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Question

1) What is edge detection?

2) Why do we need edge detection?

3) What are primitives of edge detection?

4) Explain the edge detection algorithm?

5) How to enhance first filter result?

Answers

1). Edge detection is an image processing technique for finding the boundaries of objects within images. It works by detecting discontinuities in brightness and it used for image segmentation and data extraction in areas such as image processing, computer vision and machine vision.

2). We need edge detection because we want to:

- Detect an object as image.

- Do measures of an image.

- Extract information from an image.

- Compress image data.

3). The primitives of edge detection are:

- **Edge**: it normally occurs on the boundary between two different regions in an image and it important features for analyzing images.

- **Region of interest (ROI)**: is chosen subset of samples within a dataset that identified for a particular purpose and defined the borders of an object under consideration.

- **Point of interest (POI) or corner** : is a fix or specific point in an image that can find interesting or useful and selected from the background in a field of view.

- **Patterns:** are a repetition of specific visual elements like spirals, waves, etc.

4). The edge detection algorithm contains four steps include:

- Firstly, **Filtering** is used to improve the performance of an edge detector with respect to noise. However, it is balanced between edge strength and noise reduction in result of more noise reduction to make the loss of edge strength.

- Secondly, **Enhancement** emphasizes pixels where there is a significant change in local intensity values and is usually performed by computing the gradient magnitude.

- Thirdly, **Detection** for determine which points are edge points. Frequently thresholding provides the criterion used for detections.

- Lastly, **Localization** for estimate the location of the edge with subpixel resolution if required for the application. The edge orientation can be estimated.

5). To enhance first filter result we need to find:

- A vertical edge detector: $Icv(x,y) = I(x - y) - I(x-1, y)$.

- A horizontal edge detector: $Ich(x,y) = I(x,y) - I(x,y-1)$.

- A magnitude: $Ic(x,y) = sqrt(Icv(x,y)^2 + Ich(x,y)^2)$.