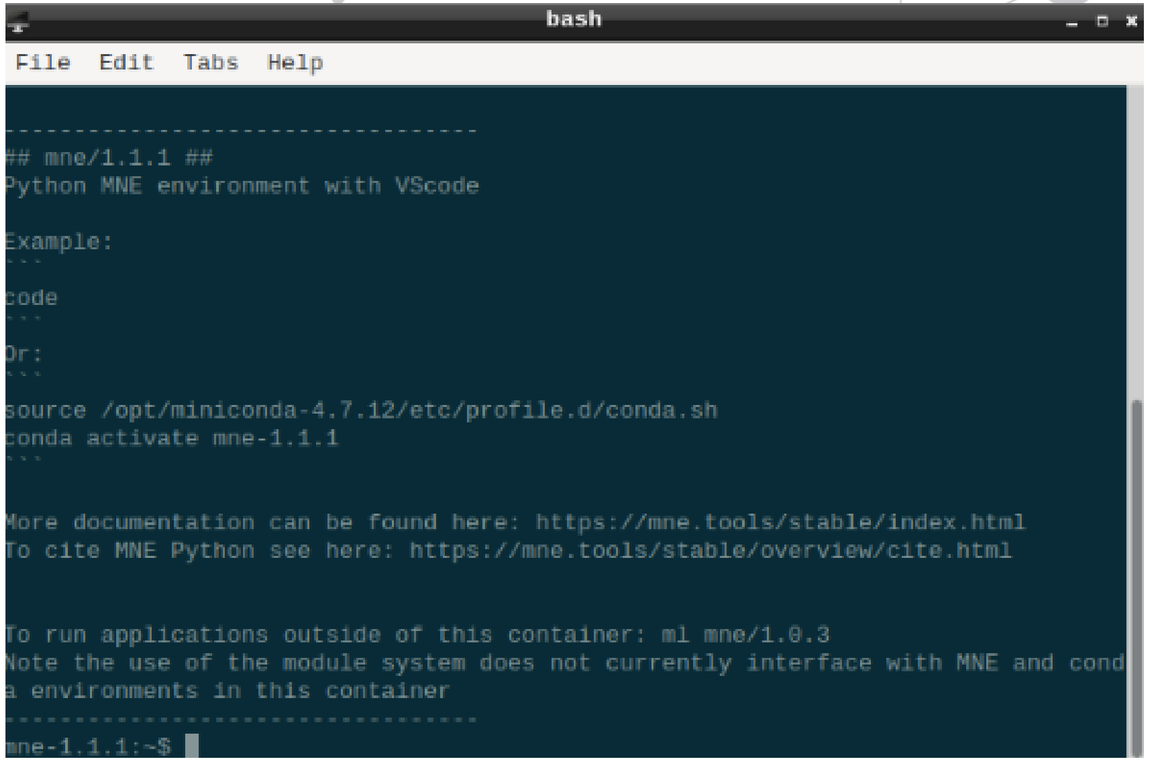


Implementación BIDS



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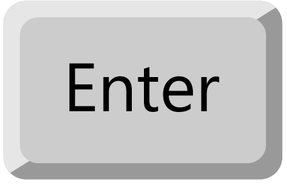
source /opt/miniconda-4.7.12/etc/profile.d/conda.sh



conda activate mne-1.1.1

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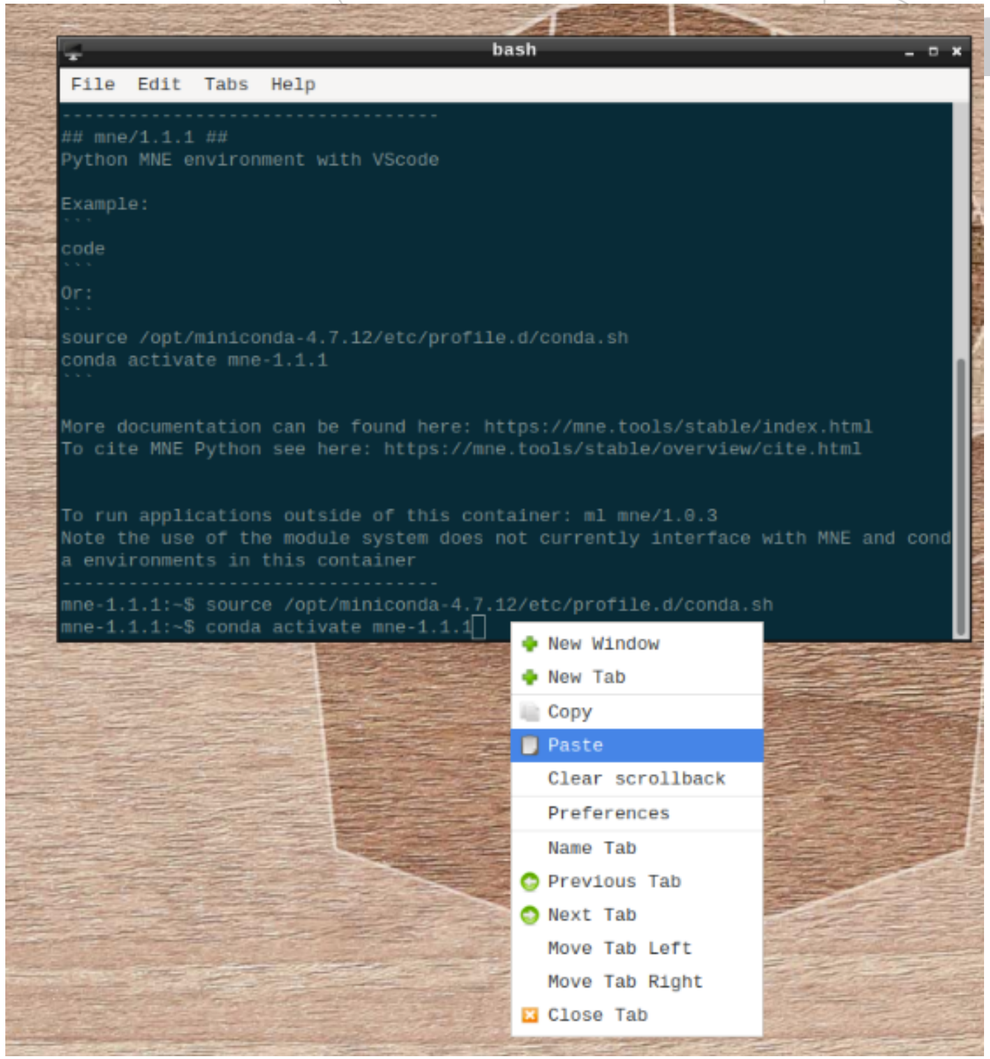
Implementación BIDS



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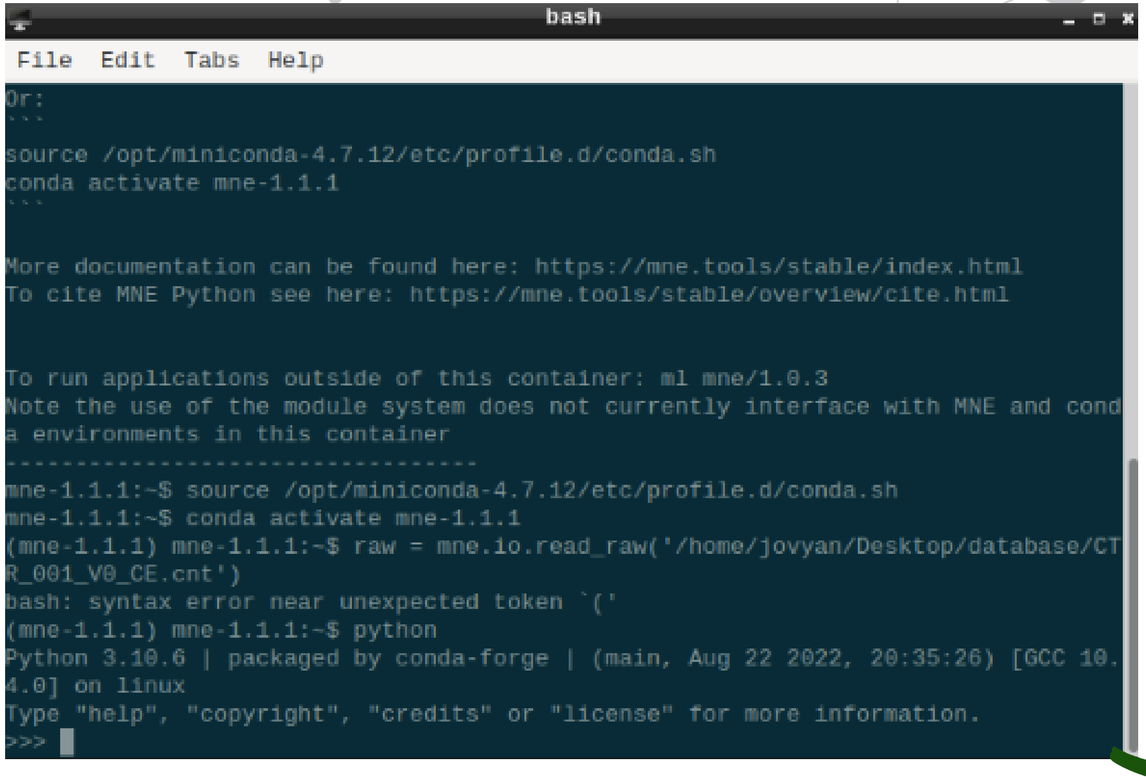
Implementación BIDS

