# MAGNETIC RESONANCE FINGERPRINTING RECONSTRUCTION VIA A SPATIOTEMPORAL NEURAL NETWORK

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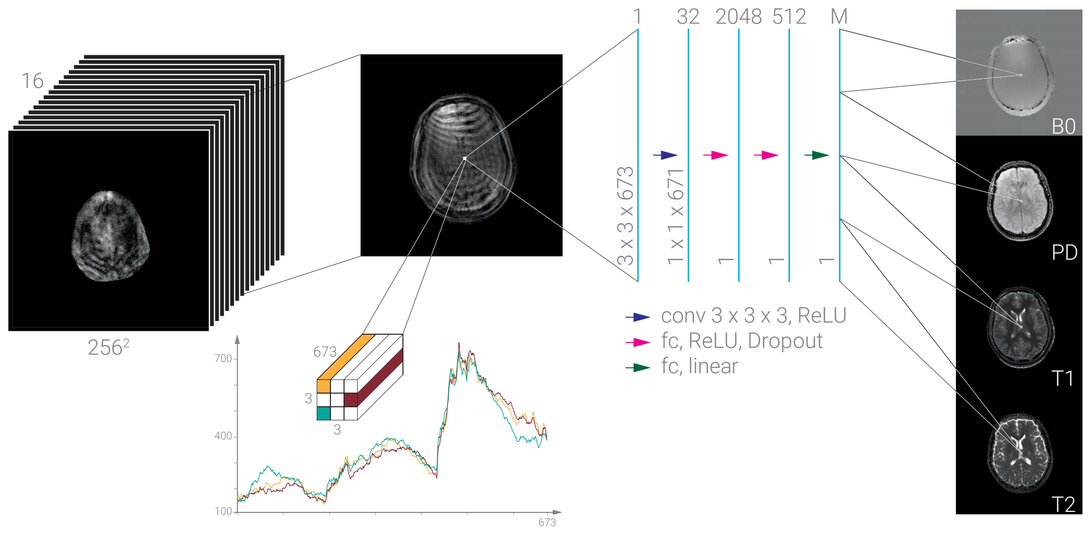
## Introduction

Magnetic resonance fingerprinting (MRF)[1)] quantifies multiple nuclear magnetic resonance parameters in one fast and motion robust acquisition. Standard MRF reconstructs the parametric tissue maps by matching the fingerprints of each voxel to a dictionary of pre-computed signals. This dictionary matching lacks scalability due to computational efficiency and introduces artefacts due to the under-sampled k-space during the acquisition. We propose a dictionary-free, spatiotemporal deep learning-based MRF reconstruction, motivated by the issues associated with dictionary-based reconstruction.

## Materials & Methods

We use a convolutional neural network (CNN) that exploits the spatiotemporal relationship between neighbouring MRF signal evolutions. The CNN consists of one three-dimensional convolutional layer and three fully-connected layers. We acquired four brain scans of healthy volunteers with four parametric maps: static magnetic field inhomogeneity (B0), proton density (PD), T1 relaxation time (T1), and T2 relaxation time (T2). We evaluate our approach using a leave-one-out cross-validation and compare to a dictionary-based[2)] and a dictionary-free[3)] reconstruction approach, which represent the state-of-the-art reconstruction approaches.



