How Image thresholding helps in various applications like object detection, segmentation, edge detection, image enhancement, and pattern recognition are given below —

1. Object Detection

Thresholding is used to isolate objects of interest from the background.

By applying a threshold, pixels are classified into two categories based on their intensity values.

Example: Detecting bright objects in a dark background (e.g., detecting traffic signs at night).

2. Segmentation

Thresholding divides an image into regions by grouping pixels with similar intensity values.

It is often the first step in image segmentation, enabling the separation of objects within an image.

Example: Separating text from the background in document analysis.

3. Edge Detection

By applying a threshold to edge intensity maps, weak or irrelevant edges are removed, leaving only significant ones.

Example: Highlighting boundaries in medical imaging, such as tumor edges.

4. Image Enhancement

Thresholding can enhance images by highlighting specific intensity ranges, improving visibility.

This is particularly useful in contrast enhancement and noise reduction.

Example: Enhancing the visibility of veins in X-ray images for medical diagnostics.

5. Pattern Recognition

Thresholding aids in preprocessing images for pattern recognition algorithms by simplifying complex images into binary forms.

It ensures that the features extracted are consistent and easier to analyze.

Example: Recognizing handwritten digits in OCR