

POTHOLE DETECTION USING OBJECT ISOLATION

19ECE457 WAVELETS AND APPLICATIONS

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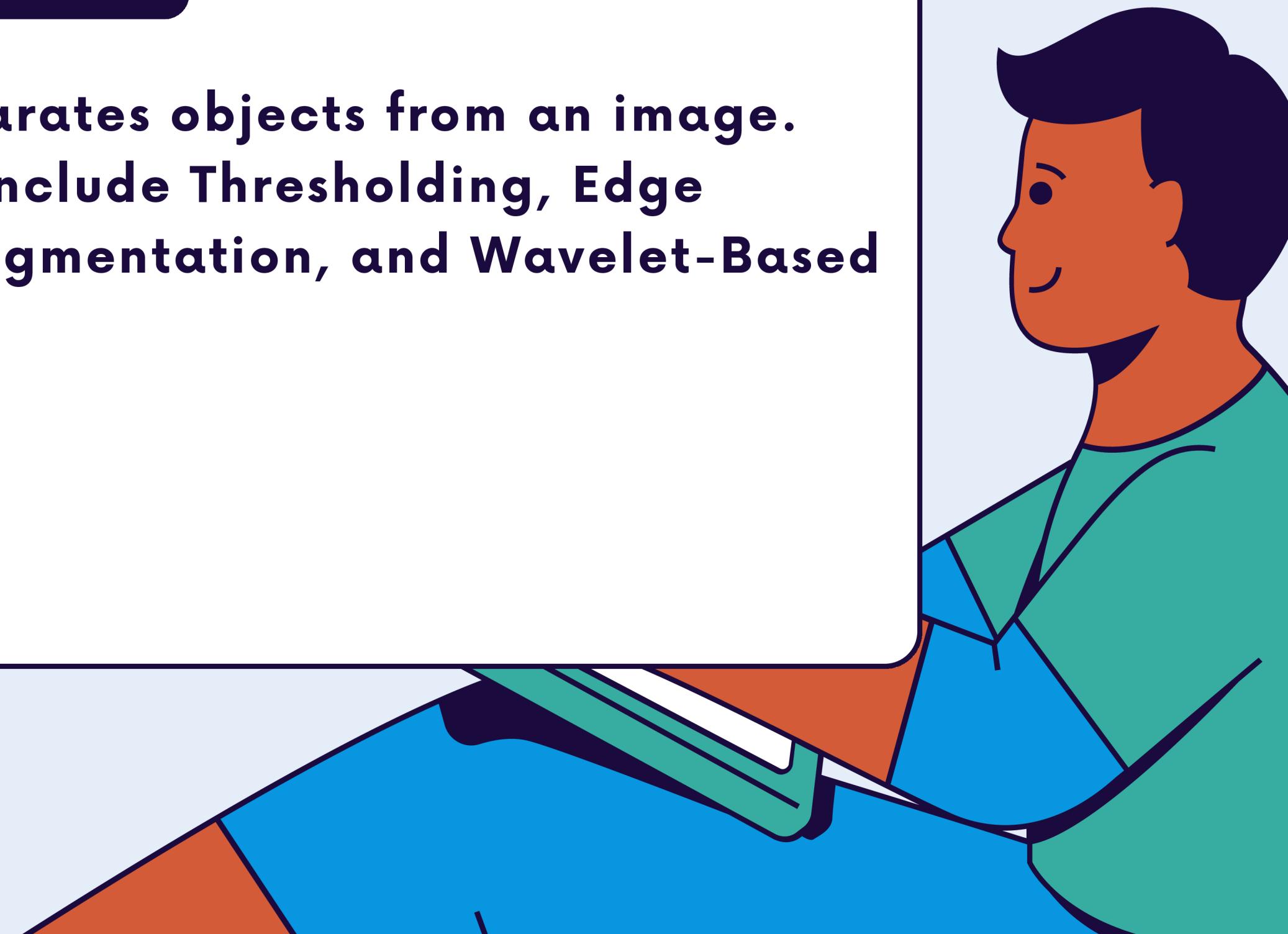
Objective

The objective of this project is to develop an efficient and automated pothole detection system using wavelet transform and image processing techniques to enhance road safety and maintenance planning.