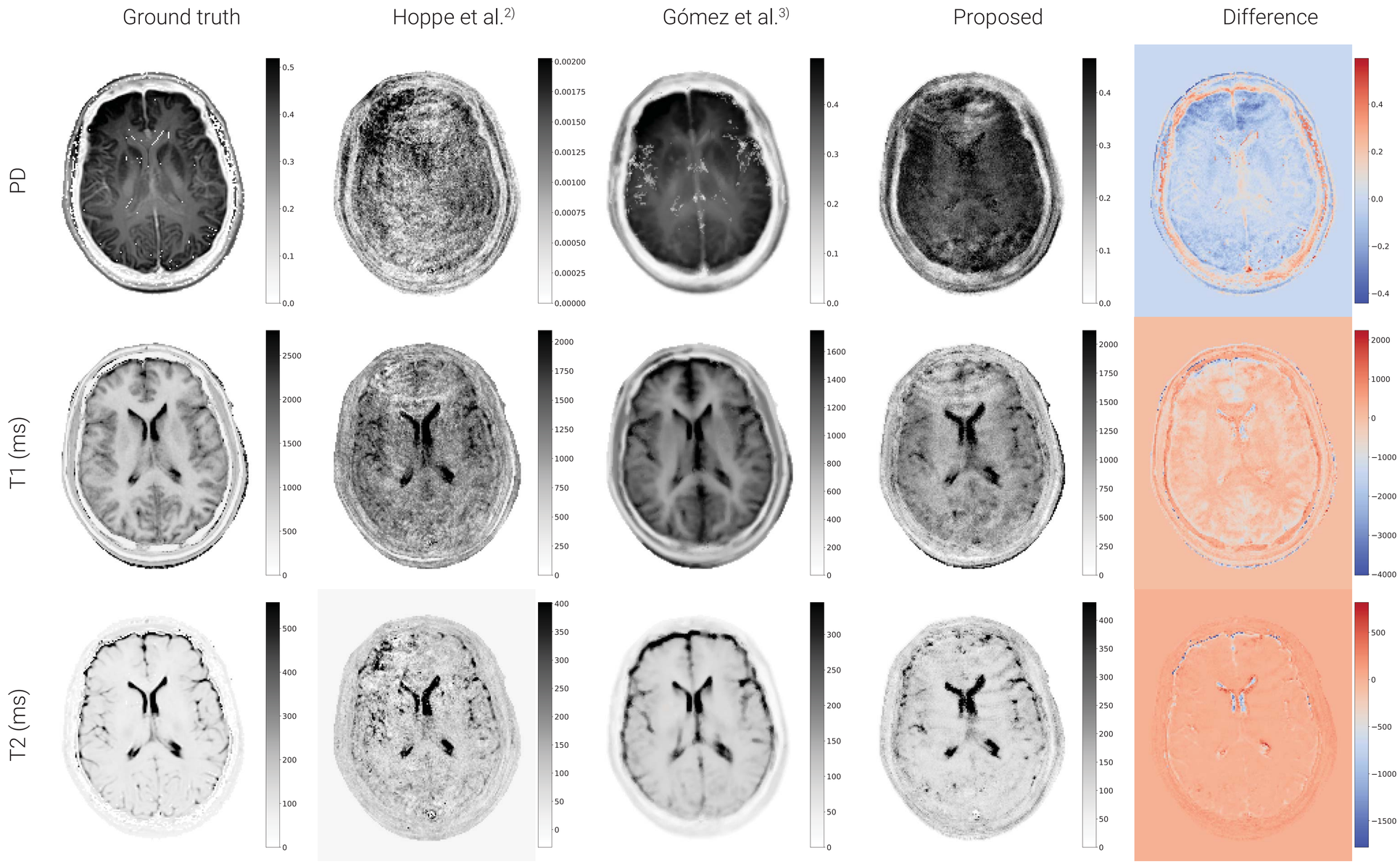

## Results

We achieve state-of-the-art reconstruction accuracy and robustness compared to the dictionary-free approach while the dictionary-based approach remains challenging to compete. The root mean square errors for B0, PD, T1, and T2 reconstruction are 233.9 Hz, 0.058, 593.4 ms, and 144.8 ms. Compared to 79.2 Hz, 0.052, 485.0 ms, and 128.5 ms for the dictionary-based method.

The reconstruction of the four parametric maps requires several seconds with our method while the dictionary-based method requires several minutes.

## Discussion & Conclusion

We developed a dictionary-free and deep learning-based approach to reconstruct parametric maps form MRF. We exploit the spatiotemporal relationship between neighbouring fingerprints, which yields a more accurate and robust reconstruction compared to other dictionary-free reconstructions. Our approach reconstructs the parametric maps in significantly reduced time compared to the dictionary-based approach. These preliminary results suggest that dictionary-free MRF reconstruction is possible and might be a solution to a clinical application of MRF.




## References

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2) Hoppe E. et al. Deep Learning for Magnetic Resonance Fingerprinting: A New Approach for Predicting Quantitative Parameter Values from Time Series. 2017.

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