**Investigation**

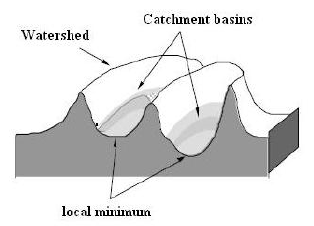
**Watershed Image segmentation**

**Watershed**:- [3]An area of land that separates waters flowing to different river, basins and seas .So, how watershed is related to biological tissues, image processing.

[2] Image segmentation is the process of separating objects in the image from the background. We can also say that divided the image into disjoint regions, such that each region is same with respect to some property like grey value or texture.

[2]The watershed transform can be classified as region based segmentation approach. An alternative approach is to imagine the landscape being immersed in a lake, with holes pierced in local minima. Basins (also called ‘catchment basins’) will fill up with water starting at these local minima, and, at points where water coming from different basins would meet, dams are built. When the water level has reached the highest peak in the landscape, the process is stopped. As a result, the landscape is partitioned into regions or basins separated by dams, called watershed lines or simply watersheds. When simulating this process for image segmentation, two approaches may be used: either one first finds basins, then watersheds by taking a set complement; or one computes a complete partition of the image into basins, and subsequently finds the watersheds by boundary detection.[2]

[4][5]The watershed based methods uses the concept of topological interpretation. The watershed methods consider the gradient of image as topographic surface. The pixels more gradient are represented as boundaries which are continuous.



**a) What is the technique used for and what is an example of its application?**

Ans:-[2] The Watershed segmentation has been widely used in medical image segmentation. Watershed transform is used to segments grey matter, white matter and cerebrospinal fluid from the Magnetic Resonance (MRI) brain image. There are main approach in segmentation is frontier approach and region approach. The segmentation by watershed is combine both approach and this is a powerful technique for rapid detection of both edge and region.

**b) Find a function in Python that can provide this functionality. Give the syntax and explain the parameters of this function**.

Ans:- The algorithm uses a priority queue to hold the pixels with the metric for the priority queue being pixel value, then the time of entry into the queue - this settles ties in favor of the closest marker.

[6]Basically, it has inbuilt library function in python in from **skimage.morphology import watershed.**

We load the package

**Syntax**:-

*skimage.morphology.watershed(image,markers, connectivity=1, offset=None, mask=None, compactness=0, watershed\_line=False)*

**Parameters**:-.

*Image*:- ndarray (2-D, 3-D, …) of integers

Data array where the lowest value point are labeled first.

*Makers*:- int, or ndarray of int, same shape as `image`

The desired number of markers, or an array marking the basins with the values to be assigned in the label matrix. Zero means not a marker.

*connectivity*: ndarray, optional

An array with the same number of dimensions as image whose non-zero elements indicate neighbors for connection. Following the scipy convention, default is a one-connected array of the dimension of the image.

*Offset* : array\_like of shape image.ndim, optional

Offset of the connectivity

*mask*: ndarray of bools or 0s and 1s, optional

Array of same shape as image. Only points at which mask == True will be labeled.

*compactness* : float, optional

we compact watershed [R720720] with given compactness parameter.Higher value result is more regularly shaped watershed basin.

***watershed\_line***: bool, optional

If watershed\_line is True, a one-pixel wide line separates the regions obtained by the watershed algorithm. The line has the label 0.

***c*) Discuss a possible application of segmentation on medical images**

Ans.:- Most commonly used radiological modalities for imaging anatomy. It help to Locate the tumors and other pathologies. This technique help us to measure the length of tissues and volume. Now days, we used image segmentation for surgery planning (see real structure of body parts). We also used it in computer integrated surgeries.

We used watershed segmentation algorithm in MRI to findout the grey and white matter inside our brain.

**d) Provide a scientific paper that uses or proposes this image enhancement technique**

[**http://ijettcs.org/Volume2Issue2/IJETTCS-2013-03-24-035.pdf**](http://ijettcs.org/Volume2Issue2/IJETTCS-2013-03-24-035.pdf)

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