python

Enter



>>>

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Implementación BIDS

```
import mne
```

Enter

```
path = '/home/jovyan/Desktop/database/CTR_001_V0_CE.cnt'
```

```
raw = mne.io.read_raw(path)
```

Enter

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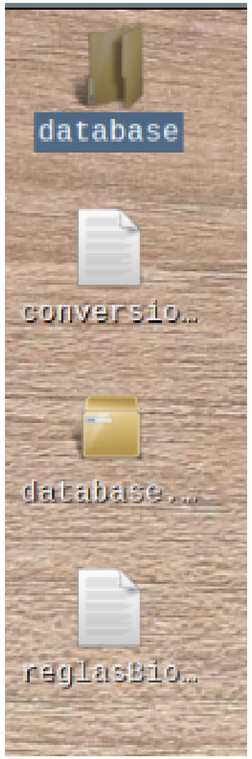
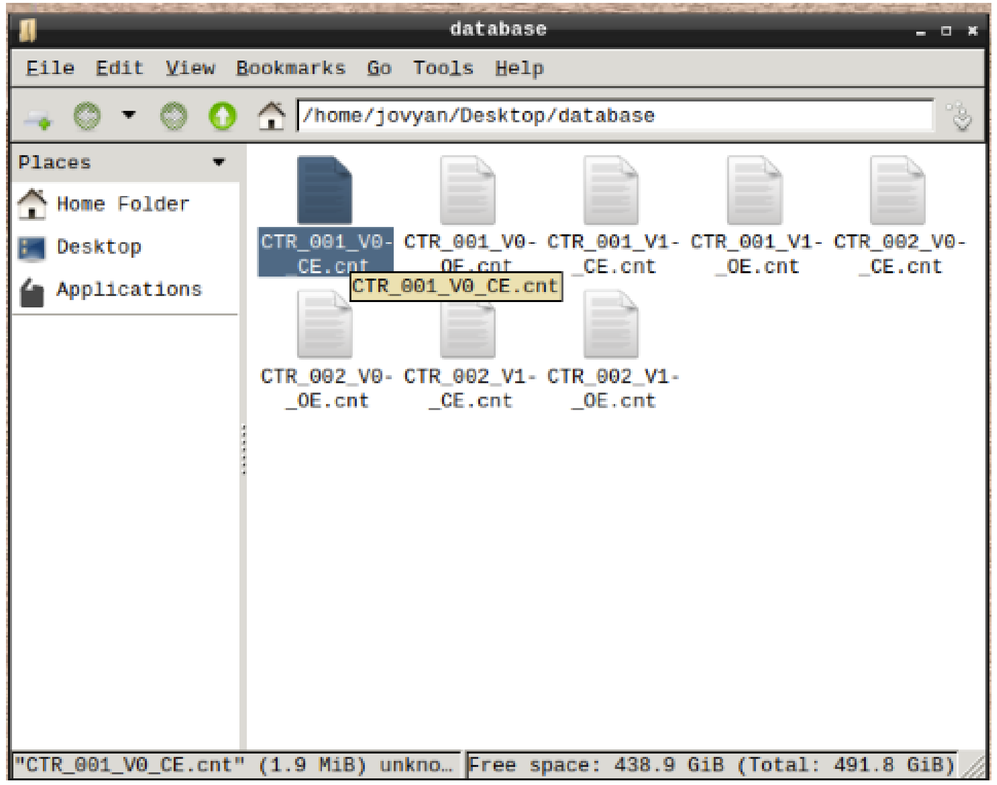
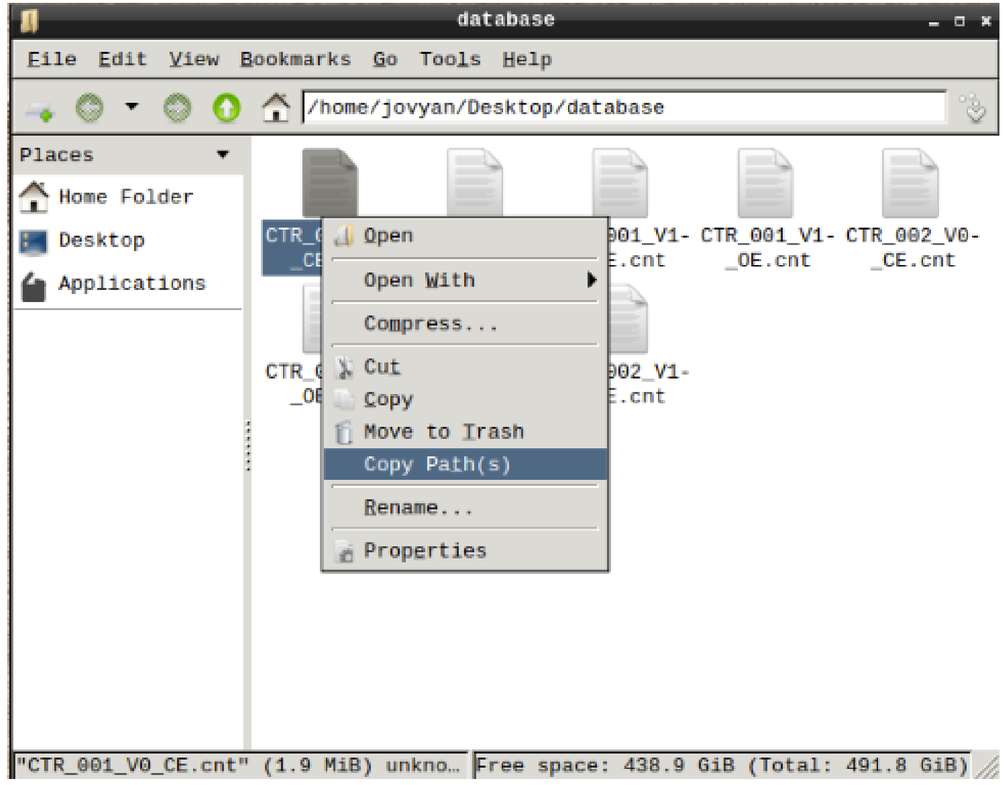
Implementación BIDS







