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PATCH-BASED SUPER-RESOLUTION FOR ARTERIAL SPIN LABELING MRI

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CONTEXT

In clinical conditions, ASL images are often acquired at low resolutions (LR). This implies partial volume effects (PVE), limiting the validity of cerebral blood flow (CBF) quantifications.

PROPOSITION

We propose an adaptation of a super-resolution algorithm1, taking advantage of a high resolution (HR) structural image to reconstruct CBF maps at a higher resolution, without increasing the acquisition time.

PROTOCOL

- **Scanner:** 3T Siemens Verio (VB17)
- **HR pCASL:** 1.75x1.75x3mm³, 100 control-label pairs, FOV=224x224mm²
- **M0 image** acquired at the same resolution than the pCASL series
- **Structural image:** MPRAGE 3DT1 1x1x1mm³, FOV=156x200mm²

PREPROCESSING

The images were processed using an inhouse processing pipeline based on Nipype2, SPM8 and Python functions. The ASL series were realigned on the first volume. The M0 and structural images were registered on the perfusion maps. The CBF maps were estimated using the general kinetic model3,4.

CONCLUSION

The proposed algorithm enables the generation of HR CBF images, without increasing the actual acquisition time. It provides more reliable CBF values than traditional interpolation methods, especially in gray matter, which is of particular interest in clinical practice.

REFERENCES


RESULTS

The following images present the CBF maps obtained with the different methods:

From left to right: HR CBF image, nearest neighbor, trilinear, 3rd order spline and super-resolution reconstructions

The original HR CBF map being considered as the reference image, the quality of the reconstructions was evaluated by calculating the PSNR between this reference and the generated images.

PSNR between the reference HR CBF map and the maps reconstructed using nearest neighbor, trilinear, 3rd order spline and the proposed super-resolution algorithm.

PARTNERS