Classification of methods for generating pseudo-CT from MRI images for MRI-alone RT

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Wafa Boukellouz[1] and Abdelouahab Moussaoui
Department of computer sciences, Faculty of sciences, Ferhat Abbas University, Setif, Algeria.
[1]w_boukellouz@outlook.fr

Abstract:

Background: Since the last decades, research have been oriented towards an MRI-alone radiation treatment planning (RTP), where MRI is used as the primary modality for imaging, delineation and dose calculation by assigning to it the needed electron density (ED) information. The idea is to create a computed tomography (CT) image or so-called pseudo-CT from MRI data. In this paper, we review and classify methods for creating pseudo-CT images from MRI data. Each class of methods is explained and a group of works in the literature is presented in detail with statistical performance. We discuss the advantages, drawbacks and limitations of each class of methods.

Methods: We classified most recent works in deriving a pseudo-CT from MR images into four classes: segmentation-based, intensity-based, atlas-based and hybrid methods. We based the classification on the general technique applied in the approach.

Results: Most of research focused on the brain and the pelvis regions. The mean absolute error (MAE) ranged from 80 HU to 137 HU and from 36.4 HU to 74 HU for the brain and pelvis, respectively. In addition, an interest in the Dixon MR sequence is increasing since it has the advantage of producing multiple contrast images with a single acquisition.

Conclusion: Radiation therapy field is emerging towards the generalization of MRI-only RT thanks to the advances in techniques for generation of pseudo-CT images. However, a benchmark is needed to set in common performance metrics to assess the quality of the generated pseudo-CT and judge on the efficiency of a certain method.

Keywords: MRI-alone RTP, Pseudo-CT, Electron density, Radiotherapy treatment planning.

1. Declaration of conflicts

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2. Authors' biography

No biography

3. References

No references