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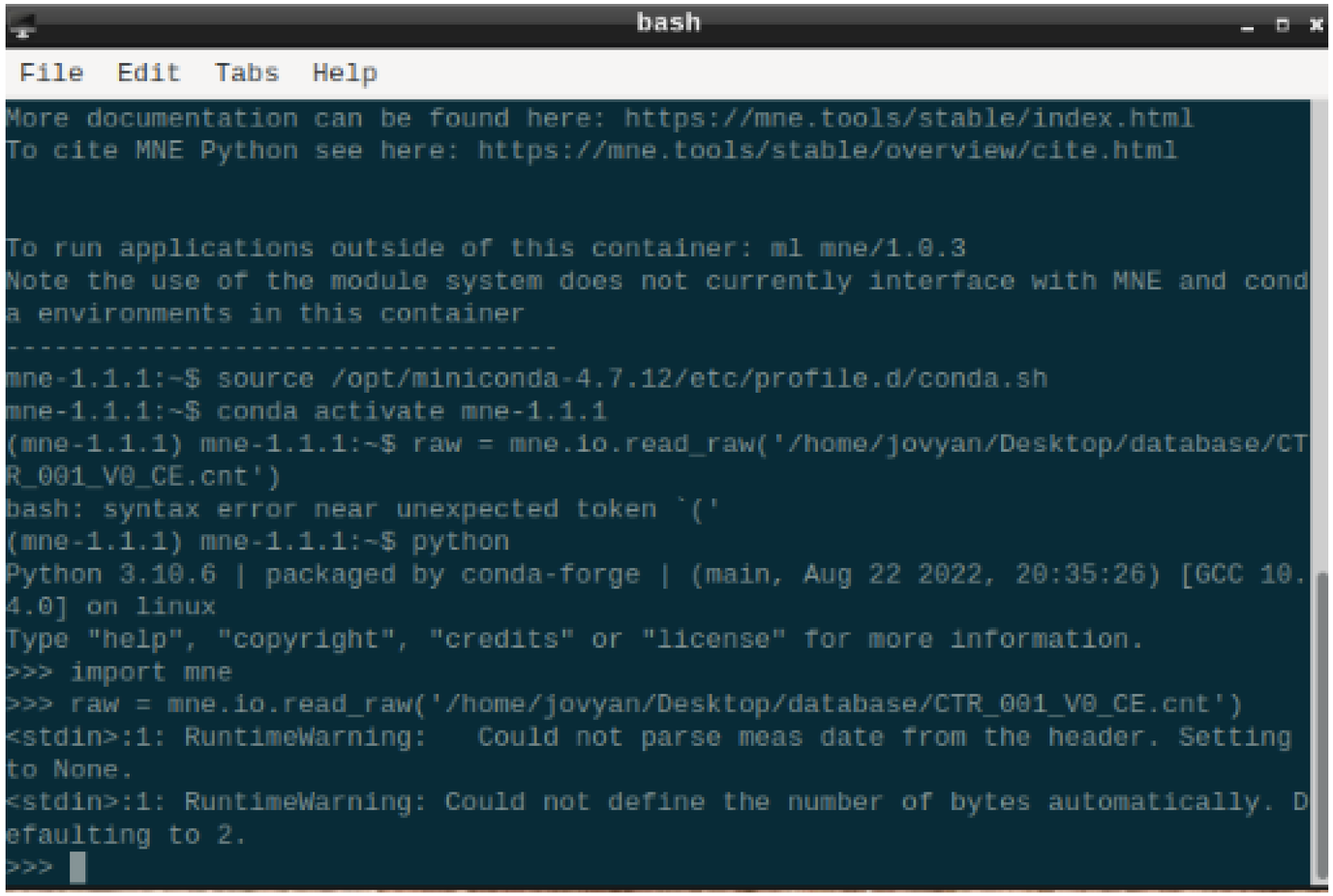

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Implementación BIDS

```
import mne
```

Enter

```
path = '/home/jovyan/Desktop/database/CTR_001_V0_CE.cnt'
```

```
raw = mne.io.read_raw(path)
```

Enter

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Implementación BIDS

raw.info

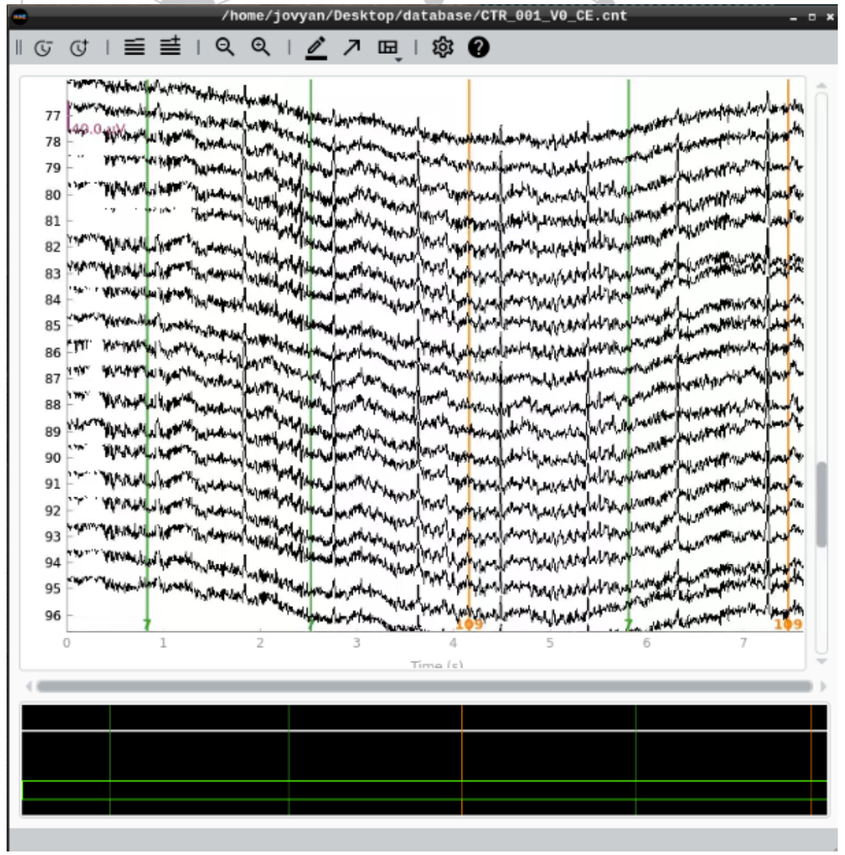

```
>>> raw.info
<Info | 10 non-empty values
 bads: 2 items (LEFT_EAR, VEOGR)
 ch_names: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, .
 chs: 128 EEG
 custom_ref_applied: False
 description: Unspecified
 highpass: 0.0 Hz
 lowpass: 200.0 Hz
 meas_date: unspecified
 nchan: 128
 projs: []
 sfreq: 400.0 Hz
 subject_info: 5 items (dict)
```

Implementación BIDS

raw.plot()

Enter

```
>>> raw.plot()
Matplotlib created a temporary config/cache directory at /tmp/matplotlib-2bwbyt
w because the default path (/home/jovyan/.config/matplotlib-mpldir) is not a wr
table directory; it is highly recommended to set the MPLCONFIGDIR environment v
riable to a writable directory, in particular to speed up the import of Matplot
ib and to better support multiprocessing.
Using qt as 2D backend.
QStandardPaths: error creating runtime directory '/neurodesktop-storage' (Read-
nly file system)
<mne_qt_browser._pg_figure.MNEQtBrowser object at 0x7fe770131120>
>>>
```



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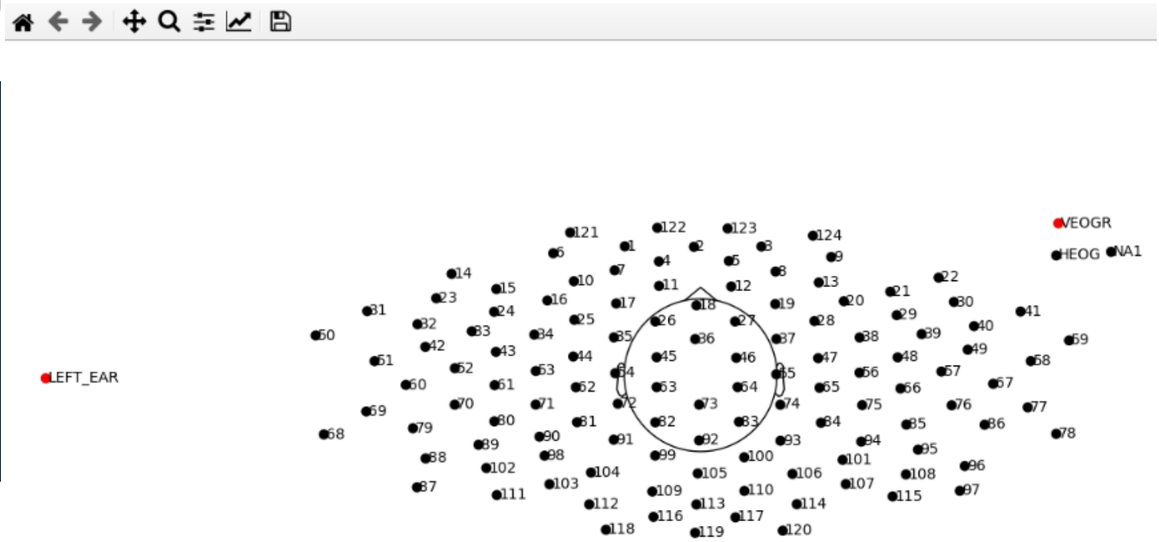
raw.plot_sensors(show_names=True)

