Python 3.11 Virtual Environment and Libraries

This document summarizes the main Python libraries used in the study environment for the P300Study project. The environment is based on **Python 3.11**, managed via `venv` and version-controlled through Git (private GitLab repository).

✅ Environment Setup

- **Python version**: 3.11
- **Environment manager**: `venv`
- **Dependency tracking**: `requirements.txt` and `pipreqs`

📦 Libraries Used in Phase 1 (Extracted with `pipreqs`)

These libraries reflect the actual imports detected in the Phase 1 virtual environment using `pipreqs`:

```
anytree==2.13.0
fitz==0.0.1.dev2
ipython==8.12.3
matplotlib==3.10.1
mne==1.9.0
numpy==2.2.5
pandas==2.2.3
Pillow==11.2.1
PyPDF2==3.0.1
reportlab==4.2.0
scikit_learn==1.6.1
scipy==1.15.2
seaborn==0.13.2
statsmodels==0.14.2
```

📚 Full Library Requirements (Entire Study Pipeline)

🧮 Core Scientific Libraries

```
numpy==1.26.4
pandas==2.2.2
matplotlib==3.9.0
seaborn==0.13.2
scipy==1.13.1
cython==3.0.10
```

🤖 Machine Learning and Statistical Modeling

```
scikit-learn==1.5.0
statsmodels==0.14.2
pydantic==1.10.7; platform_system == "Linux"
polars==0.20.3
```

🧠 EEG/ERP Processing and Reporting

```
mne==1.7.0
reportlab==4.2.0
PyMuPDF==1.24.4
PyPDF2==3.0.1
fpdf2==2.8.1
markdown2==2.5.1
pdfkit==1.0.0
anytree==2.12.1
ipykernel==6.29.5
jupyterlab-mathjax3==4.3.0
```

🔧 Requirements Management

```
pipreqs==0.5.0
```

🧪 Optional Libraries (Commented for Future Use)

These packages are reserved for potential integration with deep learning models, dataset management, or advanced data workflows:

🧠 Deep Learning

```
torch==2.3.0
torchvision==0.18.0
jax==0.4.28
transformers==4.41.1
huggingface-hub==0.23.2
sentencepiece==0.2.0
bitsandbytes==0.43.1
peft==0.11.1
trl==0.8.6
```

📊 Data Handling & Knowledge Graphs

```
opendatasets==0.1.22
kaggle==1.6.14
sqlalchemy==2.0.30
neo4j==5.20.0
langchain==0.2.1
llama-index==0.10.40
networkx==3.3
rdflib==7.0.0
graphviz==0.20.3
```

📁 Version Control and Environment Management

- All environments are maintained using `venv` and tracked through `requirements.txt`.
- Git is used for version control.
- A private **GitLab repository** stores source code, configuration files, and processing scripts.

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