Optimizing Robotic Efficiency through Advanced Image Processing Techniques

List of content

How these techniques are used in robotics

What Is an Image

Benefits of Image Processing

WHAT IS IMAGE PROCESSING

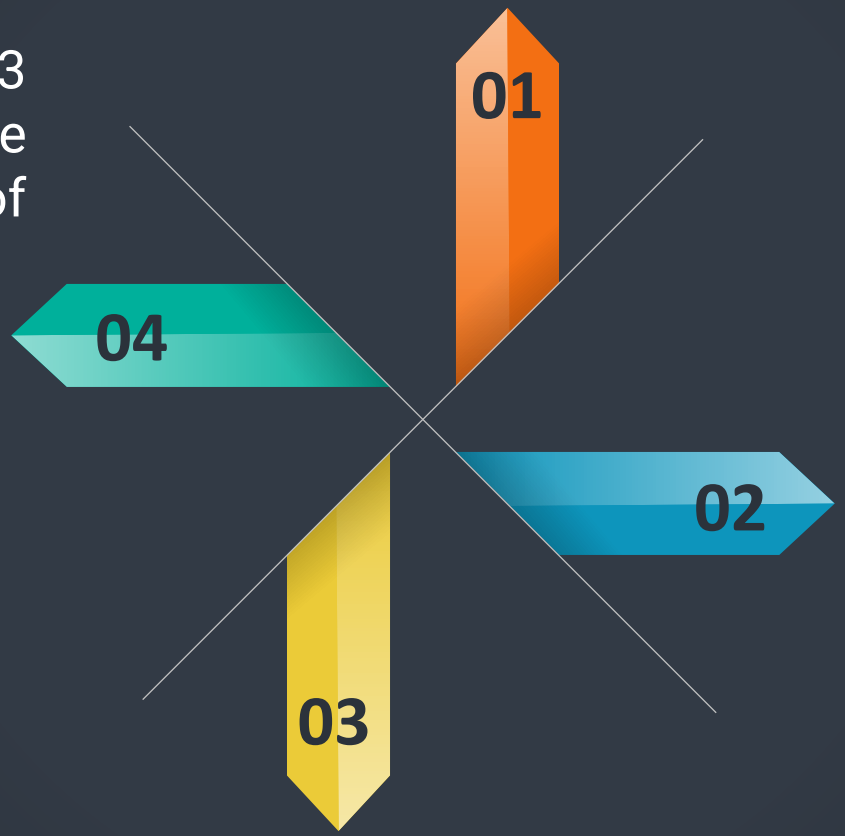
Applications of Image Processing

Types of Image Processing

What Is an Image?

RGB - A pixel is made up of 3 integers between 0 to 255 (the integers represent the intensity of red, green, and blue).

•RGBA - It is an extension of RGB with an added alpha field, which represents the opacity of the image.



An image is represented by its dimensions (height and width) based on the number of pixels. For example, if the dimensions of an image are 500 x 400 (width x height), the total number of pixels in the image is 200000

Grayscale - A pixel is an integer with a value between 0 to 255 (0 is completely black and 255 is completely white).

What Is Image Processing?

What Is Image Processing?

Image processing is the process of transforming an image into a digital form and performing certain operations to get some useful information from it. The image processing system usually treats all images as 2D signals when applying certain predetermined signal processing methods.

Types of Image Processing

Visualization

Find objects that are not visible in the image

01

Recognition

Distinguish or detect objects in the image

02

Sharpening and restoration

- Create an enhanced image from the original image

03

Types of Image Processing

Pattern recognition

Measure the various patterns around the objects in the image

01

Retrieval

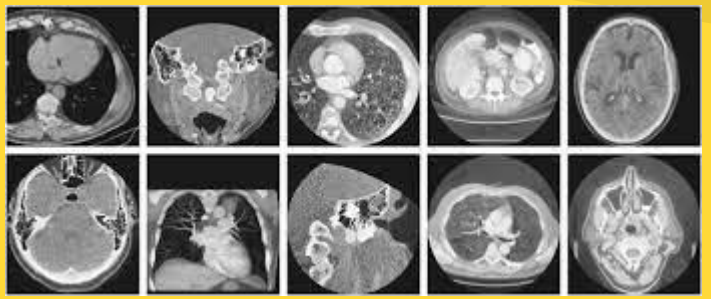
Browse and search images from a large database of digital images that are similar to the original image

