Automatic Segmentation of 3D Tomographic Images Contours at Radiotherapy Planning in Low Cost Solution

Authors : D. F. Carvalho, A. O. Uscamayta, J. C. Guerrero, H. F. Oliveira, P. M. Azevedo-Marques

Abstract : The creation of vector contours slices (ROIs) on body silhouettes in oncologic patients is an important step during the radiotherapy planning in clinic and hospitals to ensure the accuracy of oncologic treatment. The radiotherapy planning of patients is performed by complex softwares focused on analysis of tumor regions, protection of organs at risk (OARs) and calculation of radiation doses for anomalies (tumors). These softwares are supplied for a few manufacturers and run over sophisticated workstations with vector processing presenting a cost of approximately twenty thousand dollars. The Brazilian project SIPRAD (Radiotherapy Planning System) presents a proposal adapted to the emerging countries reality that generally does not have the monetary conditions to acquire some radiotherapy planning workstations, resulting in waiting queues for new patients treatment. The SIPRAD project is composed by a set of integrated and interoperabilities softwares that are able to execute all stages of radiotherapy planning on simple personal computers (PCs) in replace to the workstations. The goal of this work is to present an image processing technique, computationally feasible, that is able to perform an automatic contour delineation in patient body silhouettes (SIPRAD-Body). The SIPRAD-Body technique is performed in tomography slices under grayscale images, extending their use with a greedy algorithm in three dimensions. SIPRAD-Body creates an irregular polyhedron with the Canny Edge adapted algorithm without the use of preprocessing filters, as contrast and brightness. In addition, comparing the technique SIPRAD-Body with existing current solutions is reached a contours similarity at least 78%. For this comparison is used four criteria: contour area, contour length, difference between the mass centers and Jaccard index technique. SIPRAD-Body was tested in a set of oncologic exams provided by the Clinical Hospital of the University of Sao Paulo (HCRP-USP). The exams were applied in patients with different conditions of ethnology, ages, tumor severities and body regions. Even in case of services that have already workstations, it is possible to have SIPRAD working together PCs because of the interoperability of communication between both systems through the DICOM protocol that provides an increase of workflow. Therefore, the conclusion is that SIPRAD-Body technique is feasible because of its degree of similarity in both new radiotherapy planning services and existing services.
Keywords : radiotherapy, image processing, DICOM RT, Treatment Planning System (TPS)

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