1) Project Overview

This repo demonstrates four traditional segmentation pipelines:

Otsu Thresholding – global, histogram-based binary segmentation.
K-Means Clustering – color clustering for multi-region segmentation.
Contour Detection – edge detection followed by contour extraction/visualization.
Watershed – marker-based region growing for touching-object separation.

Each pipeline is a standalone Python script for clarity and quick experimentation.

2) Requirements & Installation

Supported on Python 3.9–3.12.

```
# (Optional) create and activate a virtual environment
python -m venv venv
# Windows
venv\Scripts\activate
# macOS / Linux
source venv/bin/activate

# Upgrade installer
python -m pip install -U pip

# Install dependencies
pip install -r requirements.txt
```

Minimal `requirements.txt`:

```
numpy
matplotlib
opencv-contrib-python
```

If you installed opencv-python and miss functions like `selectROIs`, switch to opencv-contrib-python.

3) Quickstart

Place a small test image in `data/` (e.g., `data/sample.jpg`) and run any script from `src/`:

```
python "src/Otsu Thresholding.py" --image data/sample.jpg
python "src/K-Means Algorithm.py" --image data/sample.jpg --k 3
python "src/Contour Detection.py" --image data/sample.jpg
python "src/Watershed Algorithm.py" --image data/sample.jpg
```

If your scripts don't yet accept CLI arguments, open them and set the input path near the top, then run without flags. GUI windows (`cv2.imshow`, ROI selector, or `plt.show`) require a desktop environment.

4) Troubleshooting

- **ModuleNotFoundError: cv2** → `pip install opencv-contrib-python`
- **No GUI/Windows open** (headless server) → run locally with a desktop environment, or modify code to save figures instead of showing them.
- **selectROIs missing** → uninstall `opencv-python`, install `opencv-contrib-python`.
- **Unicode path issues on Windows** → avoid non-ASCII paths; wrap paths in quotes.

5) License & Citation

Add a license file (e.g., MIT) at repo root. If this is for a class or paper, include a short citation here:

```
@software{image_segmentation_demo,
  title={Image Segmentation – Classic Pipelines},
  author={Your Name},
  year={2025},
  url={https://github.com/lxl-max/image-segmentation}
}
```

Last updated: 2025-11-07