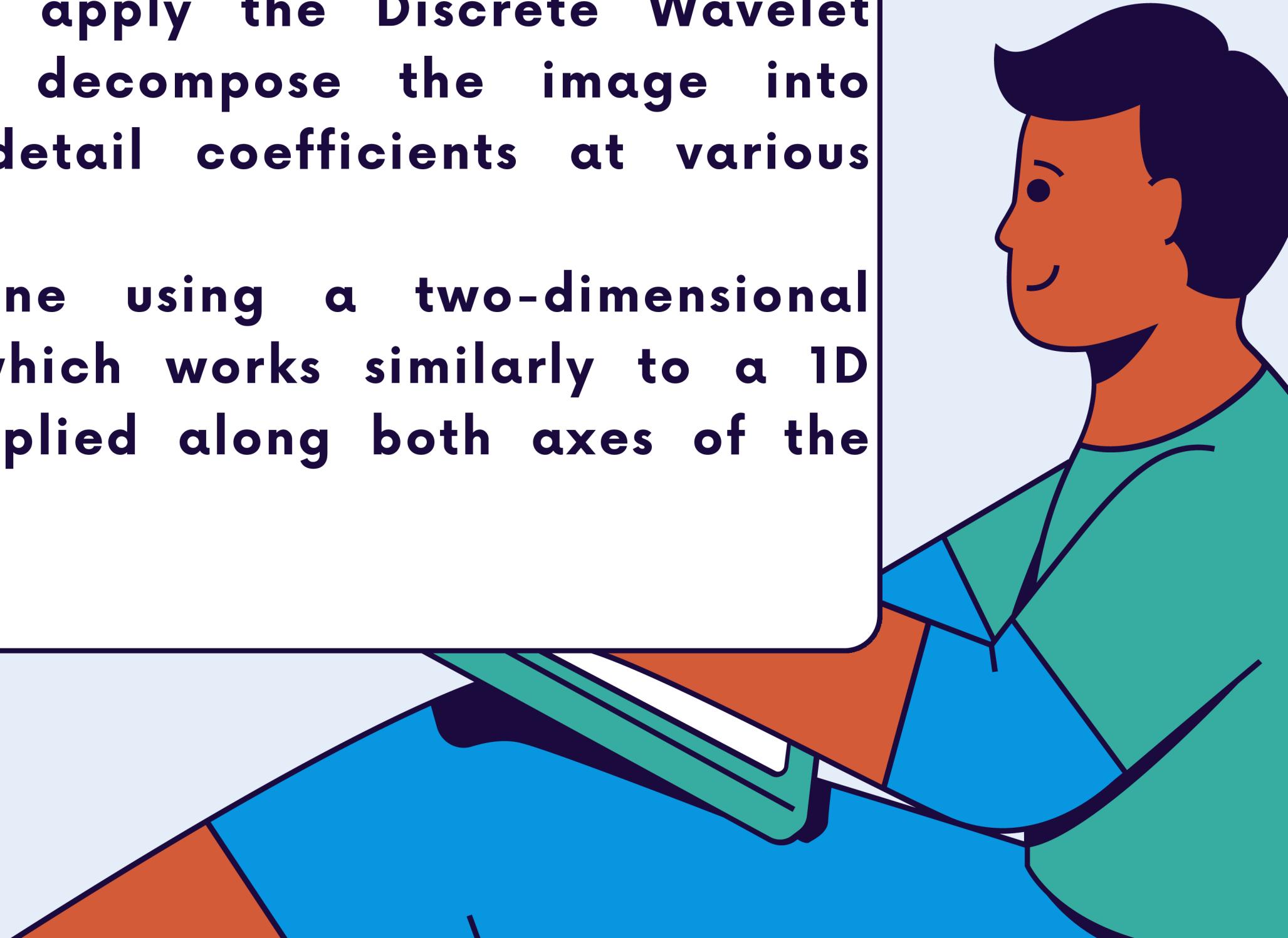
Object Isolation Strategies:

- Object isolation separates objects from an image.
- Common strategies include Thresholding, Edge Detection, Region Segmentation, and Wavelet-Based Isolation



Wavelet Transform

- The next step is to apply the Discrete Wavelet Transform (DWT) to decompose the image into approximation and detail coefficients at various levels.
- This is typically done using a two-dimensional wavelet transform (which works similarly to a 1D wavelet transform applied along both axes of the image).

