Healthcare Imaging Analysis – Brain Anomaly & Hand Fracture Detection

This Python project aims to detect anomalies in brain X-ray images and fractures in hand X-ray images using OpenCV. The goal is to help in medical diagnostics by processing X-ray images and automatically detecting potential abnormalities. The code employs image processing techniques such as Gaussian Blur, Thresholding, Contour Detection, and Edge Detection to highlight areas that might suggest medical issues.

1. **Features:**

- **Brain Anomaly Detection**:
  - Detects possible brain anomalies based on contour detection after applying a Gaussian Blur and thresholding on the X-ray image.
  - Highlights potential anomalies by marking the regions with bounding rectangles.
  - A message is displayed indicating whether possible anomalies were detected or not.

- **Hand Fracture Detection**:
  - Identifies potential fractures in hand X-ray images by detecting contours, calculating area, and determining the shape and size of the contours.
  - Fractures are likely to be identified by smaller areas and longer contour lengths, typical of fractures.
  - The image is processed to show detected fractures with bounding rectangles and labels.

2. **Installation and Setup:**

Before running the project, you need to ensure that you have Python and the necessary libraries installed.

Step-by-step setup instructions:

- **Step 1**: Clone the repository or download the project files to your local machine.

- **Step 2**: Install Python (version 3.6 or higher) if you haven't already. You can download it from:
  https://www.python.org/downloads/

- **Step 3**: Navigate to the directory where the project files are located.

- **Step 4**: Create a virtual environment to isolate the project dependencies (optional but recommended):
  ```bash
  python -m venv venv
  ```

- **Step 5**: Activate the virtual environment:
  - On Windows:
    ```bash
    ```

venv\Scripts\activate
```
- On macOS/Linux:
```bash
source venv/bin/activate
```

- **Step 6**: Install required dependencies by running the following command:
```bash
pip install -r requirements.txt
```

- **Step 7**: Make sure to place the X-ray images in the project folder with the names `brain.jpeg` and `handfracture.jpeg` for the script to process them.

3. **Running the Project:**

After the setup, you can run the script by executing the following command in the terminal:

```bash
python analysis.py
```

This will:
- Start the brain anomaly detection process.
- Start the hand fracture detection process.
- Display output messages about possible anomalies or fractures detected in the images.
- Show the processed images:
  - The original hand X-ray image.
  - The edge map of the hand X-ray image.
  - The final output of the hand fracture detection.

4. **Output:**

- **Brain Anomaly Detection**:
  - Displays whether any potential anomalies were detected in the brain X-ray and marks them with a bounding box.

- **Hand Fracture Detection**:
  - Detects fractures based on specific contour characteristics and displays a bounding box with the label "Possible Fracture".

Additionally, the script will display:
- The original hand X-ray image.
- An edge map of the hand X-ray showing detected edges.
- The processed output with potential fracture detection on the hand X-ray.

5. **Troubleshooting:**
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- Ensure the image files (`brain.jpeg` and `handfracture.jpeg`) are correctly named and placed in the same directory as the script.
- If OpenCV or NumPy is not installed correctly, run:
  ```bash
  pip install opencv-python numpy
  ```

- If there is no image displayed after running the script, make sure that the images are valid X-ray images and are properly formatted.

6. **License:**

   This project is open-source and available under the MIT License.

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