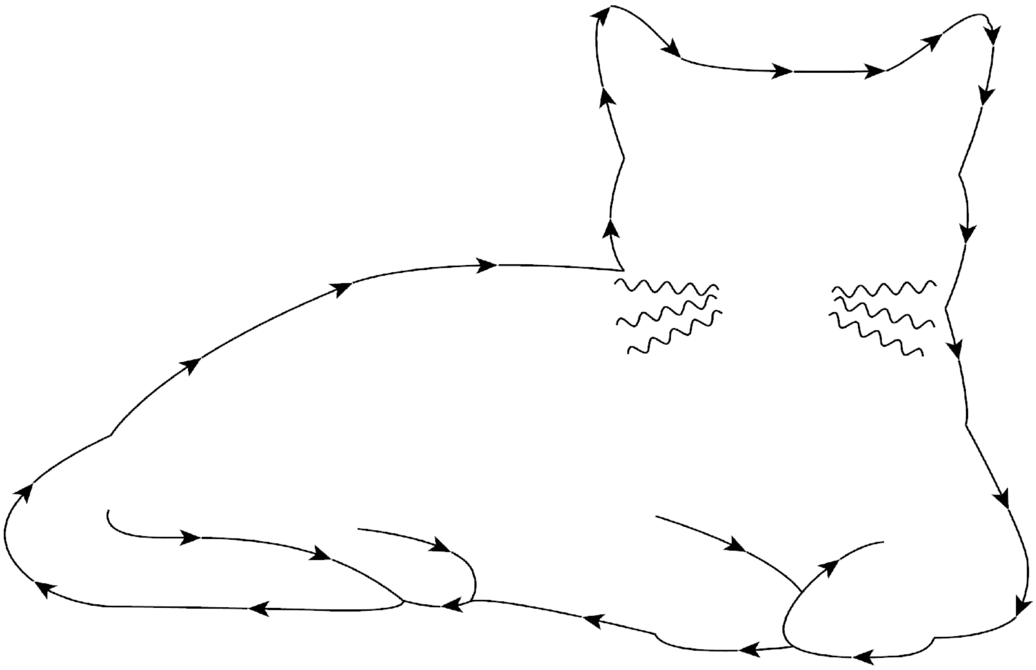

Comprehensive Analysis Toolkit for Near-field Imaging and Phase-retrieval (CATNIP) Documentation

Version 1.0

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Contents

1 Description

Comprehensive **A**nalysis **T**oolkit for **N**ear-field **I**maging and **P**hase-retrieval (**CATNIP**) is a software tool for rapidly generating simulated datasets based on wave-optics simulations, intended for testing multimodal retrieval algorithms in X-ray near-field imaging. It is developed and maintained by the High-Energy Physics Research Group at Universidad de los Andes (Uniandes). The frontend and backend are implemented in Python, and the graphical interface runs within the **CATNIP** virtual environment, whose installation is described later in this manual.

The simulations rely on the projection approximation, valid for thin samples, with future versions expected to include the multi-slice approach [1]. **CATNIP** supports simulations for Edge-Illumination (EI) [2], Single-Grating Based Imaging (SGBI) [3], Speckle-Based Imaging (SBI) [4], and Propagation-Based Imaging (PBI) [5]. It can generate data for both 2D multimodal retrieval and tomographic reconstruction. It also includes implementations of state-of-the-art algorithms such as Unified Modulated Pattern Analysis (UMPA) [6] and Low Coherence System (LCS) [7].

2 Prerequisites

To run **CATNIP**, you must have **Python** version `3.12.2` or higher installed on your system. You can verify your Python version by running the following command in your terminal:

```
python --version
```

If your system does not meet this requirement, please install the appropriate version from the official Python website: https://www.python.org/downloads/.

3 Installation Instructions

Follow the steps below to install all necessary components to run **CATNIP**.

1. **Clone the GitHub repository:**

   ```
   git clone https://github.com/Spoksonat/CATNIP.git
   ```

2. **Create the CATNIP virtual environment:**

```
python3 -m venv CATNIP_env
```

3. **Activate the CATNIP virtual environment:**

   - On Linux/Mac:

     ```
         source CATNIP_env/bin/activate

     ```

   - On Windows:

     ```
         CATNIP_env\Scripts\activate

     ```

     or

     ```
         CATNIP_env\Scripts\activate.bat

     ```

4. **Install the required dependencies:**

```
pip install -r CATNIP/requirements.txt
```

5. **Verify the installed packages:**

```
pip list
```

6. **Deactivate virtual environment:**

```
deactivate
```

Note: If your default Python version is older than `3.12.2`, and you have installed a compatible version separately, replace the command `python3` with the full path to the correct Python binary, e.g., `/path/to/python3.12`. To locate the path, you can use:

```
which python3.12
```

Common installation paths include:

- `/usr/local/bin/python3.12` (Linux/macOS)
- `~/.pyenv/versions/3.12.2/bin/python` (Linux/macOS with pyenv)
- `C:\Users\YourUser\AppData\Local\Programs\Python\Python312\python.exe` (Windows)

4 Execution

To launch the **CATNIP** graphical interface, follow these steps:

1. **Activate the CATNIP virtual environment:**

   - On Linux/macOS:

     ```
         source CATNIP_env/bin/activate

     ```

   - On Windows:

     ```
         CATNIP_env\Scripts\activate

     ```

     or

     ```
         CATNIP_env\Scripts\activate.bat

     ```

2. **Navigate to the CATNIP main directory:**

   ```
   cd CATNIP
   ```

3. **Run the main file:**

   ```
   python main.py
   ```

5 General Structure and Use

After executing the command:

```
python main.py
```

the main window of **CATNIP** opens, as shown in Figure .

6 Contact Information

For any questions or suggestions, please contact:

- **Main Developer**:
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References

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