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IMAGE SEGMENTATION USING DIGITAL IMAGE PROCESSING METHODS

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Annotation: Image segmentation techniques using digital image processing methods allow images to be divided into segments and processed. This method allows images to be automatically analyzed and segmented into the desired segments. This article provides a brief overview of digital image processing and its components, as well as digital image segmentation methods.

Keywords: Image acquisition, image enhancement, image segmentation, image descriptors, contour segmentation

Аннотация: Техники сегментации изображений с использованием методов повторной обработки цифровых изображений предоставляют возможность разделения изображений на сегменты и их повторной обработки. Этот метод предоставляет возможность автоматического анализа изображений и разделения их на необходимые сегменты. В данной статье представлена краткая информация о повторной обработке цифровых изображений и их составных частей, а также о методах сегментации цифровых изображений.

Ключевые слова: цифровое изображение, получение изображения, увеличение изображения, сегментация изображения, описатели изображения, контурная сегментация.

Digitally classifying an image and studying its components. Consider the image of a fruit basket shown in Figure 1, can we distinguish the different fruits? The answer is of course "yes", but how did we do it?

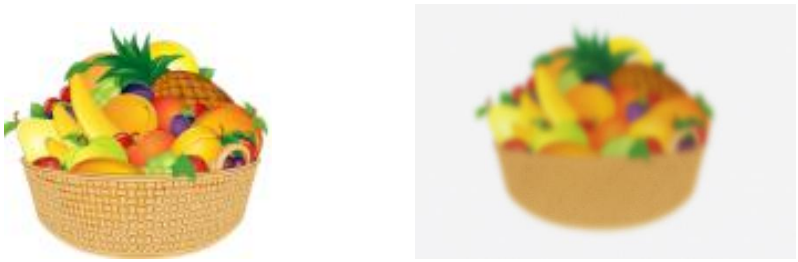

Figure 1. Left: Original image of a fruit basket; Right: Segmented image of a fruit basket. If we analyze the thinking or visual processing that takes place in our brain, we can answer the question by enumerating the different ways in which we can differentiate between a banana and an apple and an orange, and an orange and an apple and a banana. This can be done by analyzing fruits. They have different colors, shapes, textures, etc. that act as differentiating factors between them. Now the question is how can we build a computer to implement this idea or how can we design an algorithm that includes all the differentiating methods for each fruit and gives us the

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result as shown in Figure 1 (right). This is called image segmentation, where we separate the image or extract different types of objects from it. In this, we will discuss different digital image processing techniques that help us achieve image segmentation. The following sections cover machine learning and deep learning methods for potential image segmentation.Tasvirga ishlov berish asosan quyidagi bosqichlarni o'z ichiga oladi:

1. Importing an image through image acquisition tools.

2. Analyzing and manipulating the image to obtain the desired image.

3. An output image based on the analysis of this image.

Components of a digital image processing system:

1. Image acquisition is the process of converting an analog image into a digital image. This process usually occurs when we click a photo on a digital camera, because in reality, the image is an analog signal when captured by the human visual system.

2. Image enhancement is a phase used to modify the pixel values of an image so that it is better received by the HVS. This can be done using the spatial domain or frequency domain. Examples include histogram equalization, noise reduction, blur removal, image sharpening and softening, filtering, etc.

3. Color space conversion - This involves converting the color space of an image to a more accurate representation to extract features of interest from the image. Some examples of color spaces are: cieLAB, HSV, HSL, etc.

4. Digital image transformation - it deals with the representation of an image in various formats, so that the transformed image can be used in tasks such as image compression, feature extraction, etc. This transformation includes DFT, distinct cosine transform, discrete wavelet construction, and displaying images in a specific form.

Image segmentation involves dividing an image into components or objects. For example: edge detection, boundary detection, thresholding, region-based segmentation, etc.

Image descriptors are concerned with creating features that can be used to uniquely identify feature points in an image and therefore can be used in CBIR system applications. Example: SIFT, SURF, etc. Brief information about digital image segmentation methods. The following are the methods of image segmentation using digital images: 1. Threshold-based segmentation: This is the simplest method of image segmentation in which each pixel value is compared with a threshold value. If the pixel value is less than the threshold value, it is set to 0, otherwise it is set to the maximum value (usually 255). This threshold value can be changed arbitrarily. Using these algorithms, we need to separate the background from the foreground, because the disadvantage of this algorithm is that it always divides the image into two categories.

