Histogram Based Segmentation using Wasserstein Distances

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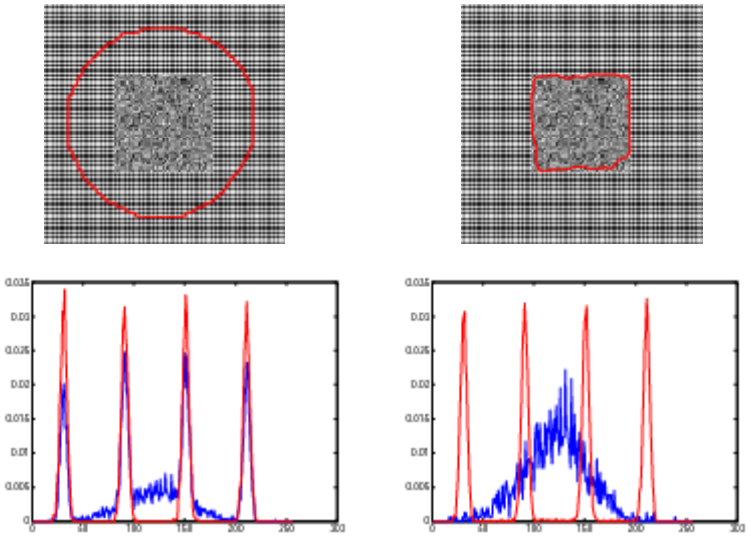
We developed variational models for image segmentation that incorporate histogram information into level set based curve evolution techniques. The novelty is in the use of Wasserstein mass transfer metrics in order to compare histograms; we found that this improves the results significantly over previous metrics used in this capacity. The advantages of our approach become particularly pronounced when the histograms of different objects in the image are concentrated in spikes.

One of our proposed models partitions the image into two regions so that local neighborhood histograms in each region are as uniform as possible. A second model partitions the image into two regions so that the histogram of the image in one region is maximally different from the histogram in the other. In quantifying uniformity and difference of histograms, mass transfer metrics are used.

Left: Segmentation based on average intensities via Chan-Vese model. Right: Proposed model based on neighborhood histograms.



Left: Segmentation based on average intensities via Chan-Vese model and histograms in the two regions found. Right: Proposed model based on maximally different histograms.