Abstract Num: 2605

Spherical-CNN based diffusion MRI parameter estimation is robust to gradient schemes and equivariant to rotation

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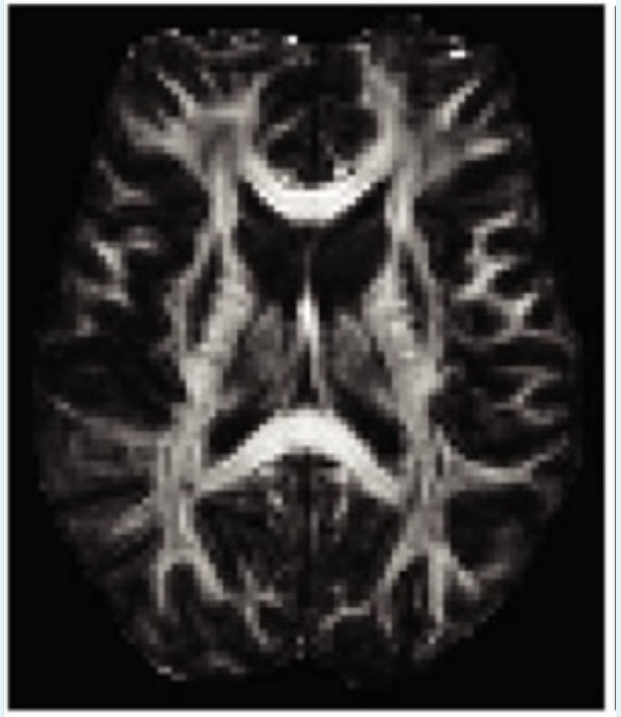
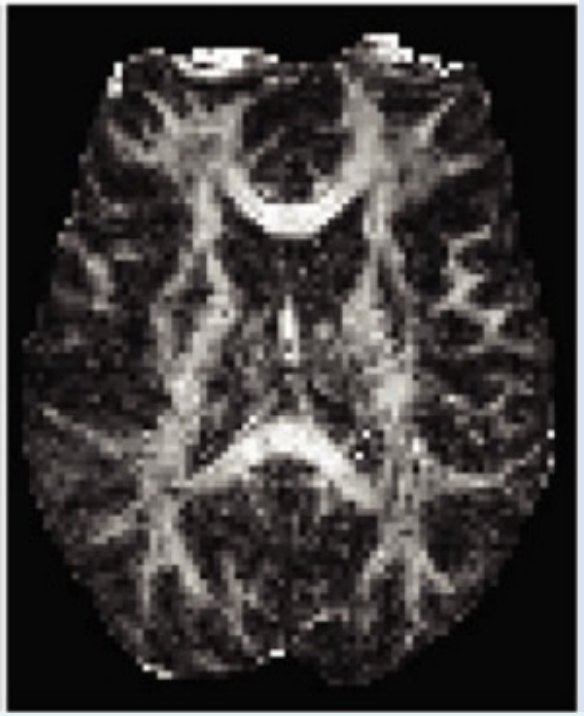
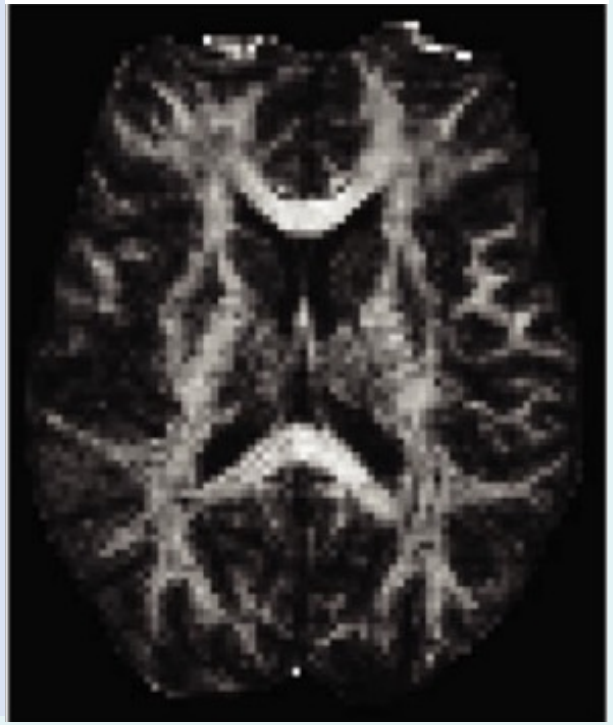
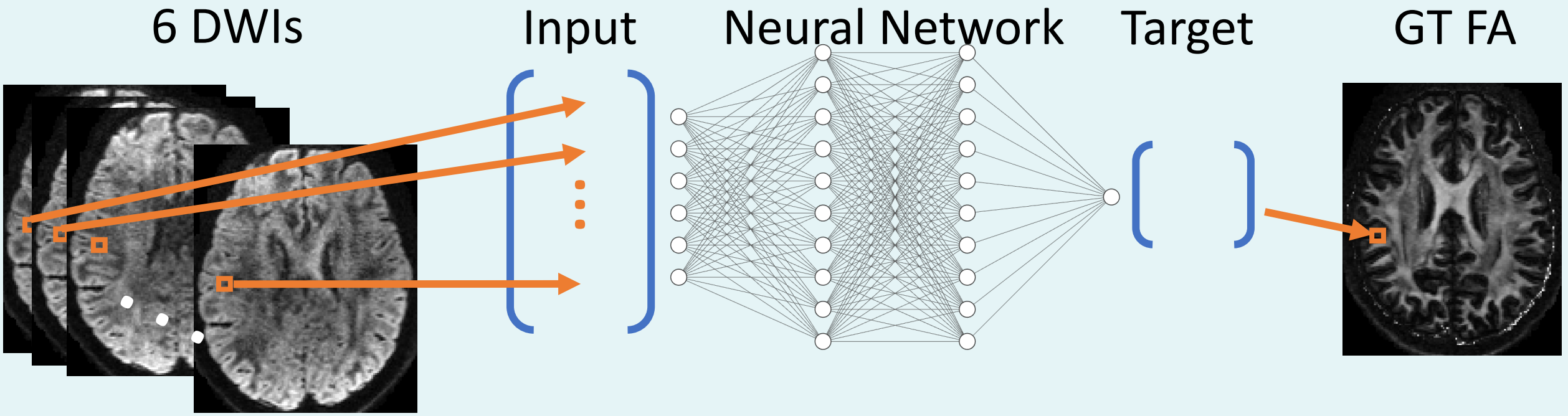
Machine learning has improved over model fitting

