B2 - 5

Determination of Tumor Boundaries on CT image using Histogram analysis

Kyung Hoo Lee[1], Young Hoon Ji[2], Dong Han Lee[2], Mi Sook Kim[2], Soo Il Kwoan[1], Jun Chul Chun[1]

Dept. of Medical Physics Graduate School, Kyonggi Univ.[1]
Dept. of Radiat. Oncol., Korea Cancer Center Hospital[2]

INTRODUCTION

Recently, Fractionated Stereotactic Radiotherapy (FSRT) methods, which describe the spat ial location, size and shape of tumor boundaries, become an issue. In this paper we prese nt a novel algorithm to quantify and visualize the tumor volume by estimating the quanti ty distribution of tumor volume margins using phantom. In addition, this paper also descr ibes how the acquired tumor margin based on the proposed methods clinically useful in t reatment plan.

METHOD

Followings are overall procedure to analyze the images. Using phantom, the tumor shap e of region-of-interest (ROI) is made first. Helical CT (CT-I, GE Medical USA) can save consecutive axial images. To display the initial class information of the image, K-means classification algorithm is adjusted. The classified image consists of 5 regions that are tu mor region, normal region, combination region, uncommitted region, and artifact region. T he characteristics of each region are among: the tumor region is ROI, which is inserted i nto the phantom. The normal region being normally distributed pixels means normal tissu e. The combination region being mixed with normal and lesion tissue will be further pro cessed with a novel segmentation algorithm. The uncommitted region and the artifact regi on are background region and physical artifact region, but artifact region from exclusively other artifacts such as motion artifact and user artifact respectively. In the experiment, th e major concern is how to separate the normal region from tumor region in the combinat ion area. The proposed segmentation algorithm progressively makes uncertain boundaries b etween two regions as certain boundaries by changing the boundaries of tumor areas as t he partial volume and subsequently extracting the correct distributions of each region. The refore, the algorithm adjusts the size of volume margin by using the polynomial equation that is described by inherent volume characteristics and spatial coherency on the cubic c oordinate. Consequently the algorithm produces a certain tumor boundary by using the an atomical value of the pixel and the statistical histogram analysis of the distribution of nor mal and tumor tissue.

RESULTS

The histogram analysis of the five regions, which use K-means algorithm repeatedly, ill ustrates that the segmentation results are related to the inherent factor of the phantom. Th e actual boundary of the tumor volume can be estimated in an allowable error limit. The error limit to the boundaries between the tumor margin and the normal margin is estima ted as 2-3%.

DISCUSSION

A limited factor to apply our algorithm to such images is the allowable errors which a re caused by the material and structure of the phantom or the creation of ROI. However, the proposed algorithm can be more reliable and can easily divide the tumor region and the normal region when the error limits is eliminated.

CONCLUSION

The error limits regarding setting up tumor boundary of ROI results from the inherent factor error limits of phantom and the error limits caused by boundary estimated methods. According to the result of experiment, the error limit is 2-3%. We believe that the prop osed approach is useful in the treatment plan based on estimating the tumor volume. The refore the proposed methods, which will be visualize and quantify the brain tumor volum e becomes a clinically valuable model in the treatment plan.