RESPIRATORY MOTION CORRECTION IN PET/CT IMAGING

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In dual modality PET-CT imaging, respiratory motion can introduce blurring in PET images and create a spatial mismatch between the PET and CT datasets. Attenuation correction errors can result from this mismatch, which can produce severe artefacts that potentially alter the clinical interpretation of the images. Various approaches of reducing these effects have been developed. Many involve respiratory gated acquisitions which generally require a measure of the respiratory cycle throughout imaging.

In this work, a retrospective respiratory gating technique was developed for both PET and CT which extracts the respiratory cycle from the acquired data itself, removing the requirement for hardware that measures respiration. This data-driven gating method was validated with phantom and patient data, and compared with a hardware based approach of gating. Extensions to the method facilitated the gating of multi-bed position, 3D clinical PET scans. Finally, 60 Ammonia cardiac PET/CT images were used to compare several different approaches of reducing respiratory induced attenuation correction errors and motion blur.

The data-driven respiratory gating method accurately substituted a hardware based approach, and no significant difference was found between images gated with either methods. Gating 11 clinical 3D whole body PET images validated the extended data-driven gating methods and demonstrated successful combination of separate PET bed-positions. All evaluated approaches to reduce respiratory motion artefacts in cardiac imaging demonstrated an average improvement in PET-CT alignment. However, cases were found where alignment worsened and artefacts resulted. Fewer and less severe cases were produced when the 4D attenuation correction data was created from a 3D helical CT and PET derived motion fields. Full motion correction produced a small effect on average, however in this case no detrimental effects were found.

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