Enter

```
>>> Channels marked as bad:
['LEFT_EAR', 'VEOGR']
Attempting to create new mne-python configuration file:
/home/jovyan/.mne/mne-python.json

>>> raw.plot_sensors(show_names=True)
<Figure size 640x640 with 1 Axes>
>>>
```



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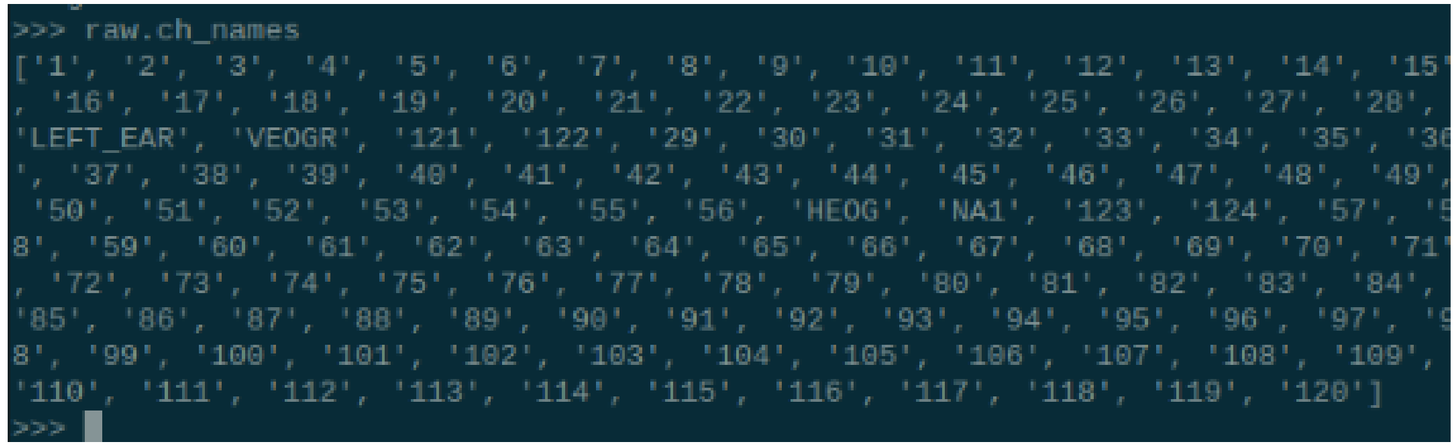
raw.ch_names

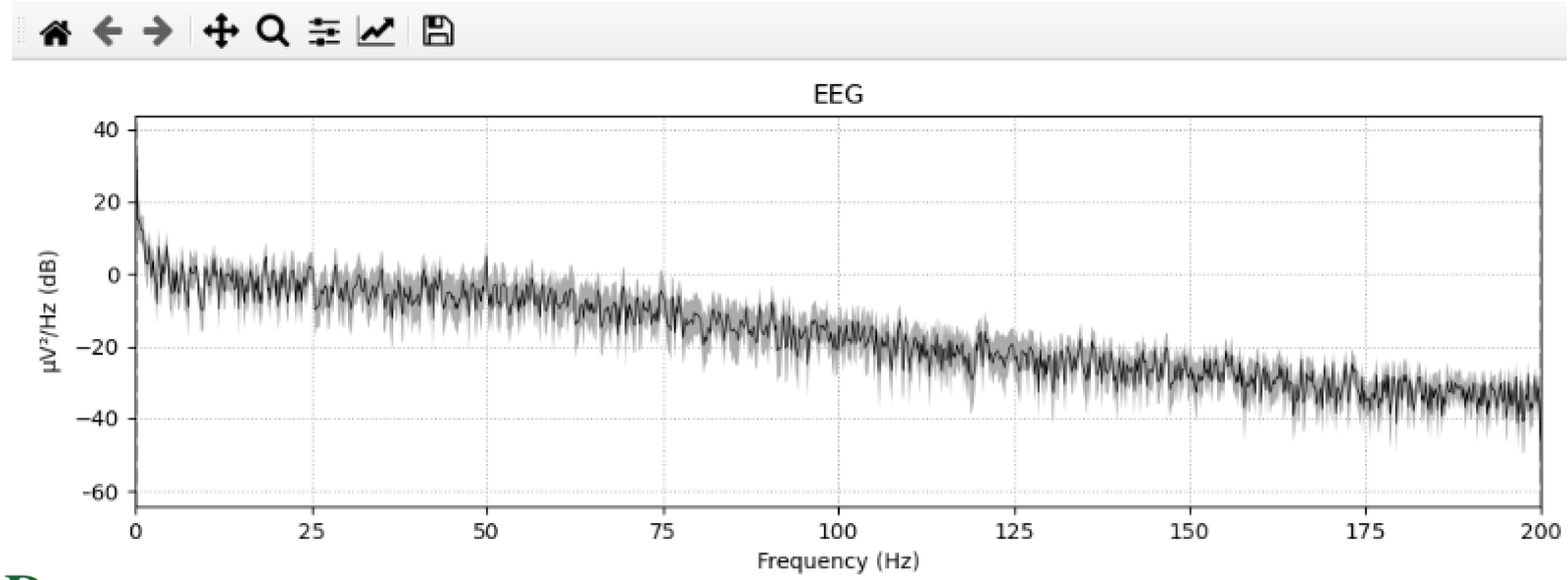



```
>>> raw.ch_names
['1', '2', '3', '4', '5', '6', '7', '8', '9', '10', '11', '12', '13', '14', '15'
, '16', '17', '18', '19', '20', '21', '22', '23', '24', '25', '26', '27', '28',
'LEFT_EAR', 'VEOGR', '121', '122', '29', '30', '31', '32', '33', '34', '35', '36
', '37', '38', '39', '40', '41', '42', '43', '44', '45', '46', '47', '48', '49',
 '50', '51', '52', '53', '54', '55', '56', 'HEOG', 'NA1', '123', '124', '57', '5
8', '59', '60', '61', '62', '63', '64', '65', '66', '67', '68', '69', '70', '71'
, '72', '73', '74', '75', '76', '77', '78', '79', '80', '81', '82', '83', '84',
'85', '86', '87', '88', '89', '90', '91', '92', '93', '94', '95', '96', '97', '9
8', '99', '100', '101', '102', '103', '104', '105', '106', '107', '108', '109',
'110', '111', '112', '113', '114', '115', '116', '117', '118', '119', '120']
>>>
```

Implementación BIDS

raw.plot_pds(average=True)

```
>>> raw.plot_psd(average=True)
Effective window size : 5.120 (s)
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    0.0s remaining:    0.0s
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    0.0s finished
```



