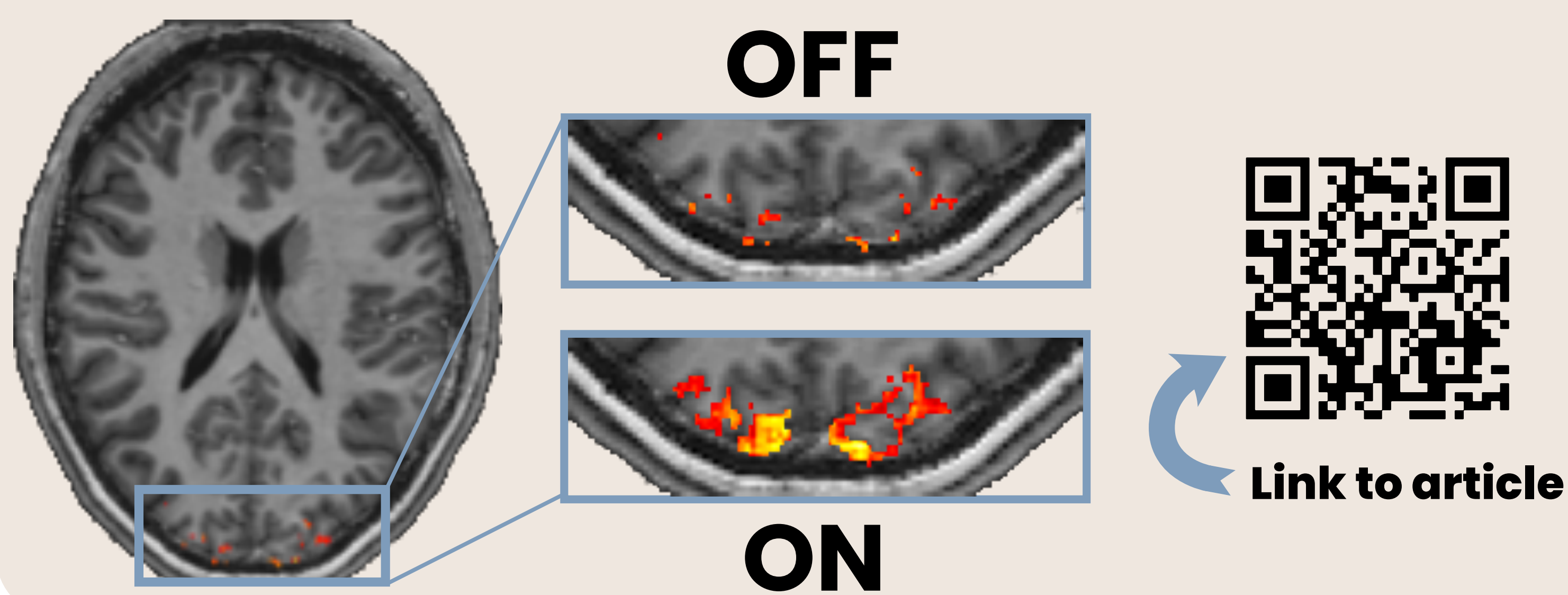


In fMRI **local low rank denoising** gives access to **x8 more activations** and also works for **magnitude only images**



```
pip install patch-denoise
patch-denoise input.nii output.nii
```

1. CONTEXT

High Resolution fMRI

Signal of interest

Neurovascular coupling gives proxy access to neuronal activity as a *change of T_2^* contrast (BOLD)* between activity and baseline.

Statistical Analysis

Statistical Power limited by *complex Gaussian thermal noise* at Ultra High Field (7 Tesla). *Rician Noise* for magnitude images.

