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Validation of CT-free Template-Based Attenuation Correction in Brain PET Imaging

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This study aims to validate a template-based attenuation correction (AC) method for clinical brain PET systems without CT, previously proposed for the new NeuroLF brain-PET. Method: The validation process involved simulating a diverse (patients/tracers) set of clinical images. This is done by transforming 142 reference PET/MR and 8 PET/CT brain images to NeuroLF image space, converting them to sinograms, then uncorrecting the sinograms for attenuation and scatter using original patient-derived attenuation maps. These uncorrected sinograms serve as a surrogate for real clinical raw data. From this, images were then re-reconstructed with both patient-specific reference and tracer-specific template attenuation maps and compared using a range of similarity metrics. Results: The stability of the template-based AC method across a diverse set of tracers for brain PET imaging could be shown. The used metrics identified cases where the MR-to-CT conversion was inadequate, but were less capable of detecting failures intentionally induced in the template map co-registration. Tracer-specific templates showed better performance than a universal (i.e. [18F]-FDG derived) template. Conclusion: The validation confirms the adequacy of the template-based AC method for clinical routine brain-PET imaging, with a recommendation for visual inspection to detect co-registration failures. We aim to further validate the template-based attenuation maps in a blinded clinical evaluation.

Field

Software and quantification

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