02

03

Applications of Image Processing

Medical Image Retrieval



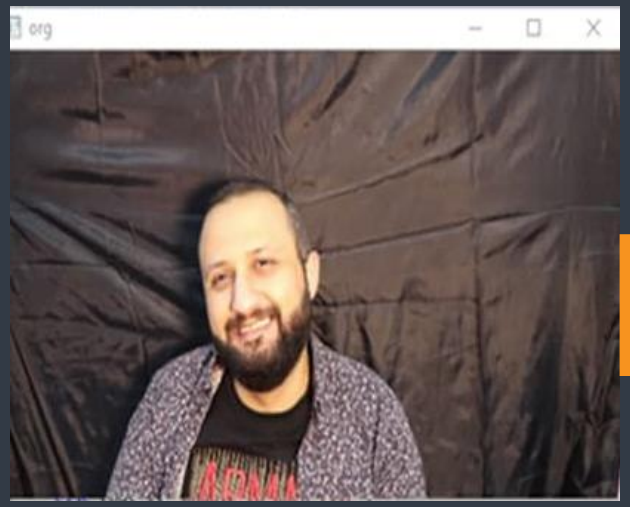
Traffic Sensing Technologies

Applications of Image Processing

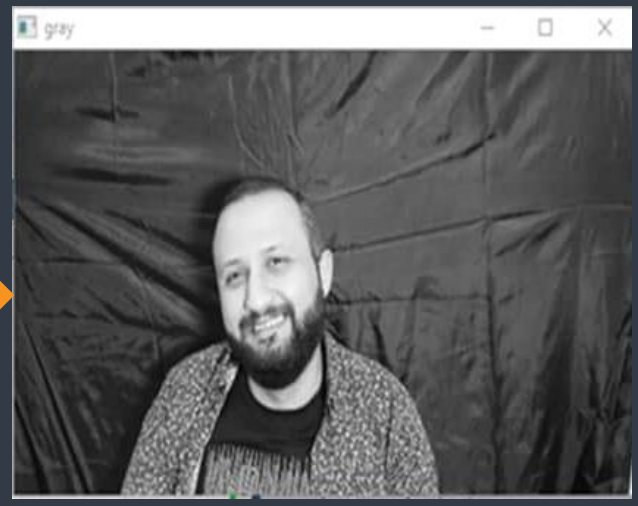
Image Reconstruction

Face Detection

Face detection is a vital tool used in security, biometrics and even filters available on most social media apps these days