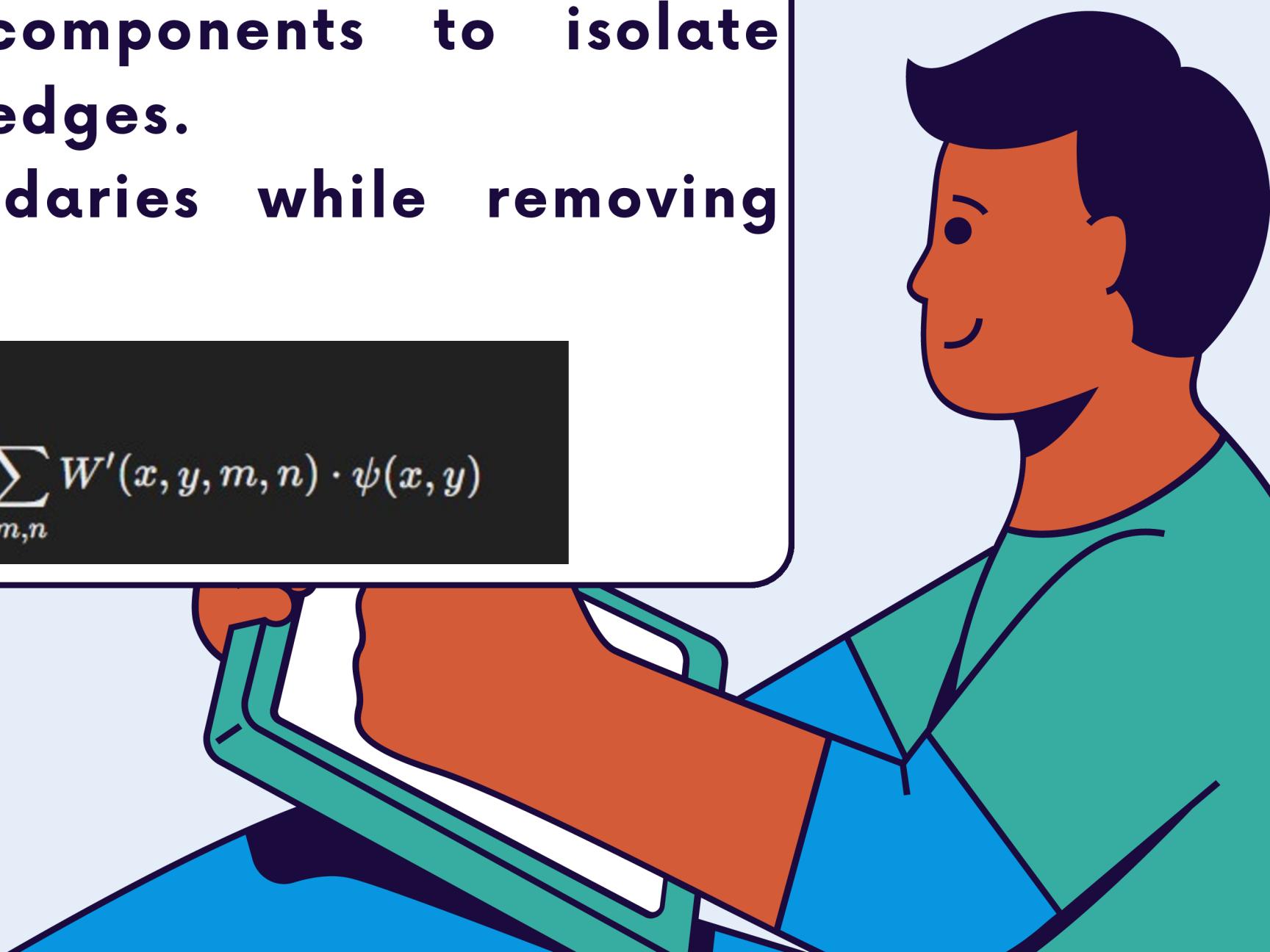


Wavelet Transform

- Focus on high-frequency components to isolate abrupt changes, like pothole edges.
- This highlights object boundaries while removing background noise.

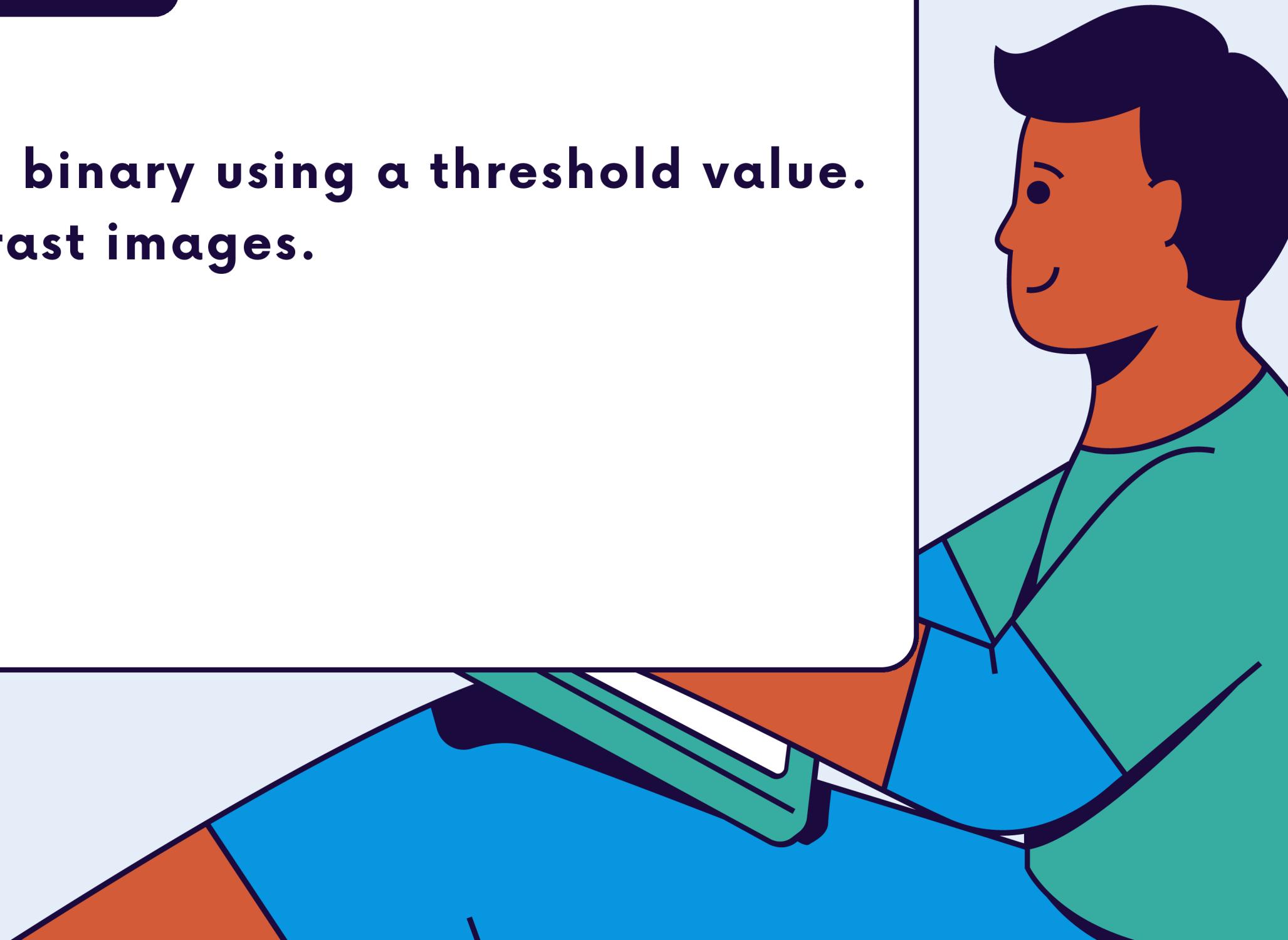
The DWT of an image $I(x, y)$ is given by:

$$I(x, y) = \sum_{m,n} W(x, y, m, n) \cdot \phi(x, y) + \sum_{m,n} W'(x, y, m, n) \cdot \psi(x, y)$$



Thresholding

- Converts an image to binary using a threshold value.
- Use Case: High-contrast images.



Morphological Operations

Morphological operations (dilation and erosion) are applied to refine the mask. This helps remove noise and fill small gaps in the isolated regions.

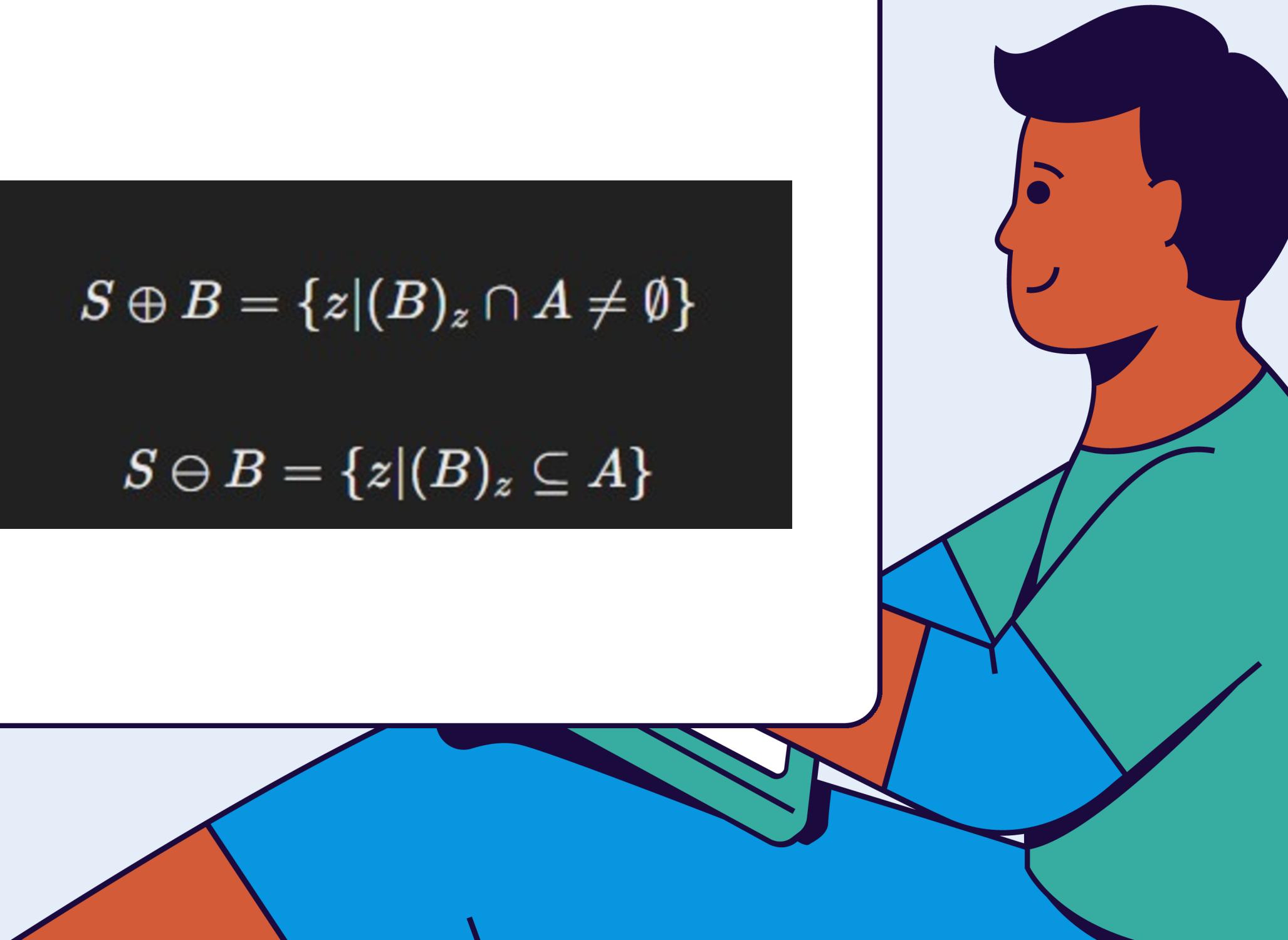


Morphological Operations

- Dilation:
- Erosion:

$$S \oplus B = \{z | (B)_z \cap A \neq \emptyset\}$$

$$S \ominus B = \{z | (B)_z \subseteq A\}$$

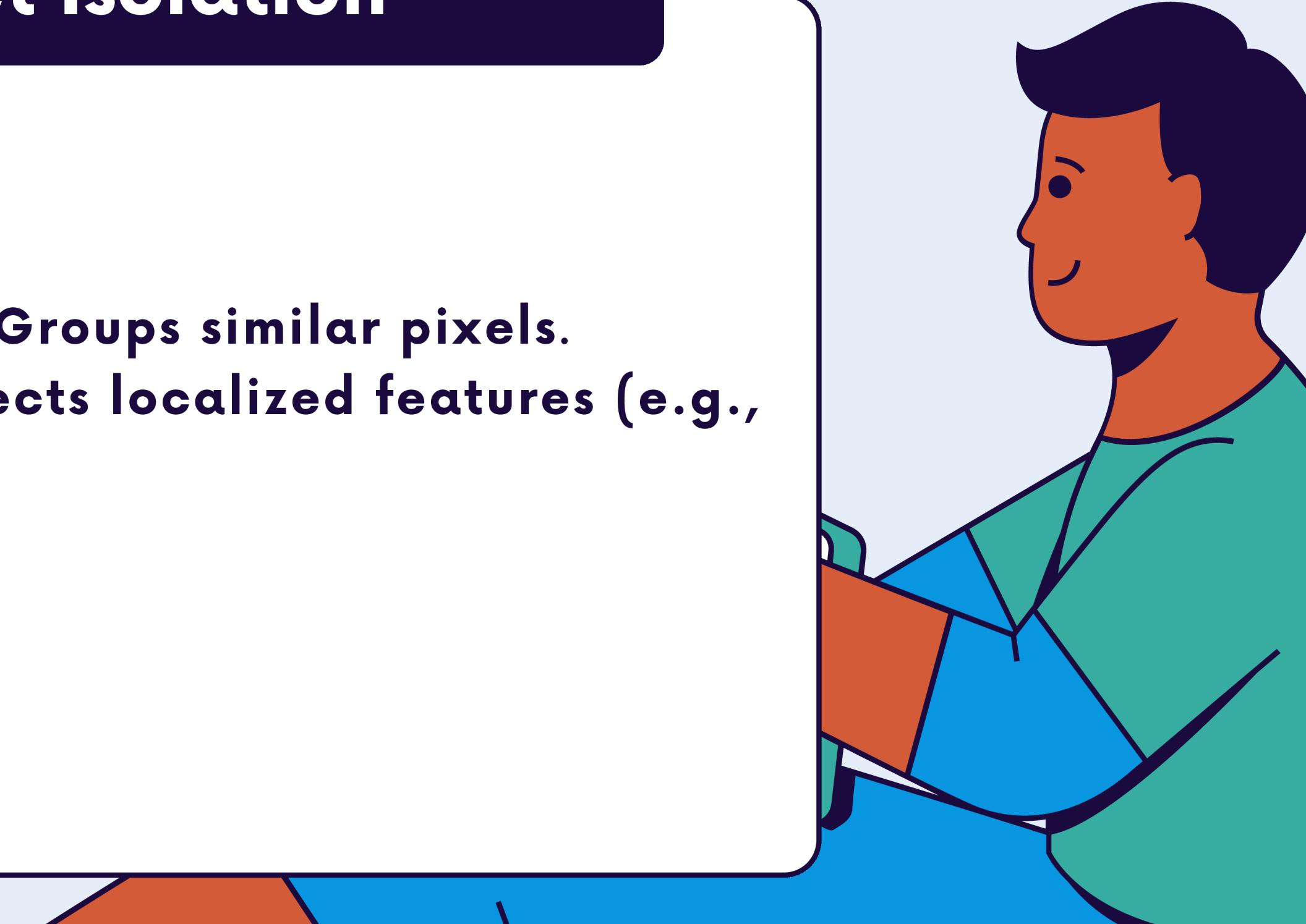


Other Isolation Strategies



