IMAGE SEGMENTATION

The goal is to partition an image into its relevant regions.

A large number of methods.

The watershed is the fundamental method in morphological segmentation.

A gradient-based approach.

* Pure watershed approach

The gradient is partitioned into its catchment basins (regions).

  This can be computed very efficiently

    Waiting queues algorithms
      See, for example:
      L. Vincent, P. Soille. "Watersheds in Digital Spaces:
      An Efficient Algorithm Based on Immersion Simulations",
      IEEE Trans. Pattern Anal. Mach. Intell., 1991.
      DOI:10.1109/34.87344

A catchment basin (region) arises for each minimum of the gradient.

A problem is that, normally, an image gradient has an extremely large number of minima.

  This produces an over-segmentation problem.

    A large number of non-relevant regions is obtained.

A solution to this over-segmentation problem is achieved by adding markers.

* Watershed + markers approach

Markers of relevant regions can be incorporated to modify the gradient of the image, so that all minima that are not marked are removed (or rather, 'filled').

Those markers can be computed by several techniques (v.g., by using contrast operators such as the 'top-hat', etc.), or can be provided manually.

After modifying the gradient, a watershed algorithm can be applied to compute its catchment regions.

  Each marker will produce a catchment basin (region).