JPG TO GREY

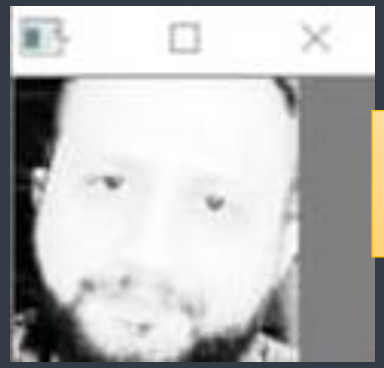


$$GRAY = 0.30\ R + 0.59\ G + 0.11\ B$$

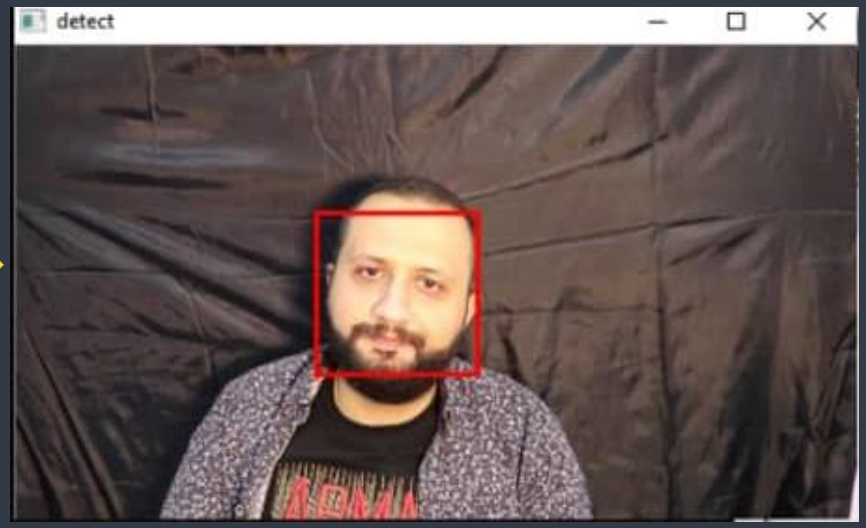
Histogram Equalization did to the images

Histogram equalization is a spatial domain method that produces output image with uniform distribution of pixel intensity means that the histogram of the output image is flattened and extended systematically

$$Cdf\,(\mathrm{X}) = \sum_{i=1}^{x} \mathrm{h}(i)$$



Cropping & VJ



Benefits of Image Processing

01

It helps to improve images for human interpretation

Information can be processed and extracted from images for machine interpretation

02

03

The pixels in the image can be manipulated to any desired density and contrast

Benefits of Image Processing

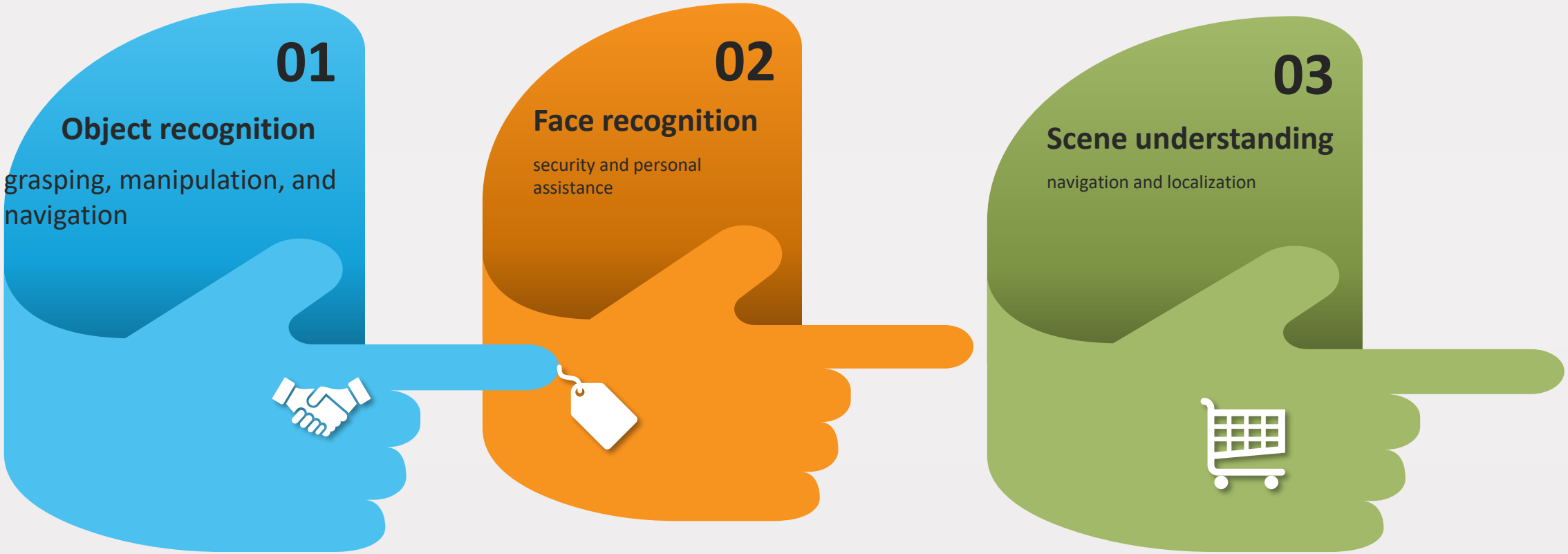
04

Images can be stored and retrieved easily

It allows for easy electronic transmission of images to third-party providers

05

How these techniques are used in robotics



Robotics applications that use image processing

Industrial automation

For example, a robot equipped with image processing can be used for pick-and-place tasks, sorting and packaging, and quality control inspection

