Tutorial

1. Getting the Code

1. Download the source code from the provided repository or location.
2. Open the Final.py file using your preferred Python IDE, such as **Spyder**, **PyCharm**, or **VS Code**.

2. Running the Code

Step 1: Modify Input and Output Paths

Before running the script, modify the input and output file paths in the main() function in Final.py. Ensure the paths point to the correct image files.

Example:

IMRI = cv2.imread('path_to_MRI_image.png', cv2.IMREAD_GRAYSCALE) # Replace with your MRI image path

IPET = cv2.imread('path_to_PET_image.png', cv2.IMREAD_COLOR) # Replace with your PET image path

Step 2: Install Required Libraries

Ensure that Python 3.7 or later is installed on your system. Then, install the necessary libraries by running the following command in your terminal or command prompt:

pip install numpy opencv-python matplotlib scipy

Step 3: Run the Code

After modifying the input/output paths and installing the required libraries, press **Run** in your Python IDE to execute the Final.py script.

3. Explanation of Expected Outputs

The IEXDoG_COA algorithm outputs the following:

- **Fused Image (FColor)**: A single image that combines:
    - **MRI structural details**: High spatial resolution and clear anatomical features.
    - **PET functional details**: Color-coded metabolic activity.
- **Optimal Parameters**:
    - **α**: Weight for the MRI low-frequency component.
    - **β**: Weight for the PET low-frequency component.

- **Log Information (Optional)**:
    - Details of the optimization process, such as iterations and fitness values.

Medical Applications

The fused image enhances contrast and visualization, making it useful for:

- Tumor detection.
- Brain activity analysis.
- Surgical planning.