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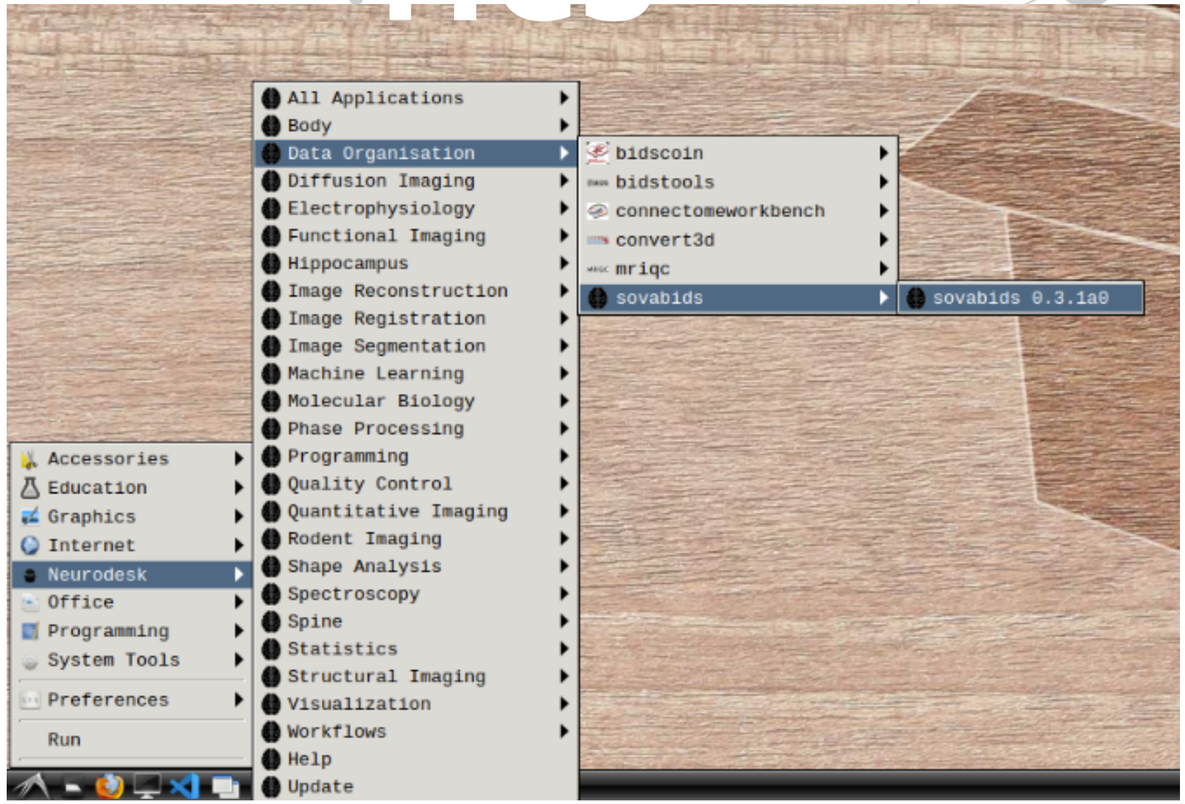

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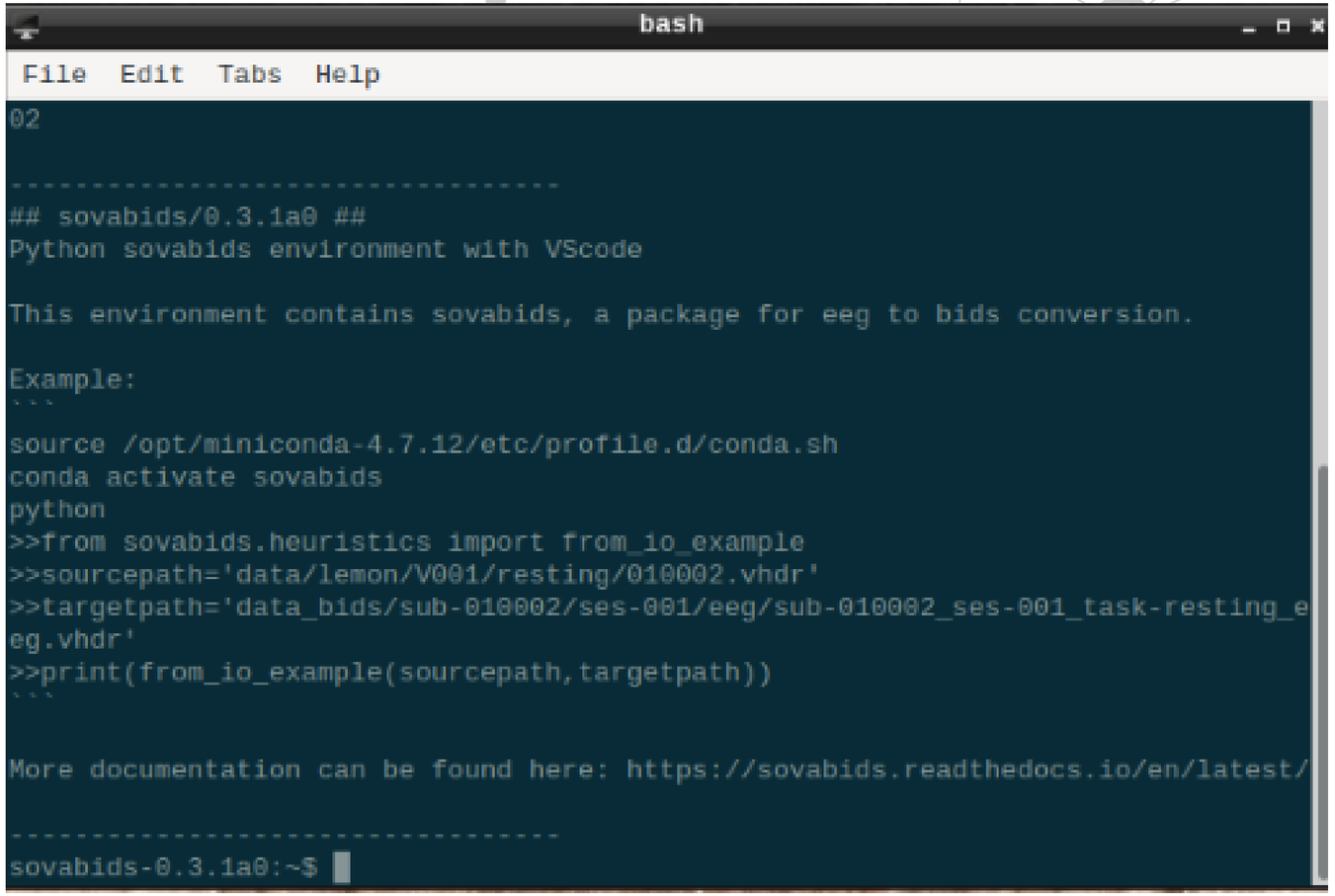

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Implementación BIDS

source /opt/miniconda-4.7.12/etc/profile.d/conda.sh

conda activate sovabids

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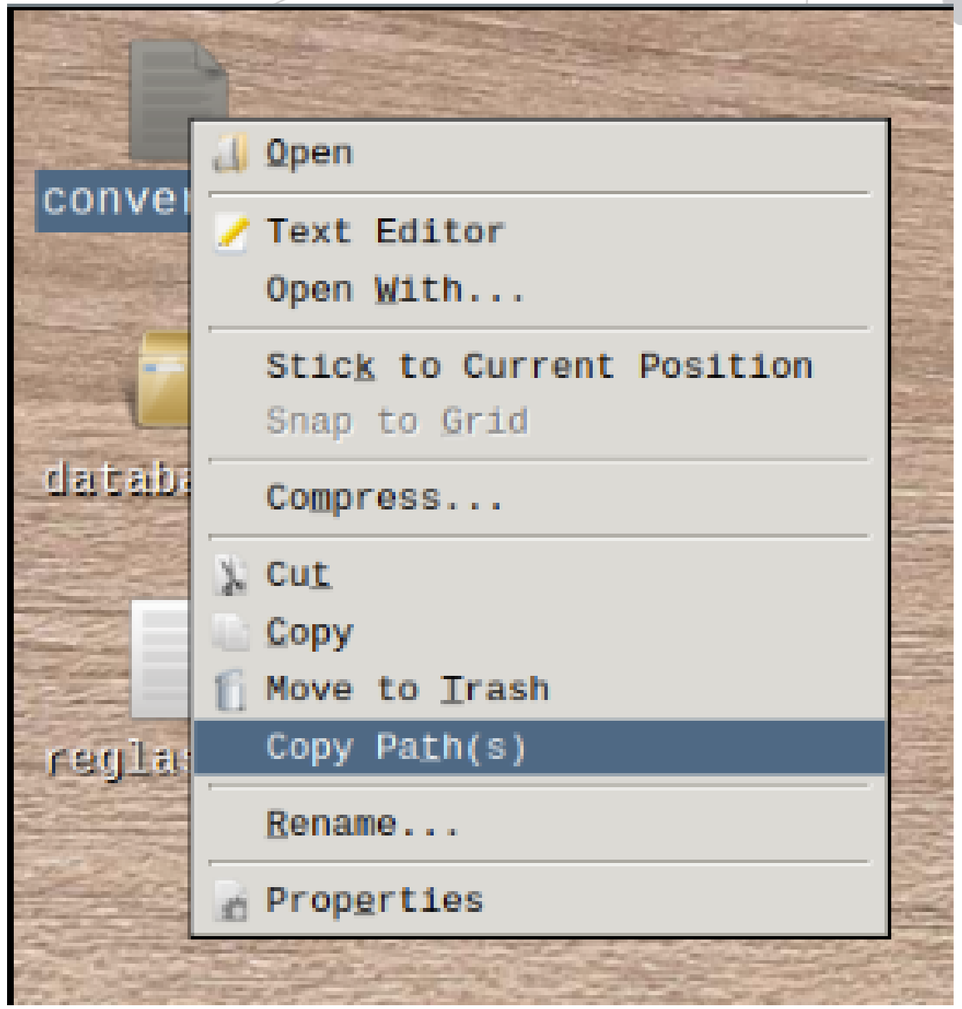