Robotics applications that use image processing

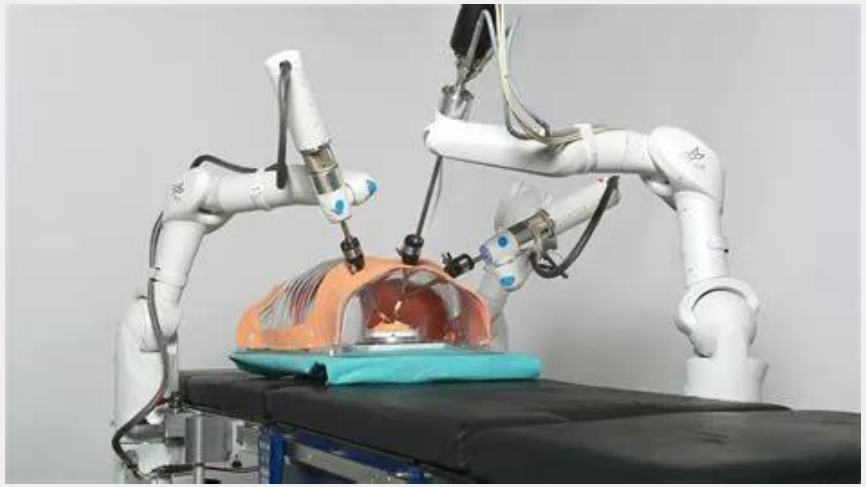
Surveillance and security

Image processing is used in surveillance and security applications to perform tasks such as object and face recognition, and scene understanding. For example, a robot equipped with image processing can be used for monitoring and securing a perimeter, tracking individuals, and identifying suspicious behavior.

Robotics applications that use image processing

Robotics in medicine

Image processing plays a crucial role in robotics in medicine by allowing robots to perform tasks such as image-guided surgery, minimally invasive procedures, and therapy. For example, a robot equipped with image processing can be used for image-guided biopsy, catheter navigation, and rehabilitation therapy.



Challenges and Future Directions

Real-time processing

•One of the main challenges in image processing for robotics is the need for real-time processing. Robots need to be able to process visual information quickly and accurately in order to make decisions and perform tasks in real-time.

