UF Herbert Wertheim College of Engineering
Florida Institute for National Security (FINS)
UNIVERSITY of FLORIDA

IC SEM RE Tutorial using AI
Part 1: Simple Thresholding

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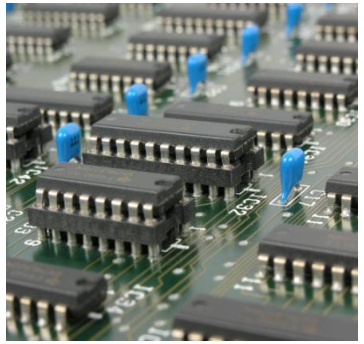
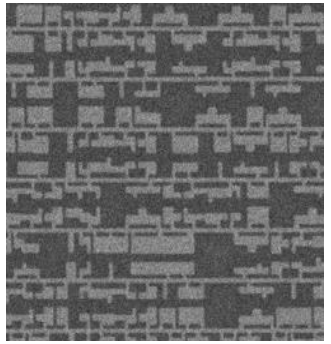


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Objective

- Hardware Reverse Engineering Project using AI
  - Hands-on tutorial
  - Practical application in hardware assurance
  - Resume-builder / professional development
- Topics
  - Python for AI
  - Image Processing and Computer Vision
  - Machine Learning
- This lecture:
  - Introduction of the IC SEM RE problem
  - Code pipeline setup

Refer to the prerequisites and documentation!