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Implementación BIDS

cd Desktop

Enter

python /home/jovyan/Desktop/conversion_bids.py

Enter

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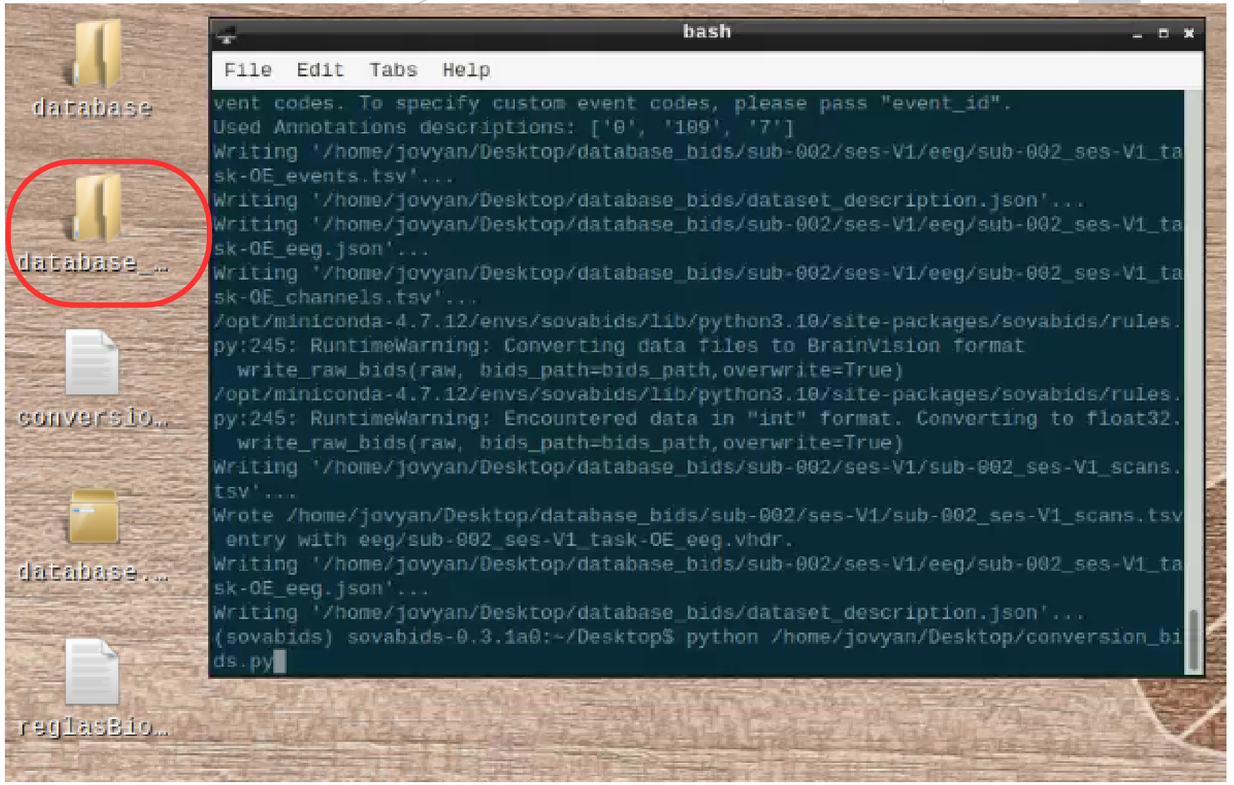

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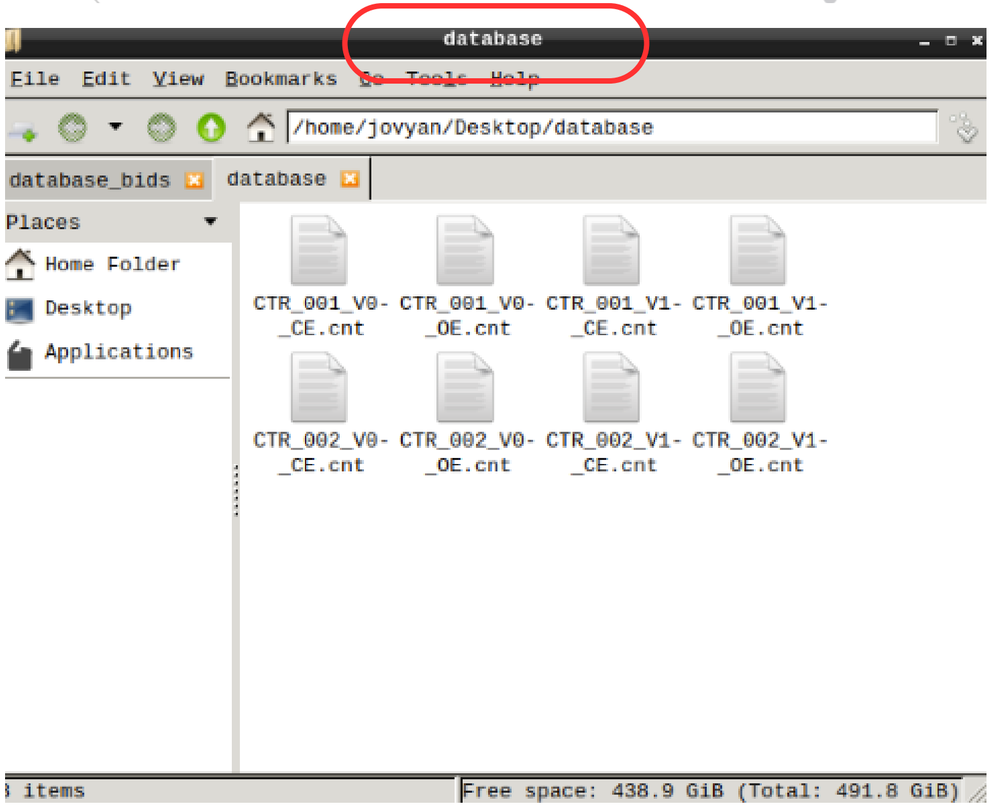