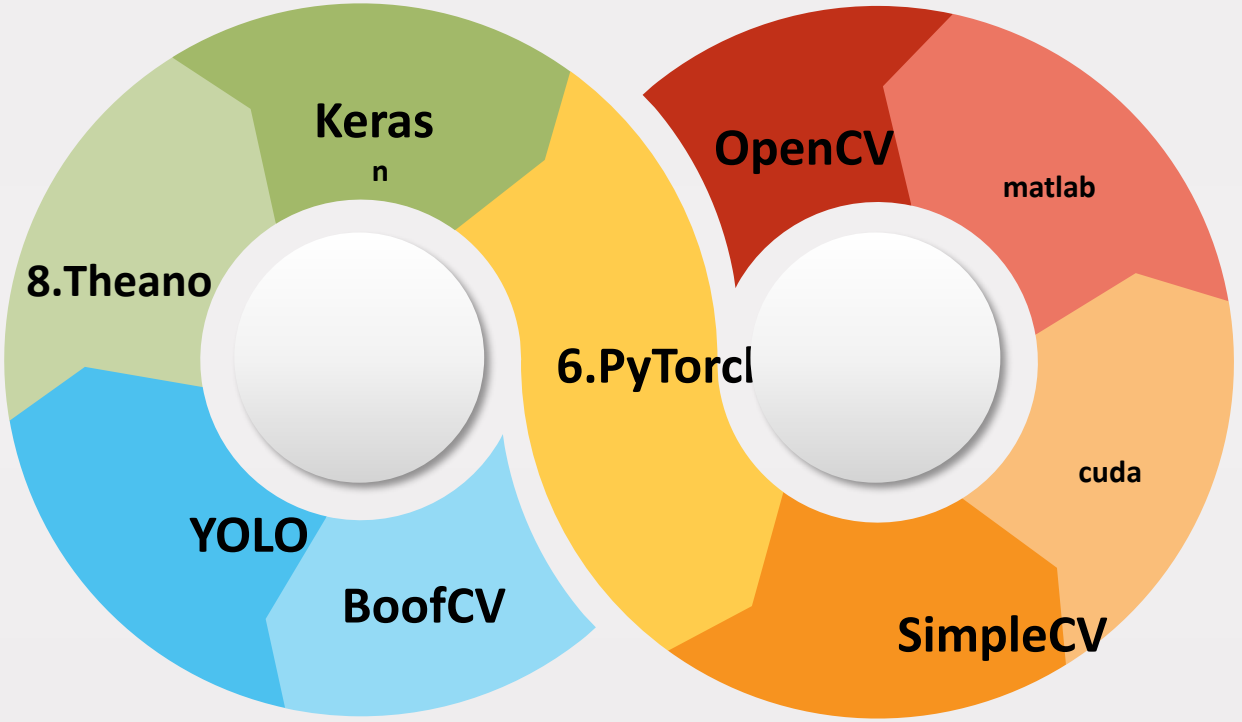
Robustness to changing conditions

•Image processing algorithms need to be robust to changing conditions such as lighting, weather, and occlusions. This requires algorithms that can adapt to changing conditions and maintain a high level of performance.

Handling large amounts of data

The large amounts of data generated by cameras and sensors used in robotics can be a challenge to process and analyze. This requires efficient algorithms and powerful computing resources.

Best Image Processing Tools



CONCLUSION

The successful implementation of image processing in various applications including industrial automation, surveillance and security, and robotics in medicine, has led to significant improvements in precision, accuracy, and efficiency

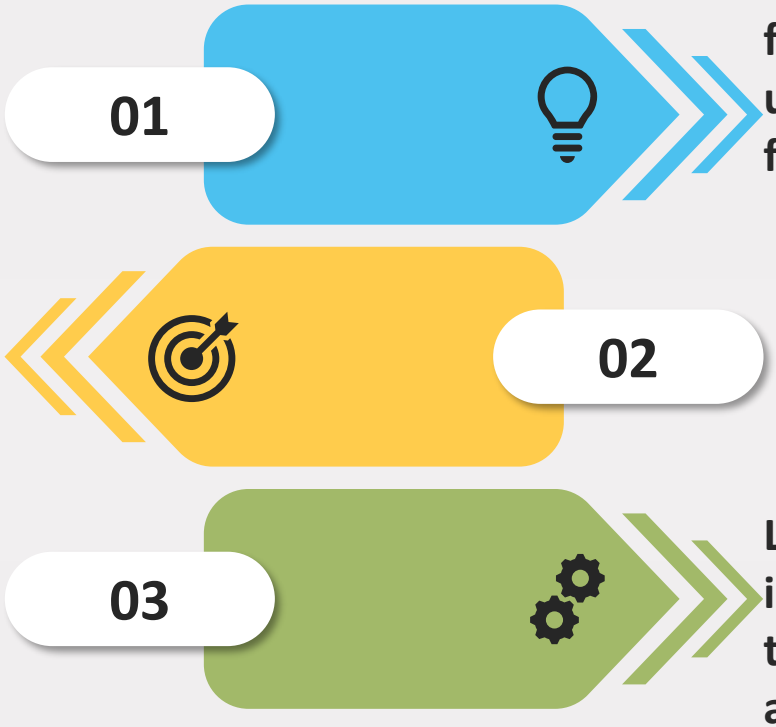


image processing plays a crucial role in the field of robotics, enabling machines to understand and interpret visual information from the world around them

Looking towards the future, research in image processing for robotics will continue to focus on developing efficient algorithms and powerful computing resources, as well as addressing the challenges of real-time processing, robustness and handling large amounts of data