

# **Highly constrained backPRojection (HYPR) in contrast enhanced MR angiography**

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In recent years, various fast magnetic resonance imaging techniques have been proposed for spatial, temporal, and spatio-temporal undersampling to improve the otherwise limited achievable resolution in one or both domains. In this thesis, a Highly constrained backPRojection (HYPR) technique that makes use of spatial information embedded in the time series has been implemented and evaluated.

The HYPR reconstruction method has been applied to interleaved undersampled projection sets. In the initial study of HYPR TRICKS, high acceleration factors were achieved, permitting a high frame update rate, while maintaining high SNR and negligible artifacts. In a subsequent investigation of HYPR stack-of-stars, a high temporal resolution was obtained with validated temporal fidelity. In other studies, the temporal resolution was maintained while the spatial resolution was increased. With HYPR VIPR, similar successes were accomplished, benefiting from the true 3D acquisition. All these 3D PR acquisitions were modified to meet the needs of HYPR processing.

The classic HYPR technique has been successfully applied in contrast-enhanced MRA of the lower extremities and for the cerebral vessels, potentially providing clinical benefits for future diagnosis. A comparison also was conducted to evaluate alternative HYPR algorithms that aim to improve the accuracy of HYPR images when the spatio-temporal correlation is low.