Python Libraries

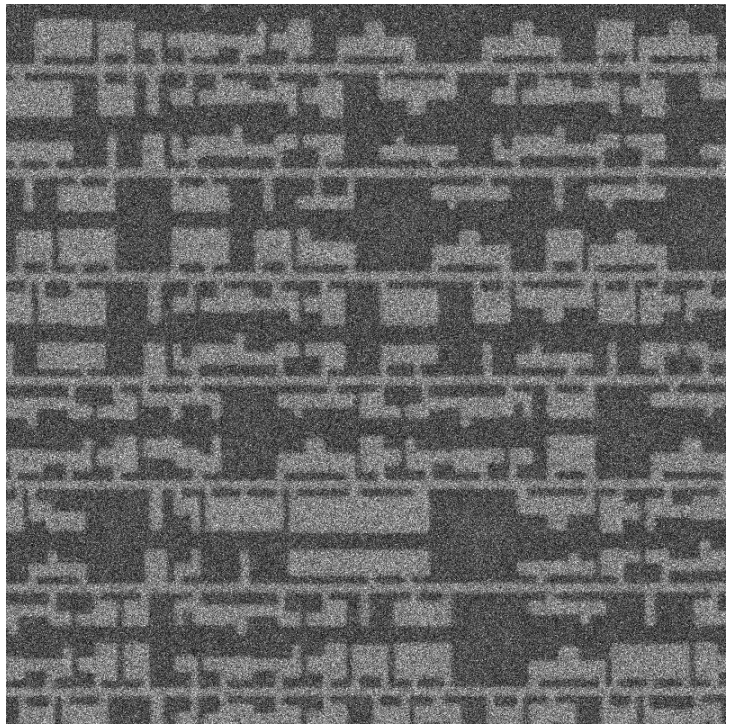
NumPy

matplotlib

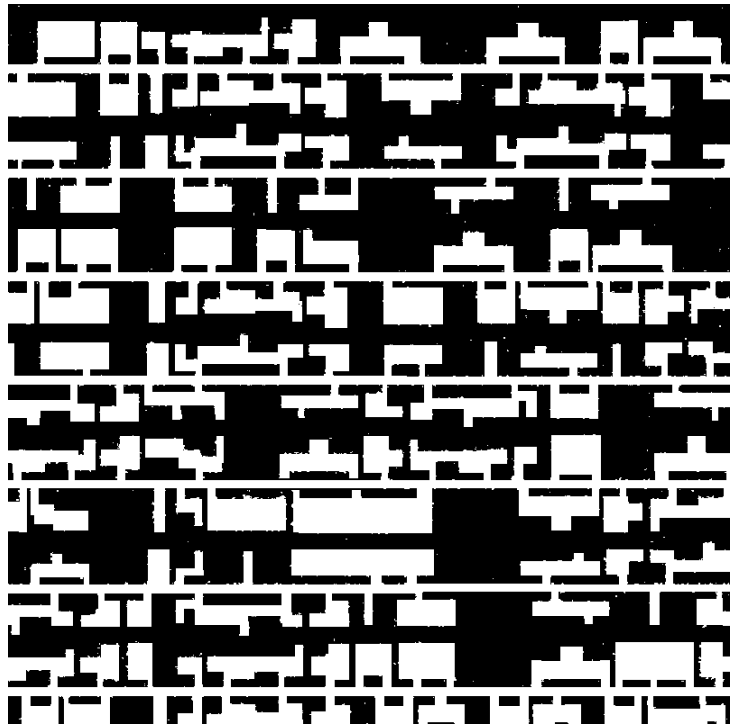
scikit-image
image processing in python

scikit learn

Goal

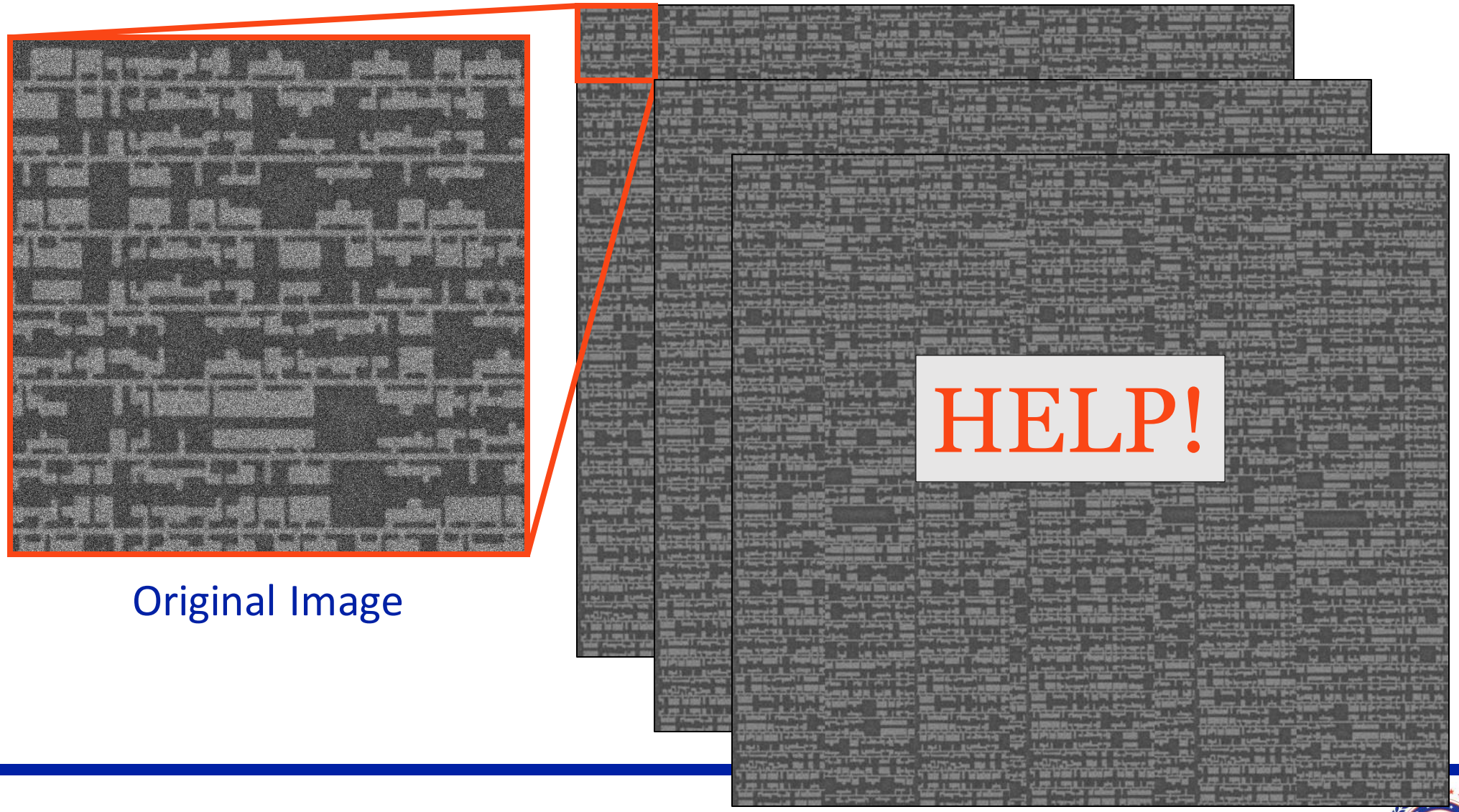


Original Image



End Goal (Ground Truth)