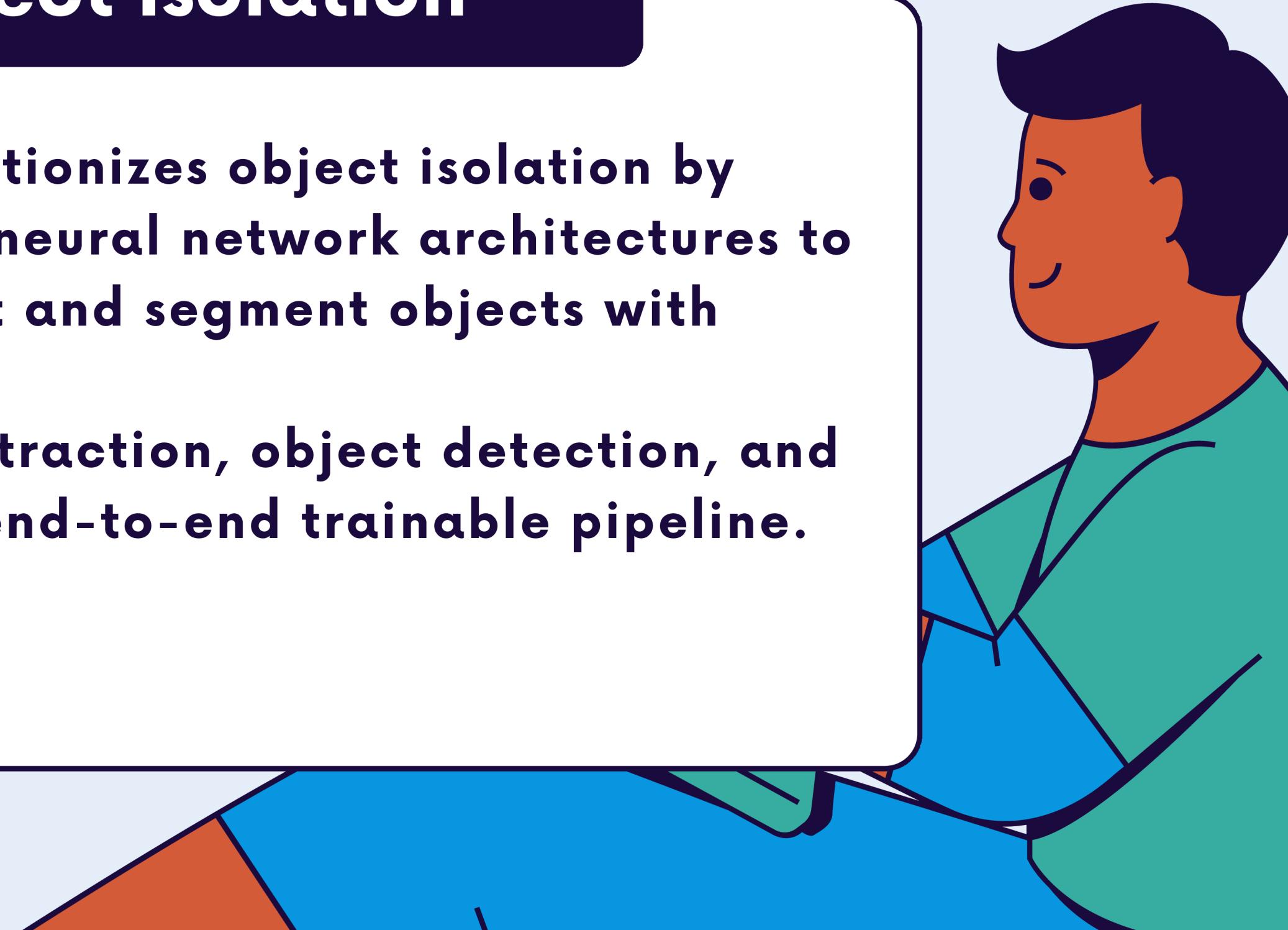
Region Segmentation and Wavelet Isolation

- **Region Segmentation:** Groups similar pixels.
- **Wavelet Isolation:** Detects localized features (e.g., cracks/potholes).