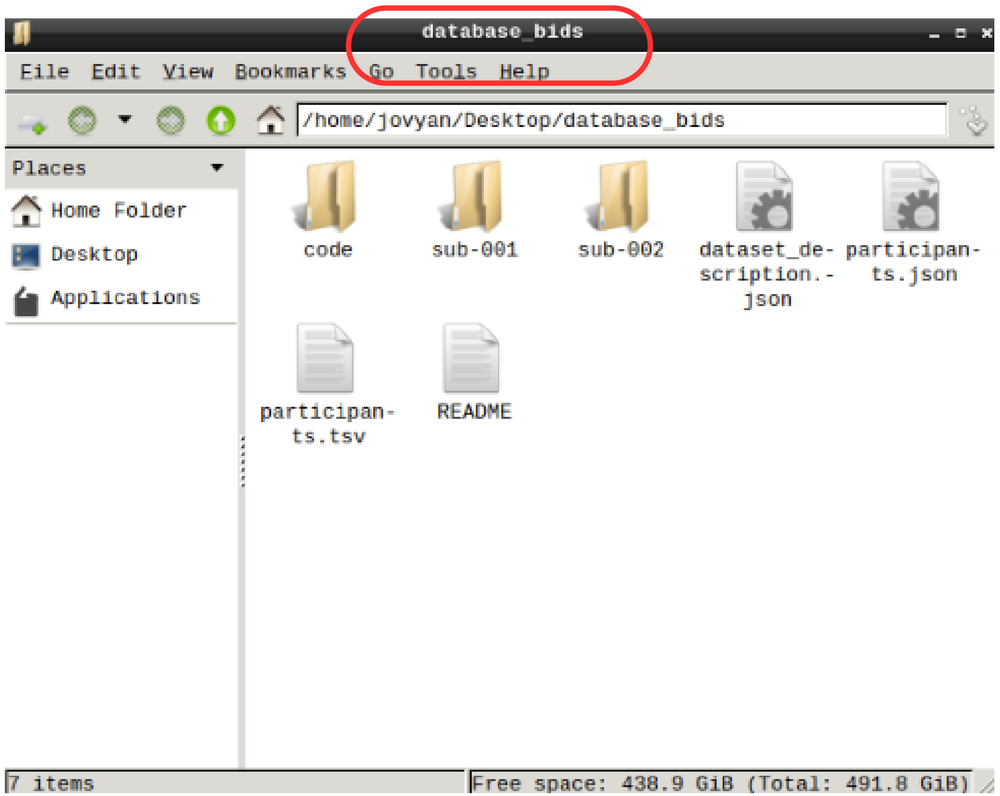

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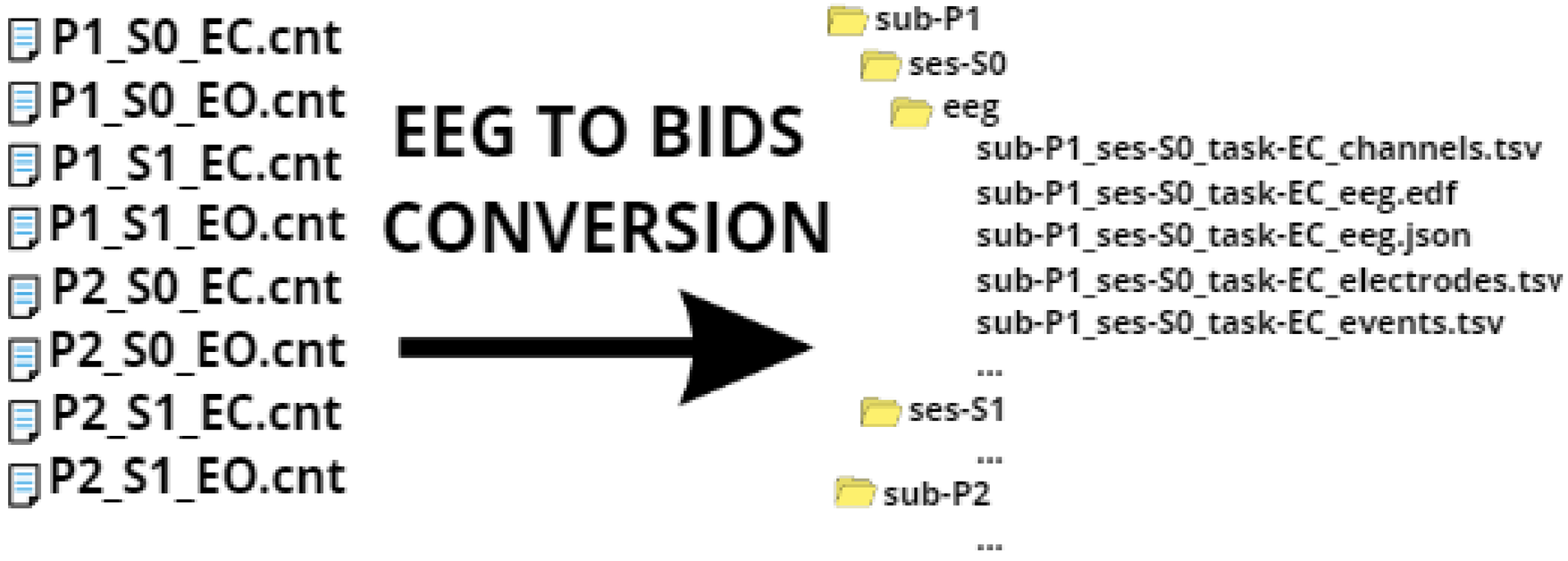

Implementación BIDS

Comprimir la carpeta para descargar

tar -czvf new_database.tar.gz database_bids

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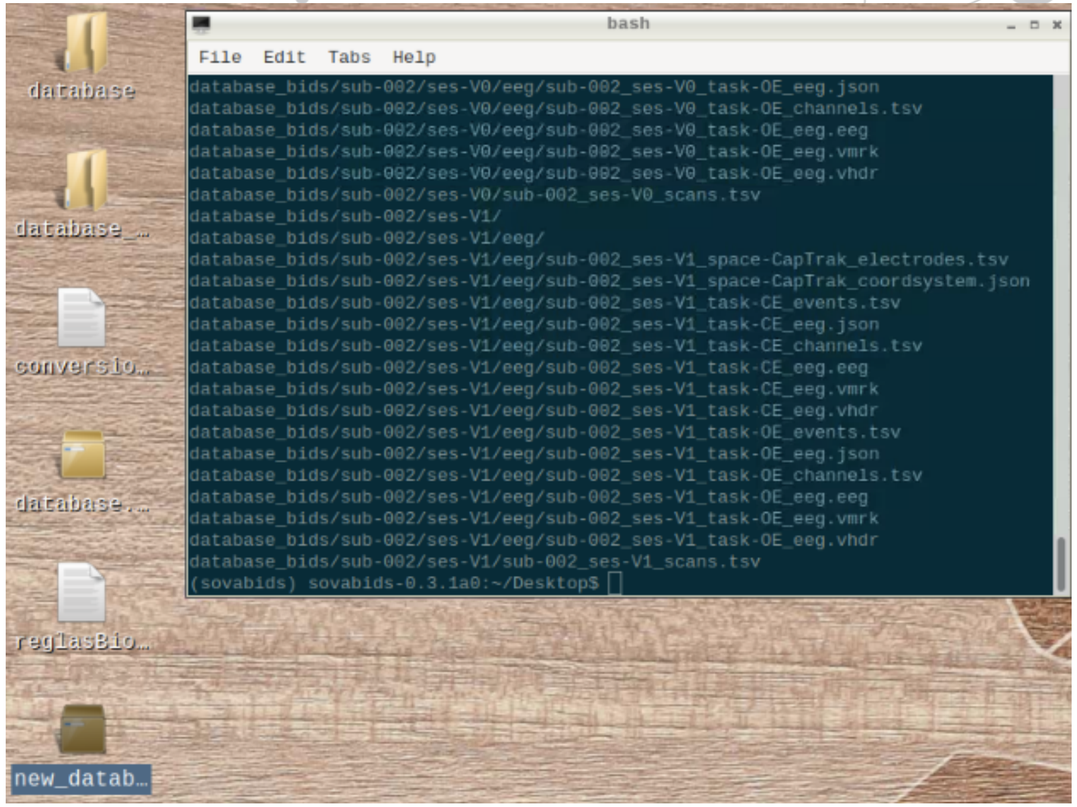

