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Dopaminergic PET to SPECT Domain Adaptation: A Cycle GAN translation approach

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Dopamine transporter imaging is routinely used in the diagnosis of Parkinson's disease (PD), although unreliable in distinguishing PD from atypical parkinsonian syndromes (APS). While [11C] CFT PET is common in East Asia, with a substantial APS database to support AI advancements, Europe primarily relies on [123I] FP-CIT SPECT, with limited APS data. Cross-modality translation is appealing to facilitate multicenter/long-term studies. We aim to develop a deep learning(DL)-based cross-modality synthesis between CFT PET and FP-CIT SPECT.
Methods: A 3D CycleGAN was trained with CFT PET and FP-CIT SPECT images from PD and non-parkinsonian (NC) subjects and used to generate synthetic SPECT from the real PET test set. Quantitative and qualitative evaluations were performed.
Results: The Fréchet Inception Distance between synthetic and real SPECT was lower than between synthetic SPECT and real PET. The striatal specific binding ratios values of synthetic SPECT were not significantly different from those of real SPECT. The DL model for NC vs PD classification achieved an AUC of 0.992. Visual grading analysis showed no significant differences between real and synthetic SPECT.
Conclusion: The CycleGAN generated visually indistinguishable synthetic SPECT images, preserving disease-specific classification information. This can improve reproducibility of quantitative measures and AI classification accuracy, aiding in the diagnosis of PD and APS.

Field

Software and quantification

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