A NOVEL APPROACH TO PET/CT IMAGE FUSION FOR QUANTITATIVE BRAIN IMAGING

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Background

Image registration is an important procedure in nuclear medicine particularly for hybrid systems such as PET/CT, which generate anatomic (CT) and functional (PET) images that are often displayed as an overlay for qualitative and quantitative evaluation. In the overlay, the CT is used in grayscale and the PET in pseudo colors. The fused display is available in 2D and 3D mode while color intensity and transparency are adjustable. In this work, a fusion approach is proposed where each pixel of the fused image is colored according to specific CT and PET properties.

Materials & Methods

The proposed registration method was based on the encoding of HU and SUV information on separate transformed .png files as reversible color information in combination with .png basic information metadatas based on DICOM attributes. Linux Ubuntu using Python was used for the implementation and pilot testing of the proposed methodology on brain ^{18}F-FDG PET/CT scans acquired with different PET/CT systems. The range of HU and SUV values was mapped using a novel *weighted color distribution function* that allows a balanced representation of the data and an improved visualization of anatomic and metabolic differences.

Results

The figures on the right present representative results of the standard and the new registration method in 2D. There is improved visualization of the various brain regions as shown in Fig. 2 that could facilitate qualitative and quantitative evaluation and analysis. The resulted .png files contain all the raw values and may be used as input to image segmentation and classification algorithms possibly yielding improved results.

Conclusion

The enhancement of presentation data with color contrast that keeps the root pixel values of PET and CT imaging modalities may lead to improved visualization of the metabolism of specific brain regions of interest that present significant challenges in automated detection and classification due to poor signal and contrast with current registration techniques.
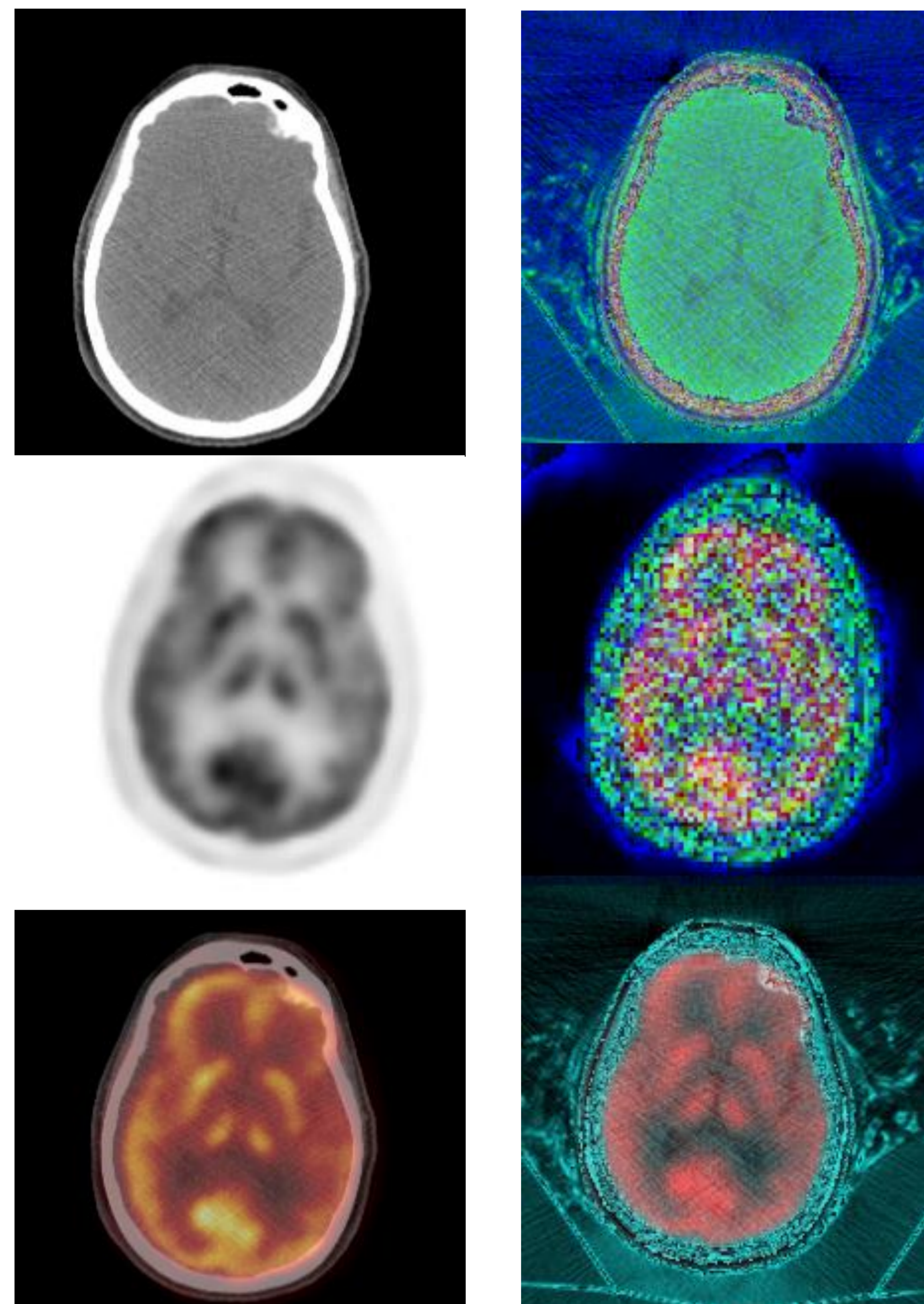

Fig. 1. (Top to bottom) Standard classical CT, PET, and fused PET/CT representation.

Fig. 2. (Top to bottom) CT, PET, and fused PET/CT images using the proposed new pixel mapping and enhancement technique.