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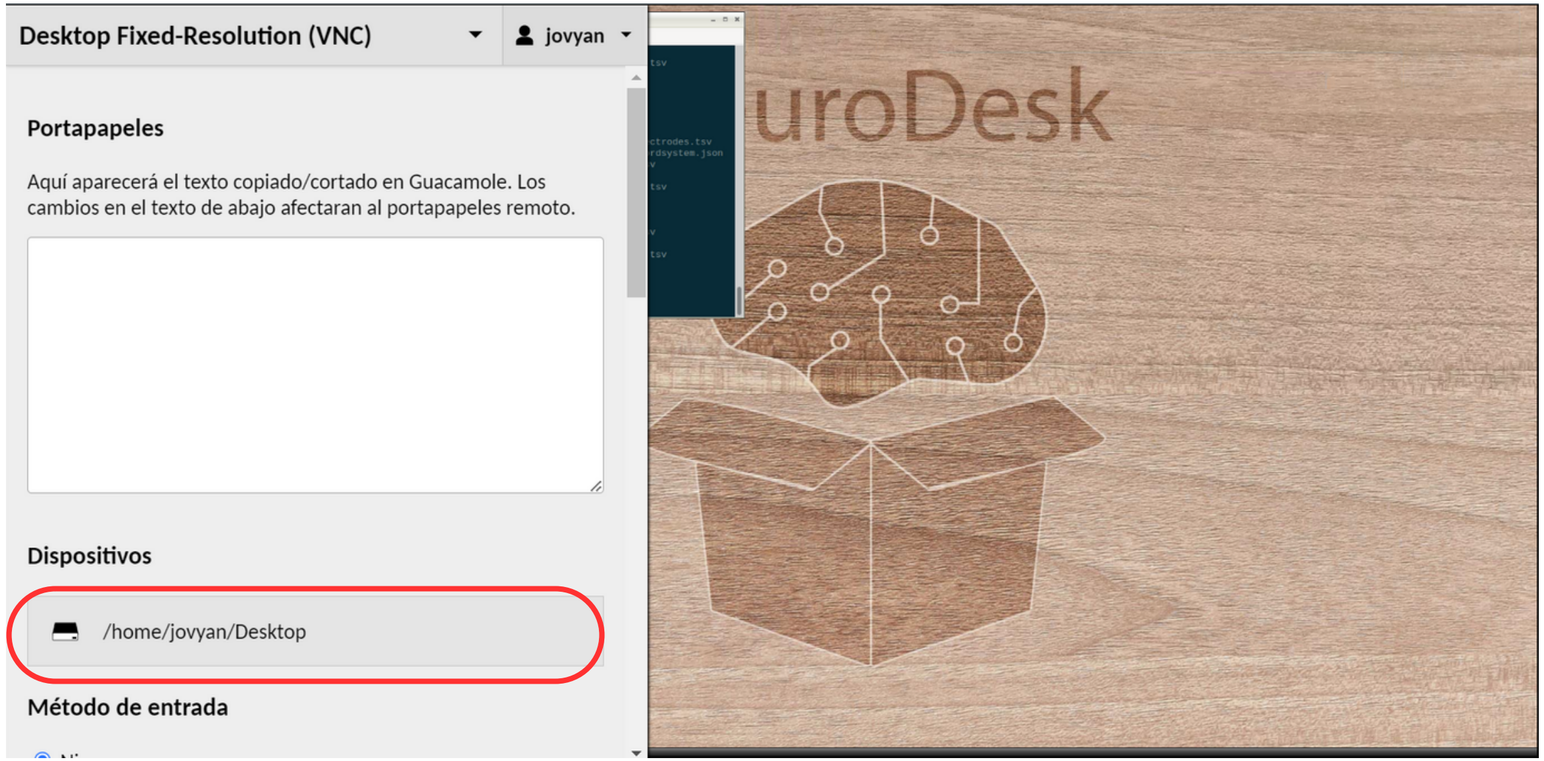
Implementación BIDS

Ctrl + Alt + shift



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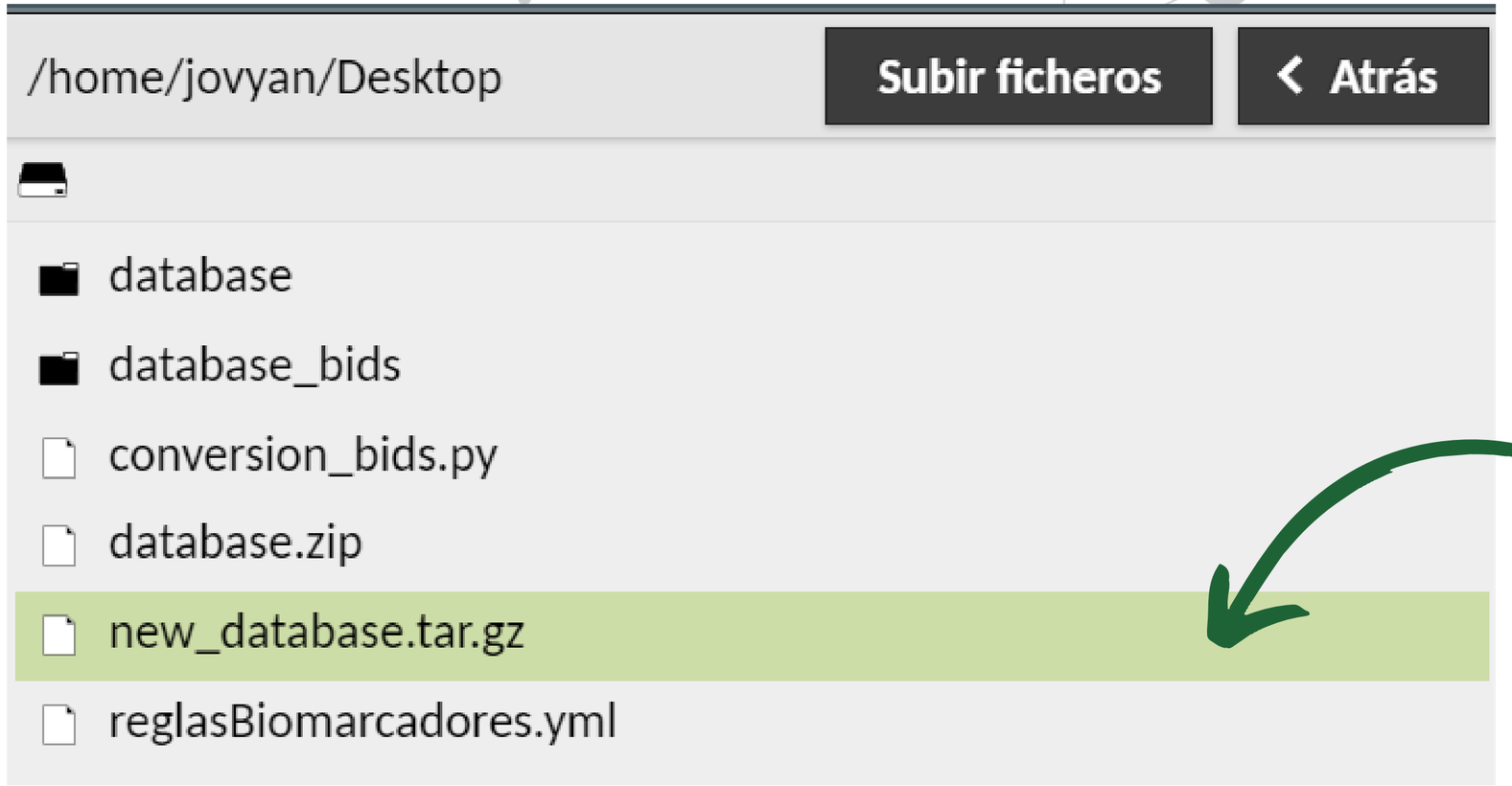

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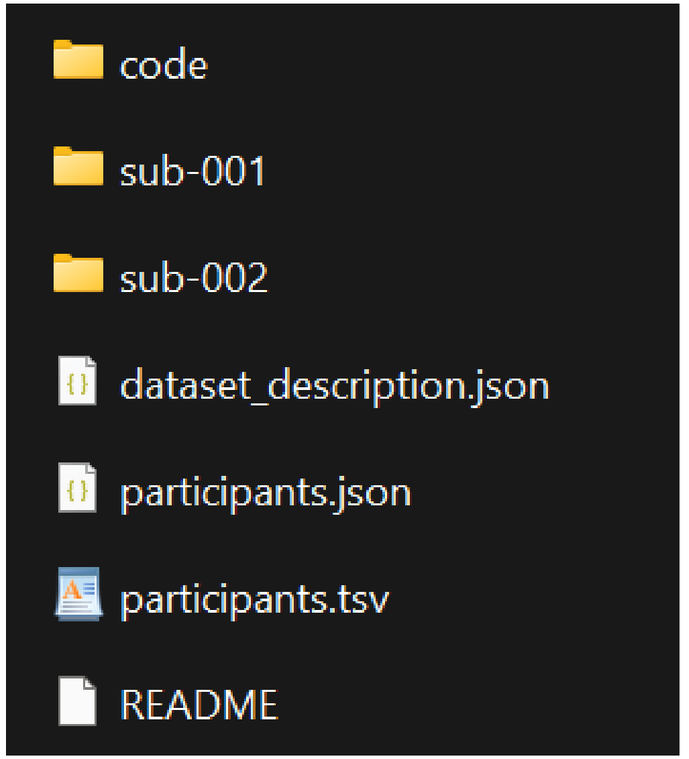
Implementación BIDS

Descomprimir y usar



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thank you for your time and attention

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