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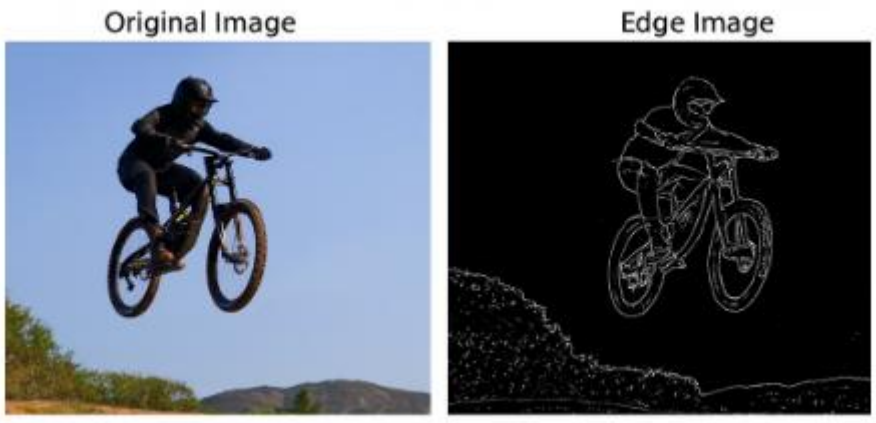
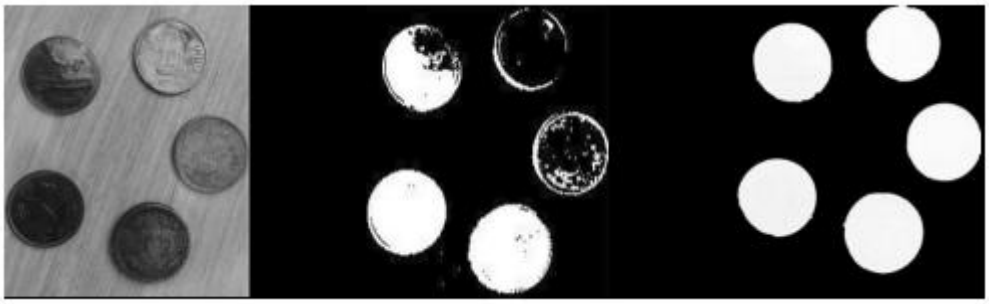


Figure 2. Contour segmentation of an image using a Kenny filter.

Segment-based morphological methods: This is a methodology for analyzing the geometric structure of an image. In this technique, the output image pixel values are based on similar pixels in neighboring images and a new binary image is generated. This method is also used in foreground-background separation. The basis of morphological operations is expansion, erosion, opening, and closing, which are expressed by logical AND and OR. This method is mainly used in shape analysis and noise removal after image thresholding. Example: watershed algorithm.



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Graph-based segmentation techniques: Graph-based approaches treat each pixel as a node in a graph. The edge weights between two nodes are proportional to the similarity between neighboring pixels. Pixels are combined to form segments or superpixels by minimizing a cost function defined over the graph.

Figure 4. Undirected graph structure of an image.

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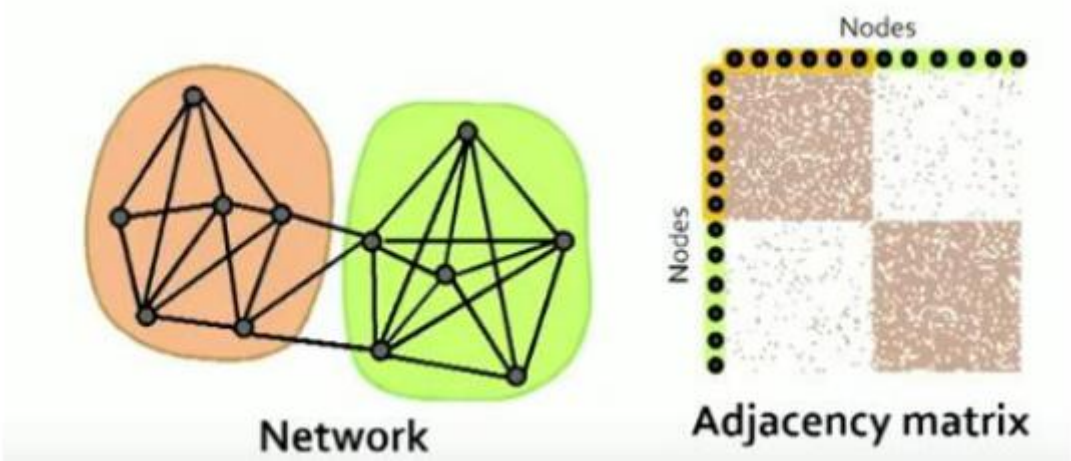

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nodes in the network represent pixels, and the edges are the neighbors of these pixels. The entire image is considered as an undirected graph structure, and the goal is to divide this graph into segments, such as the red and green regions shown in the left image. The right image is the adjacency matrix that we can form from the network of graphs.

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