Goal

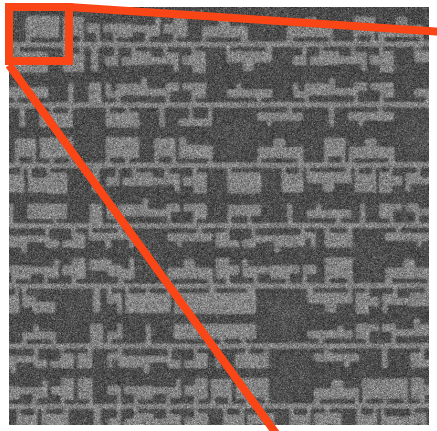


Original Image

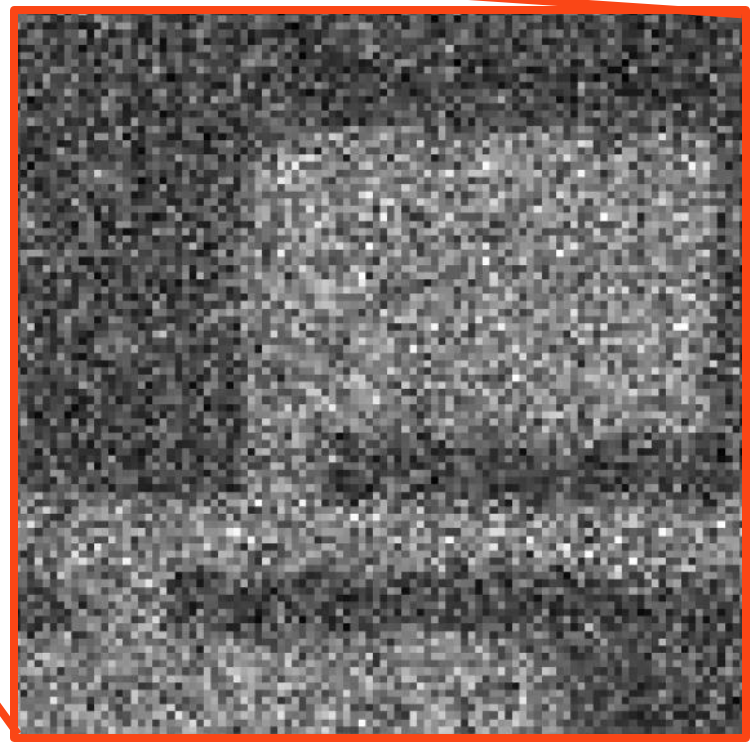
Segmentation Method 1: Simple Thresholding

- Pick a threshold value
- If a pixel value is > (or <) the threshold value
  - Mark the pixel as foreground
- Else
  - Mark the pixel as background

Evaluation: Intersection over Union (IoU)

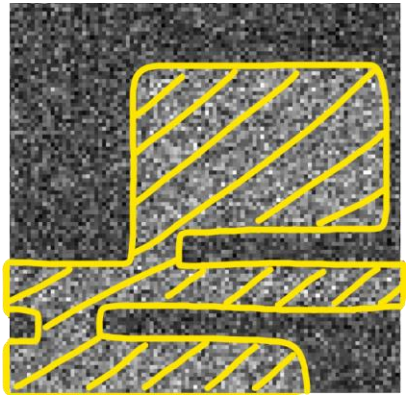


Original Image



Original Image
(close-up)

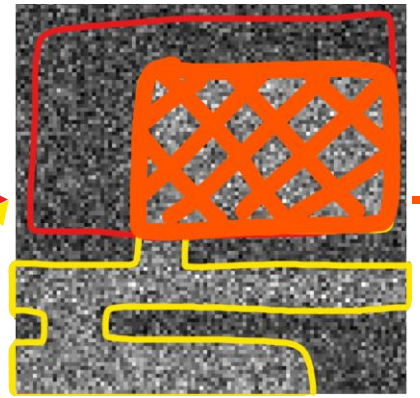
Segmentation Result



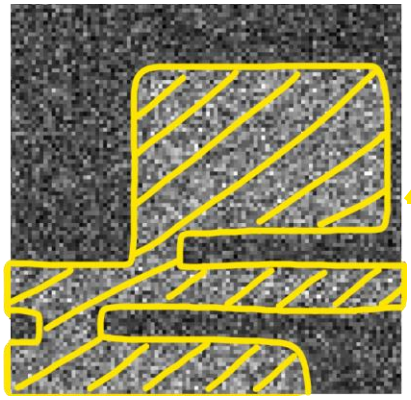
Ground Truth

Evaluation: Intersection over Union (IoU)

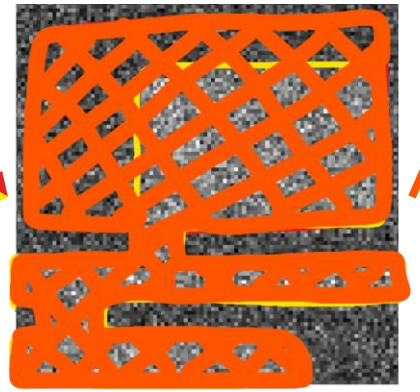
Segmentation Result



Intersection



Ground Truth



Union

$$IoU = \frac{Area_{Intersection}}{Area_{Union}}$$

Key Takeaways

1. Introduced the IC SEM RE problem
2. Segmentation: Simple thresholding
3. Evaluation: Intersection over Union (IoU)

Next: More advanced image processing and computer vision