Insightful Vision: Exploring Traditional Computer Vision

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What is Computer Vision?

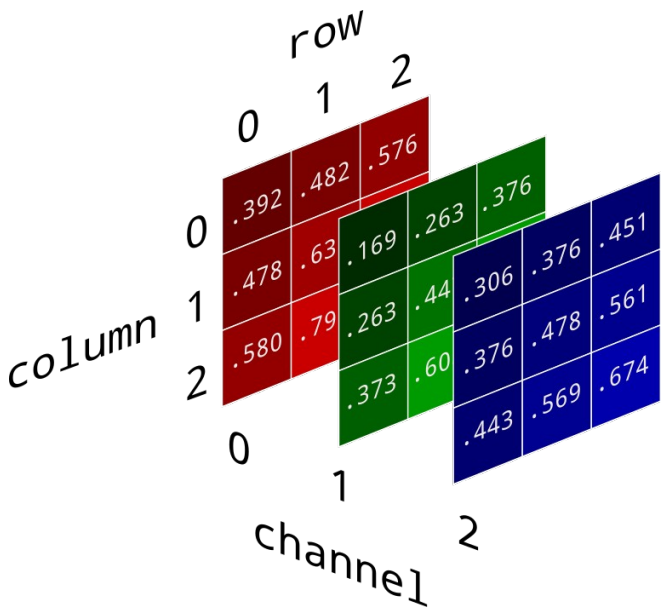
- Enabling computers to interpret and understand visual information from digital images or videos, mimicking human vision processes to analyze, process, and extract meaningful insights.

Agenda

- Analyzing digital images (videos)
- Using classical image processing techniques
- Employing feature extraction methods
- Applying pattern recognition algorithms
- *Excluding modern deep learning or AI techniques*

Analyzing Images

- An image is a static visual representation, while a video is a sequence of moving images.



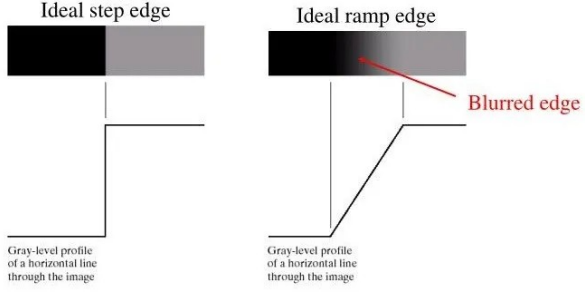
Using Classical Image Processing

- Feature Extraction – detecting edges, corners, textures.
- Image Filtering – manipulting image characteristics
- Histogram Analysis – analyzing of pixel intensities
- Contour Detection – detecting outlines of objects
- Optical Character Recognition – we know this!

Employing Feature Extraction

Edge Detection

- Detects abrupt changes in color or brightness.
- Identifies boundaries between objects.
- Uses gradient analysis for edge detection.
- Enables object detection.



-1	0	+1
-2	0	+2
-1	0	+1

Gx

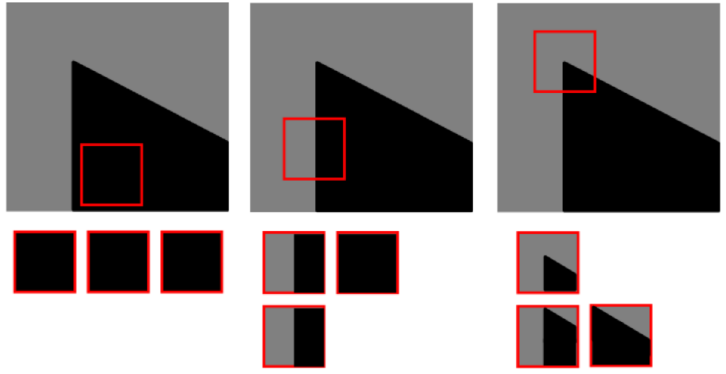
+1	+2	+1
0	0	0
-1	-2	-1

Gy

Employing Feature Extraction

Corner Detection

- Analyzes pixel neighborhoods to find corners.
- Measuring based on the variation in px intesity.
- Detecting when two edges meet.



Applying Pattern Recognition

Optical Character Recognition

- ***Pre-processing***: Enhance quality and remove noise.
- ***Feature Extraction***: Detect edges, corners, features.
- ***Text Segmentation***: Identify regions containing text.
- ***Character Recognition***: Classify and extract characters from text regions.

Applying Pattern Recognition

Object Detection

- ***Feature Extraction***: Identify key visual patterns or characteristics in the image.
- ***Template Matching***: Compare these features with predefined templates or patterns.
- ***Localization and Classification***: Determine the location and category of objects based on matched features and templates.

Hands-On!

Limitations of Classical CV

- Manual feature design often misses relevant details.
- Relies on fixed rules, limiting flexibility.
- Lacks learning capability for improvement.
- Vulnerable to noise and outliers.
- Difficult to manually tune to fit a large dataset.

Thank You!