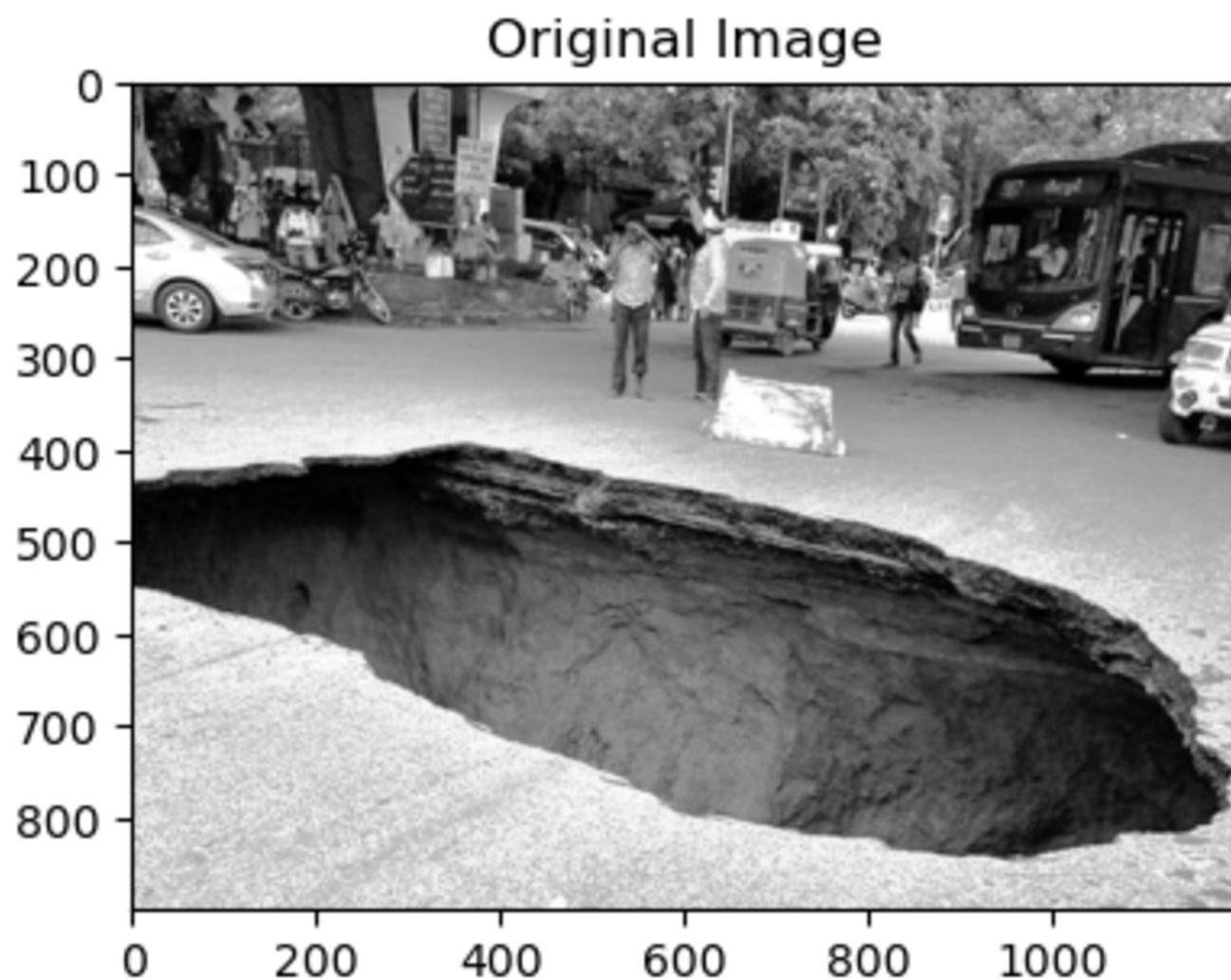


Advanced Deep Learning-Based Object Isolation

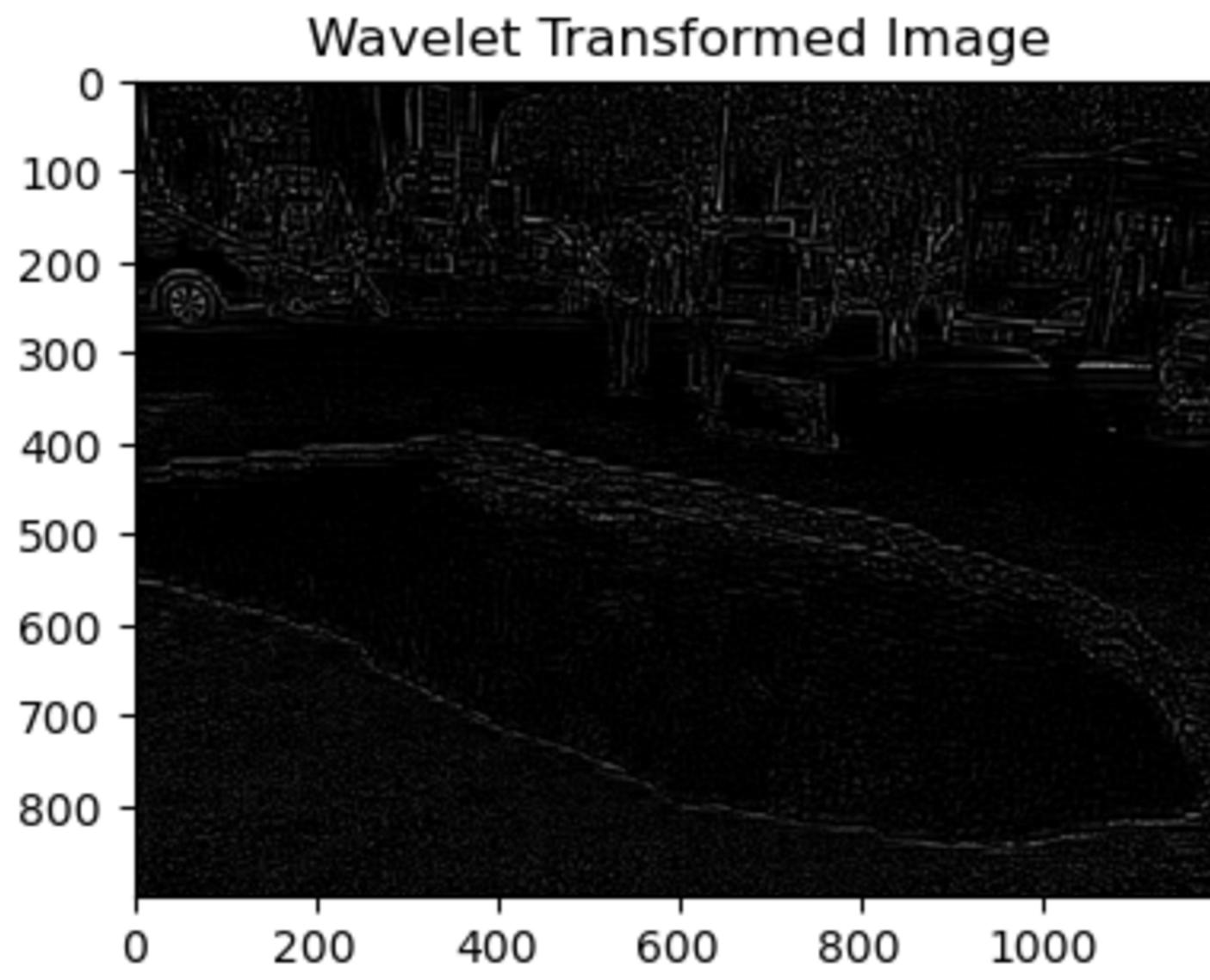
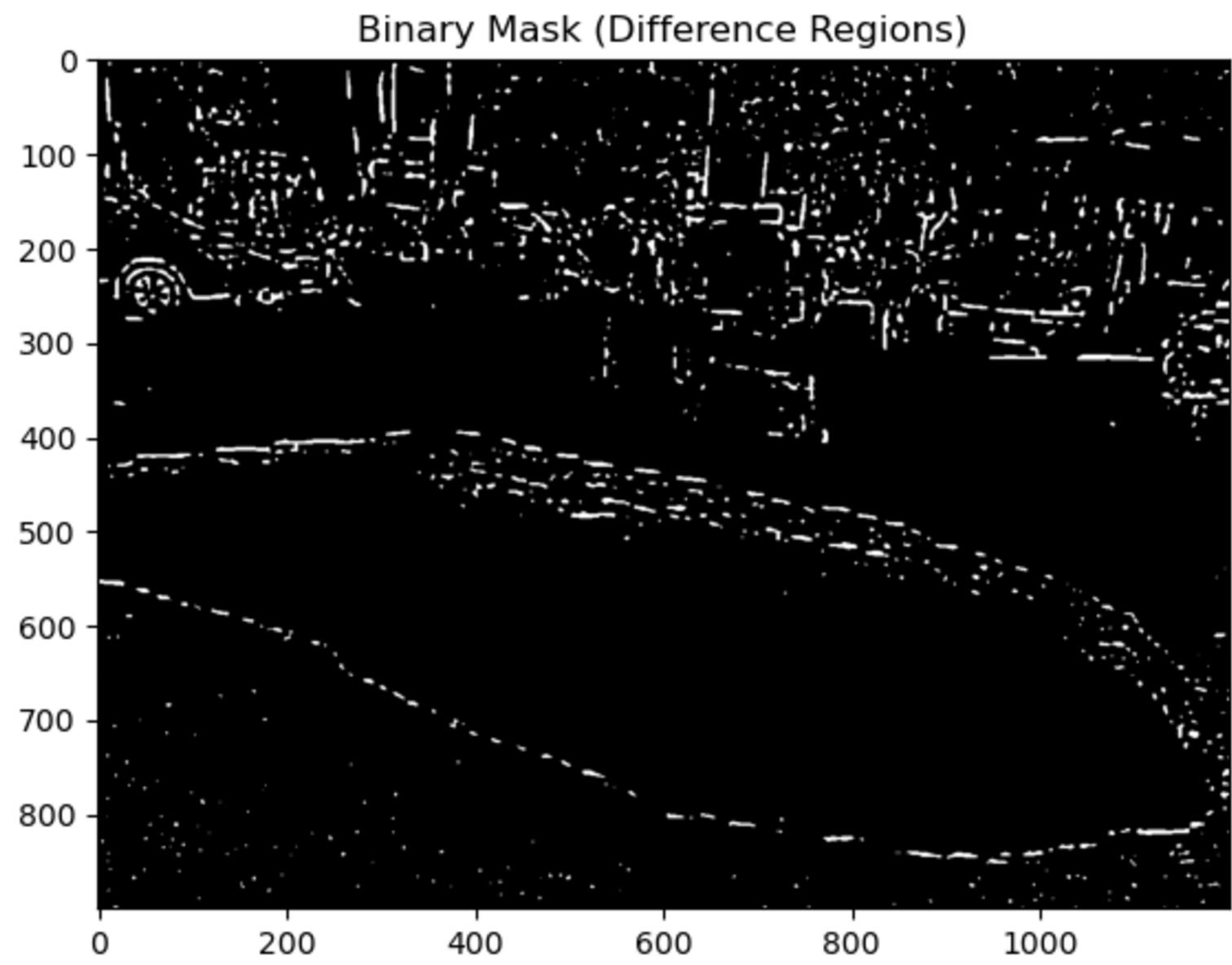
- Deep learning revolutionizes object isolation by leveraging complex neural network architectures to automatically detect and segment objects with precision.
- Combines feature extraction, object detection, and segmentation in an end-to-end trainable pipeline.



Input



Output



THANK YOU

