

TA-IICorner Detection Algorithms.

Link:- <https://github.com/Rohit-2026/Corner-Detection>

❖ Moravec Corner Detection

Concept:

Moravec is one of the earliest corner detection algorithms. It is based on the idea that at a corner, the image intensity changes significantly in multiple directions.

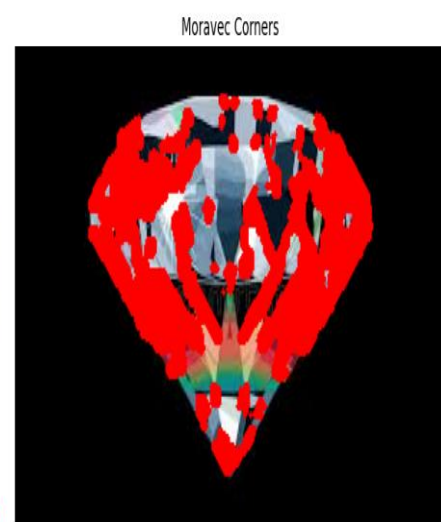
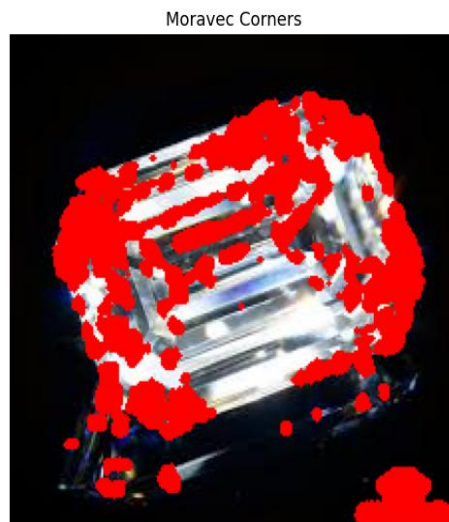
Working:

A small window is shifted in several directions (typically left, right, up, down), and the sum of squared differences (SSD) between the original and shifted window is computed. If the minimum SSD across all directions is large, the point is marked as a corner.

Limitations:

- Not rotation invariant.
- Sensitive to noise.
- Only considers limited directions (not all possible shifts).

➤ Output



❖ 2. Harris Corner Detection

Concept:

Harris is an enhancement over Moravec. Instead of just checking differences in intensity, it uses the gradient of intensity in all directions and analyzes how the image varies in a neighborhood using eigenvalues.

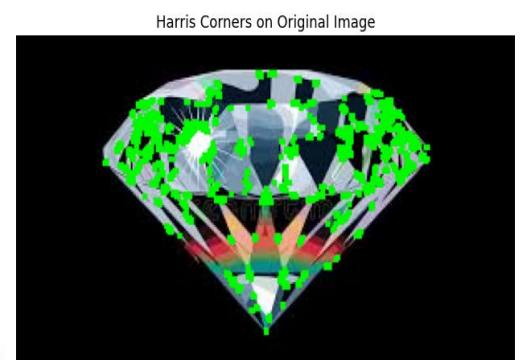
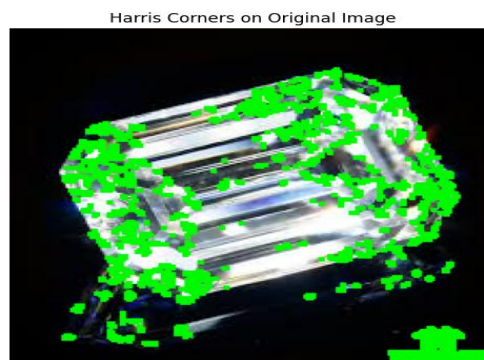
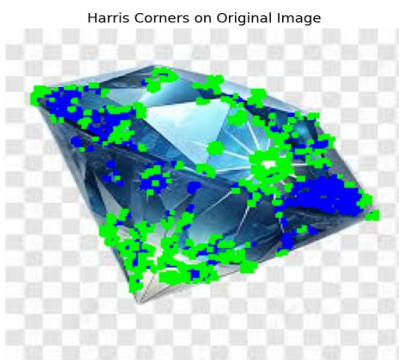
Working:

It computes a structure tensor (a matrix) from image gradients. From this matrix, a corner response function is calculated. A point is considered a corner if there is significant variation in both gradient directions, meaning both eigenvalues are large.

Advantages:

- More accurate than Moravec.
- Rotation invariant.
- Robust to small image noise.

➤ Output



❖ 3. Shi-Tomasi Corner Detection

Concept:

Shi-Tomasi is a refinement of the Harris detector. It improves corner detection accuracy by changing the condition for identifying corners.

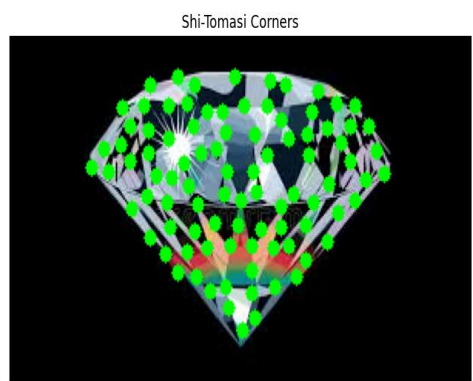
Working:

Instead of using a mathematical formula involving the determinant and trace of the structure tensor, it simply checks the minimum eigenvalue of the matrix. If this minimum eigenvalue is above a threshold, the point is marked as a corner.

Advantages:

- More stable and reliable than Harris.
- Widely used in modern computer vision tasks.
- Implemented in OpenCV as `goodFeaturesToTrack`.

➤ Output



Conclusion: -In this task, we explored and implemented three popular corner detection algorithms: Moravec, Harris, and Shi-Tomasi. Each method helps identify key interest points in an image where intensity changes significantly in multiple directions — these are crucial in various computer vision applications like object tracking, image matching, and 3D reconstruction.

- Moravec is the simplest and earliest method, but it lacks robustness and rotation invariance.
- Harris improved on Moravec by incorporating gradient-based analysis and rotational invariance, making it more reliable for real-world tasks.
- Shi-Tomasi further refined Harris by focusing on the minimum eigenvalue, resulting in better performance in feature detection and tracking.

By visualizing corners on the original image, we gained insight into how these algorithms detect distinctive features and how they respond to different textures and edges in the image.