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Scientists apply a mathematical method that refines the contour of tumors to image analysis to improve their treatment

Cancer treatment needs refinement. Any method aimed at treating a tumor, from extirpation to radiotherapy, requires a precise knowledge of the cancerous tumor margins so that the intervention on it may be performed in such a way that the possibilities of healing are maximised and the effects on surrounding healthy tissues are minimised. A group of researchers from the Department of Mathematics at the Universitat Jaume I in Castelló have implemented a mathematical method that is applied to medical imaging analysis, which enables to determine the margins of a tumor in the prostate, lung or bladder.

In most cases, the task of delimitating the contour of a tumor is carried out manually by a specialist. According to his or her experience, the doctor draws the perimeter within which he or she locates the cancerous tissue on an image obtained by computerised axial tomography (CAT) or magnetic resonance (MR) images. This perimeter may vary slightly depending on the professional who traces it. The method developed by the mathematicians at the UJI does away with such a great subjective variability, and enables a single, more objective and standardised confidence interval to be obtained for each tumor type and patient depending on his or her characteristics.

“What we have done is to define an average and most adjusted confidence interval possible from a series of contours delineated by various professionals on one same tumor, in such a way that it only surrounds the tissue that is considered cancerous and leaves any surrounding tissue which is not to be submitted to treatment unharmed”, as Ximo Gual, the person in charge of the research, explains.

By combining concepts of geometry, statistics and probability, the scientists at the UJI in cooperation with the radiotherapist oncology service at the Hospital Universitari La Fe in Valencia have developed a standard method for prostate cancer cases in patients aged 40-60 years. “All that remains now is to incorporate these mathematical formulae into the software used by medical teams”, Gual points out. The idea is that the machine can automatically write the confidence interval on the contour of the tumor previously drawn by the specialist.

However, the subjectivity of the health professionals is not the only variable that affects the task of determining the margins of a tumor. Indeed, this internal organ motion itself hinders the identification and subsequent monitoring of cancerous tissue. This is particularly obvious in the case of lungs. The problem is that the CAT or MR images corresponding to the same patient but taken on different days do not fit owing to internal organ motion, even though the external cut-off at which the images are taken is the same on each occasion.

“Our aim is to make progress in our research in order to achieve a 3D contouring of the tumor. The idea is to rebuild the tumor in 3D from crosscut images, and to define the three-dimensional confidence interval that accounts for the variability due to internal organ motion”, Ximo Gual explains.

More information: www.uji.es/ocit/noticies/detall&id_a=6081899

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