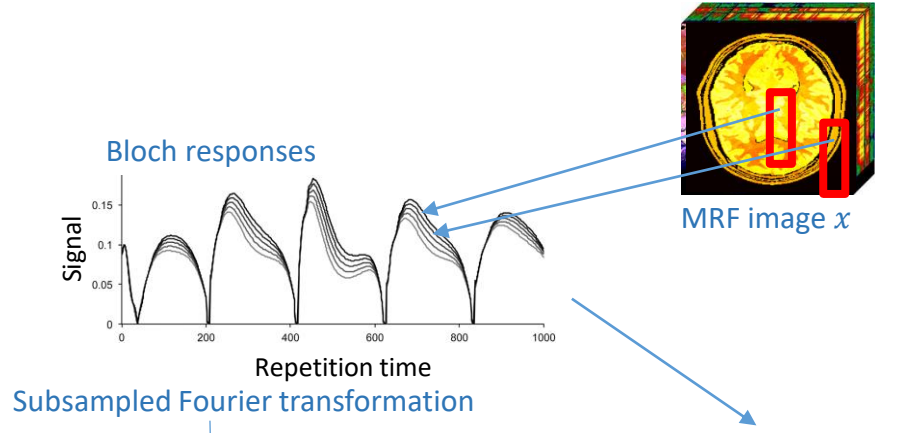


Compressive MR Fingerprinting Reconstruction with Neural Proximal Gradient Iterations (*accepted to MICCAI'20*)

Dongdong Chen¹ (d.chen@ed.ac.uk), Mike E. Davies¹, Mohammad Golbabaee²

¹ School of Engineering, the University of Edinburgh, ² Department of Computer Science, University of Bath



$$y = H(x) + \xi \quad \text{where, for each voxel } x_v \approx \rho_v \mathcal{B}(T1_v, T2_v) \quad m$$

$$\arg \min_{x, m} \|y - Hx\|_2^2 + \phi(x, m)$$

$$\text{PGD} : \begin{cases} g^{(t+1)} = x^{(t)} + \alpha^{(t)} H^H (y - Hx^{(t)}) \rightarrow \text{Gradient with step size } \alpha \\ \{x^{(t+1)}, m^{(t+1)}\} = \text{Prox}_\phi(g^{(t+1)}) \rightarrow \text{Proximal update} \end{cases}$$

$$\text{Prox} := \text{BLOCH} \circ \mathcal{G} \quad \text{Deep Neural Network}$$

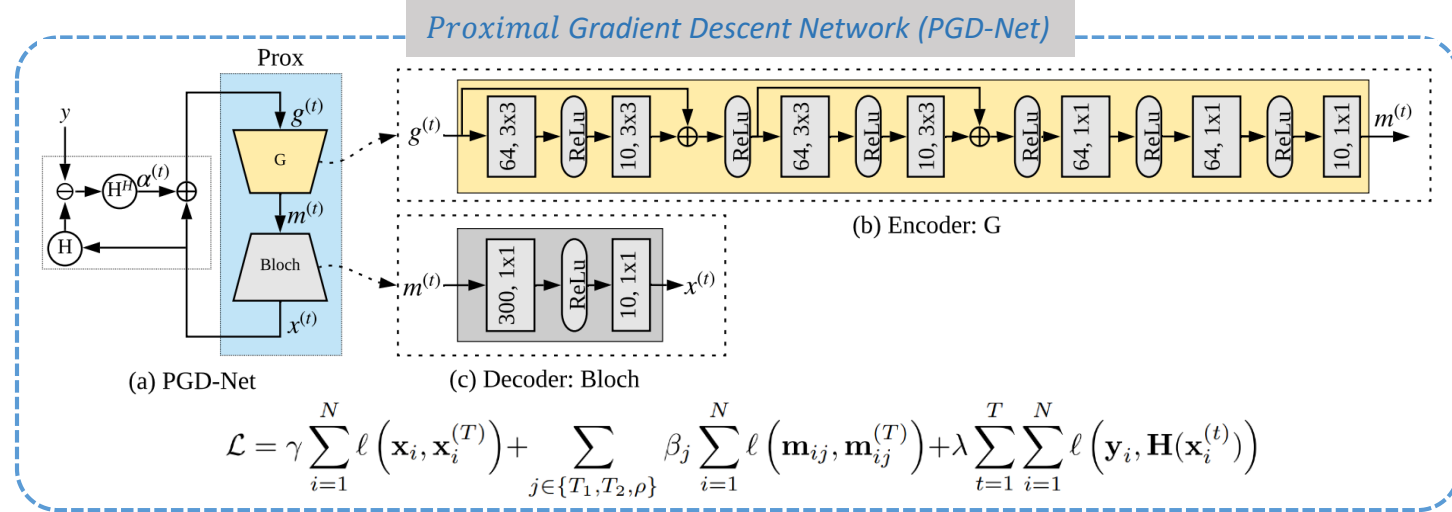


Table 1: Average errors (NRMSE, SSIM, MAE), memory (for storing a dictionary or a network) and runtimes (per image slice) required for computing T1, T2 and PD maps using the MRF baselines and our PGD-NET algorithm.

	NRMSE			SSIM			MAE (msec)		time (sec)	memory (MB)
	T1	T2	PD	T1	T2	PD	T1	T2		
FGM	0.475	0.354	1.12	0.614	0.652	0.687	350.0	14.6	1.29	8.81
BLIP+FGM	0.230	0.545	0.073	0.886	0.880	0.984	91.7	8.0	79.28	8.81
MRFCNN	0.155	0.158	0.063	0.943	0.972	0.987	80.3	5.4	0.083	4.72
SCQ	0.172	0.177	0.064	0.929	0.967	0.984	91.7	6.1	0.132	464.51
\mathcal{G} (encoder alone)	0.142	0.155	0.065	0.948	0.973	0.987	77.1	5.6	0.067	0.55
PGD-NET ($T = 2$)	0.104	0.138	0.050	0.973	0.979	0.991	59.9	5.0	0.078	0.57
PGD-NET ($T = 5$)	0.100	0.132	0.045	0.975	0.981	0.992	50.8	4.6	0.103	0.57

The proposed PGD-Net:

- ❑ State-of-the-art MRF reconstruction
- ❑ interpretable and Physics-engaged
- ❑ Cheaper computation
- ❑ Cheaper memory

