

Patch-Match based tracklets for Medical Video/Volume Segmentation

Background Machine learning techniques for medical image processing have attracted huge interest in numerous medical applications. In particular, the impact of Deep Learning methods and GPU based computing has brought important performance levels within reach. Yet, the reliance of these methods on large amounts of annotated training data remains the primary limitation in most applications.

In the context of large SNSF project, we are interested in exploring how sparse annotations can be leveraged in volumetric or video image data that must be pixel-wised segmented for a given object of interest in mind. In particular, we are interested in the case where a single 2D location per frame/slice, provided as either a mouse click or a gaze location, are available to segmented the complete extent of a structure of interest over the entire image sequence.

Aim The goal of this project is explore the use of patch-matching techniques to co-register frame within volumes and allow correspondences between image locations to be determined. Observed locations can then be treated as tracklets, or subsequent image patches with high correspondence coefficients. The hypothesis is that these can then be used for structure of interest segmentation.

Materials and Methods The student will have at his/her disposal image data in the form of image sequences and volumes. At the same time, 2D locations on a structure of interest (e.g. cochlea in CT, brain tumor in MRI, surgical instruments in endoscopy) across data sequences will be provided. The goal will be to build segment as accurately as possible the full extent of the object over all images.

Nature of the Thesis:

Method exploration: 35%

Implementation: 35%

Experimentation: 30%

Requirements:

Knowledge in Computer Vision, Machine Learning, Matlab / Python / C++

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