Kernel Smoothing-based Probability Contours for Tumour Segmentation

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Statistical imaging together with other machine learning techniques are the epitome of digitalizing healthcare and are culminating towards developing innovative tools for automatic analysis of three-dimensional radiological images — PET (Positron Emission Tomography) images [1]. However, the three major challenges in radiology are: (1) increasing demand for medical imaging (2) decreasing turnaround times caused by mass data (3) diagnostic accuracy that leads to a quantification of images. To address these challenges along with ethical issues regarding the use of Artificial Intelligence in patient care, there is a need to develop a new framework of statistical analysis which can be readily used by clinicians and can be trained with a relatively lower number of samples. Most existing algorithms segments a 2D slice by assigning the grid of pixels into the tumour or non-tumour class. Instead of a pixel-level analysis, we will assume that the true intensity comes from a smooth underlying spatial process which can be modelled by a kernel estimates [2]. In this project, we have developed a kernel smoothing-based probability contour method on PET image segmentation, which provides a surface over images that produces contour-based results rather than pixel-wise results, thus mimicking human observers' behaviour. In addition, our methodology provides the tools for developing a probabilistic approach with uncertainty measurement along with the segmentation. Our method is computational efficient and can produce reproductive and robust results for tumour detection, delineation and radiotherapy planning, together with other complementary modalities, such as CT (Computed tomography) images.

Keywords: medical image segmentation, positron emission tomography, kernel, 3d contouring, multi-modal segmentation

References

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