Local Low Rank (LLR) Denoising Methods

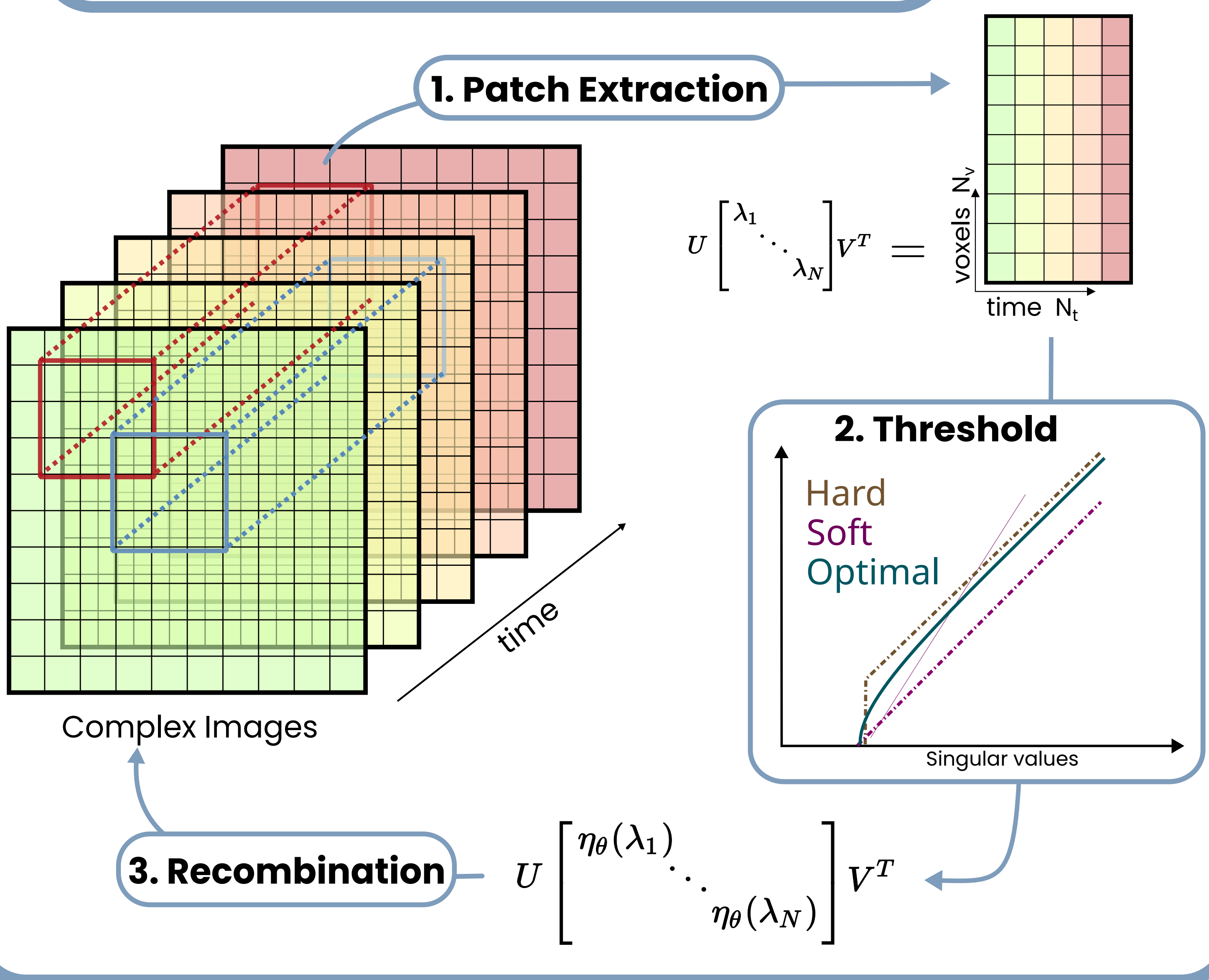
Low Rank Hypothesis

Solution provided by *Singular Value Thresholding*

Local Formalism

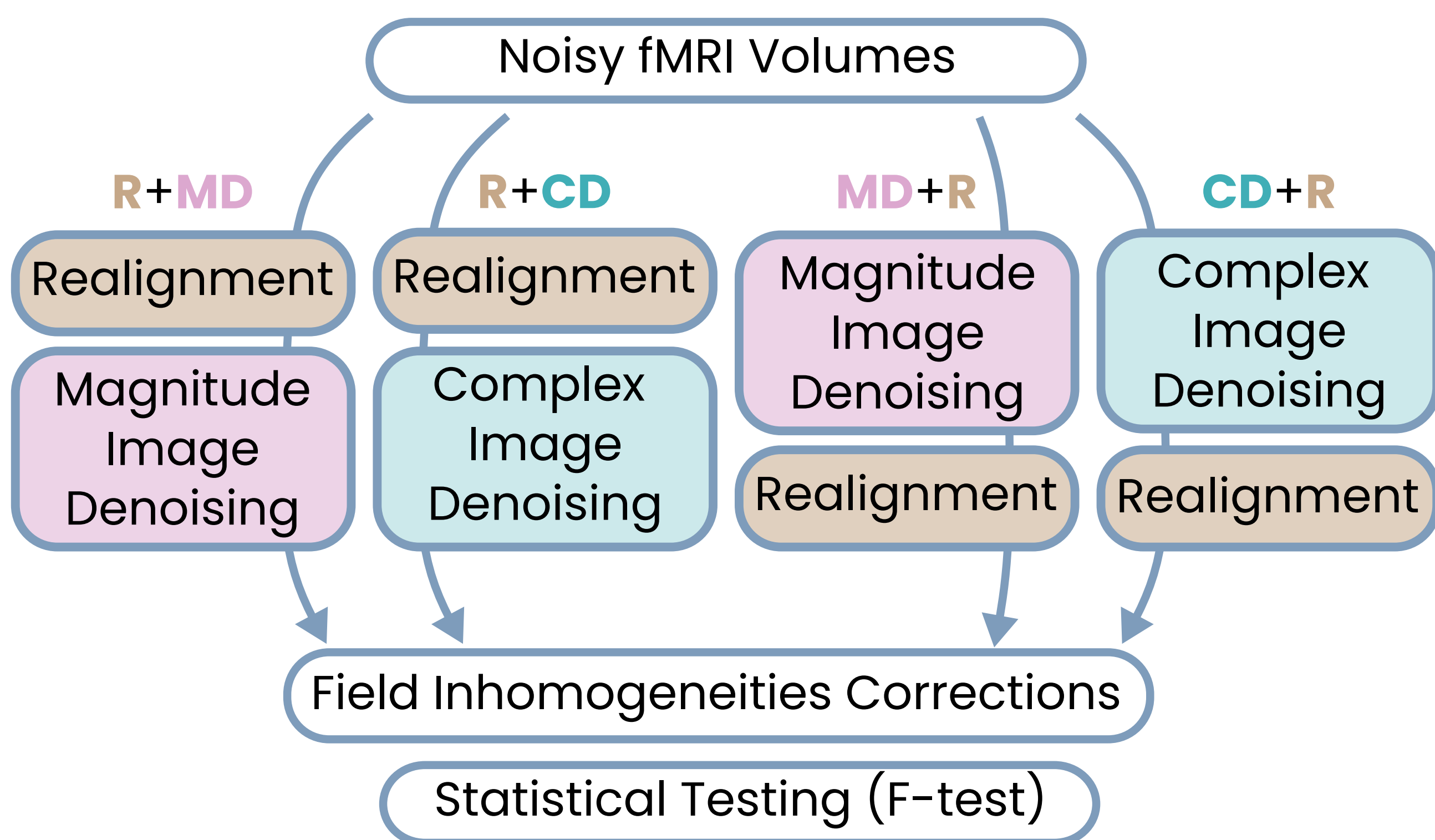
Accomodate the *spatially varying noise* structure using a patch-based processing.

2. LLR GENERAL PROCESSING



3. MATERIALS & METHODS

4 Scenarios



Benchmark on 5 methods

Name	Threshold Function	Reference
NORDIC	$\max(0, \lambda - \theta_{global})$	[Vizioli et al. 2021]
MP-PCA	$\max(0, \lambda - \theta_{[u]})$	[Veraart et al. 2016]
HYBRID-PCA	$\max(0, \lambda - \theta_{[u]})$	[Henriques et al. 2022]
OPTIMAL THRESH	$\frac{N_t \sigma^2}{\lambda} \sqrt{\left(\frac{\lambda^2}{N_t \sigma^2} - \beta - 1\right)^2 - 4\beta} \mathbf{1}_{\frac{\lambda}{\sqrt{N_t} \sigma} \geq 1 + \sqrt{\beta}}$	[Gavish et al. 2017]
HYBRID-OT	$\beta = \frac{N_v}{N_t}$	

6 Healthy Volunteers

- 1mm³ and TR=2.4 s (7 Tesla, EPI3D, full brain FOV)
- Retinotopic mapping paradigm (2 runs of 5 min each)