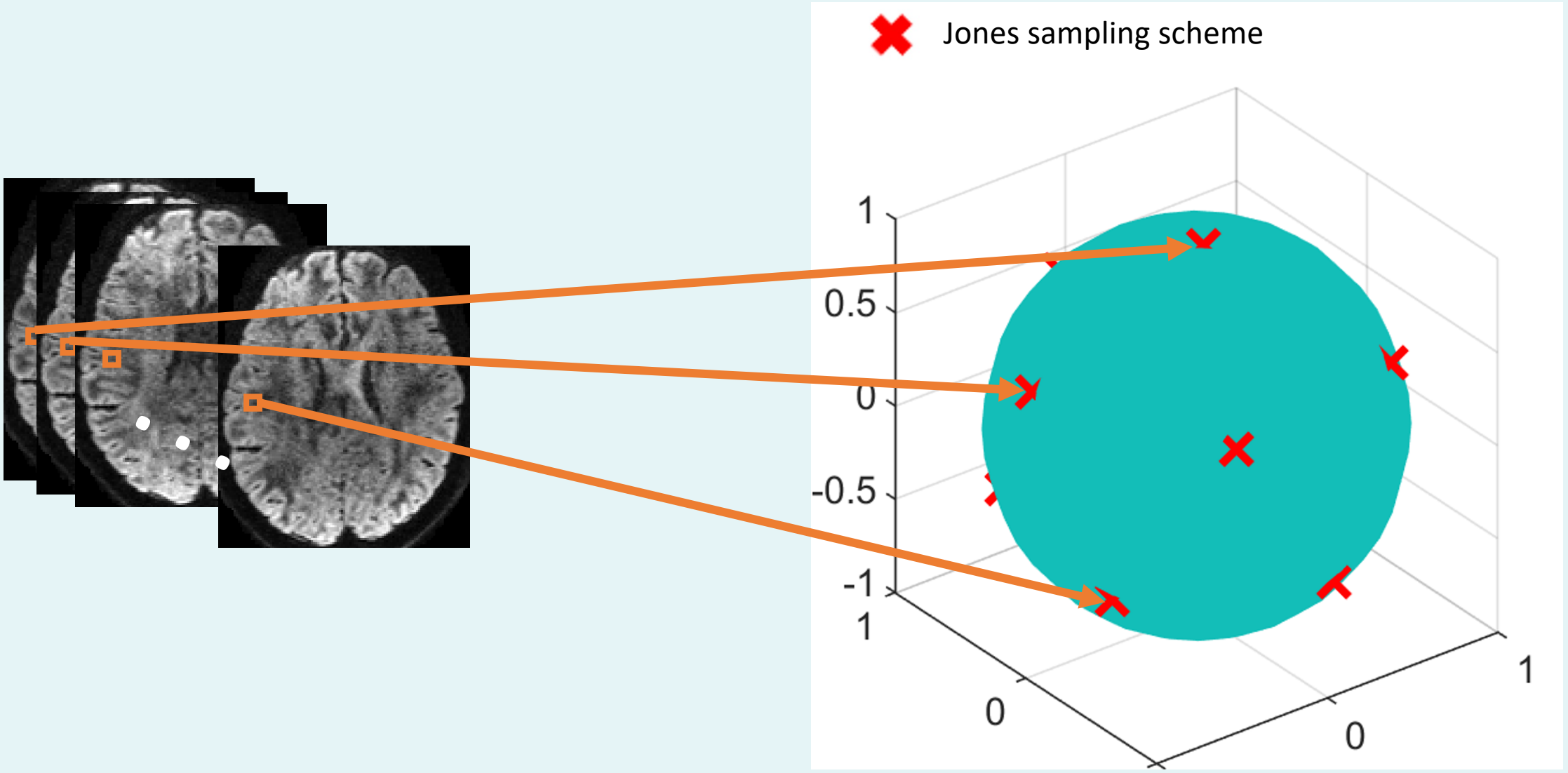
90 DWI	6 DWI	
Ground Truth	LLS	DiffNet
		

Aliotta, Medical Physics, 2019

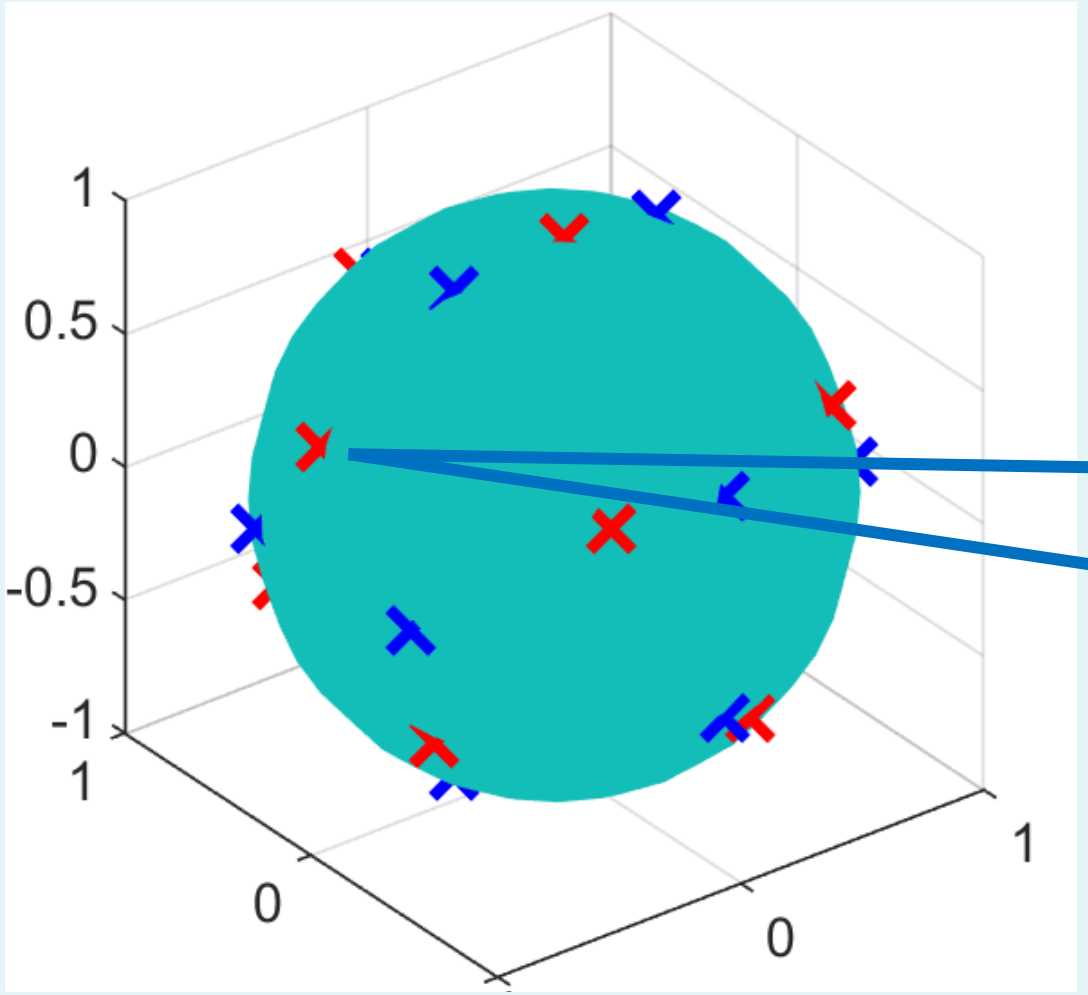
An example of current ML



The spherical geometry of diffusion weighted measures



Issue 1: Not flexible to new sampling schemes



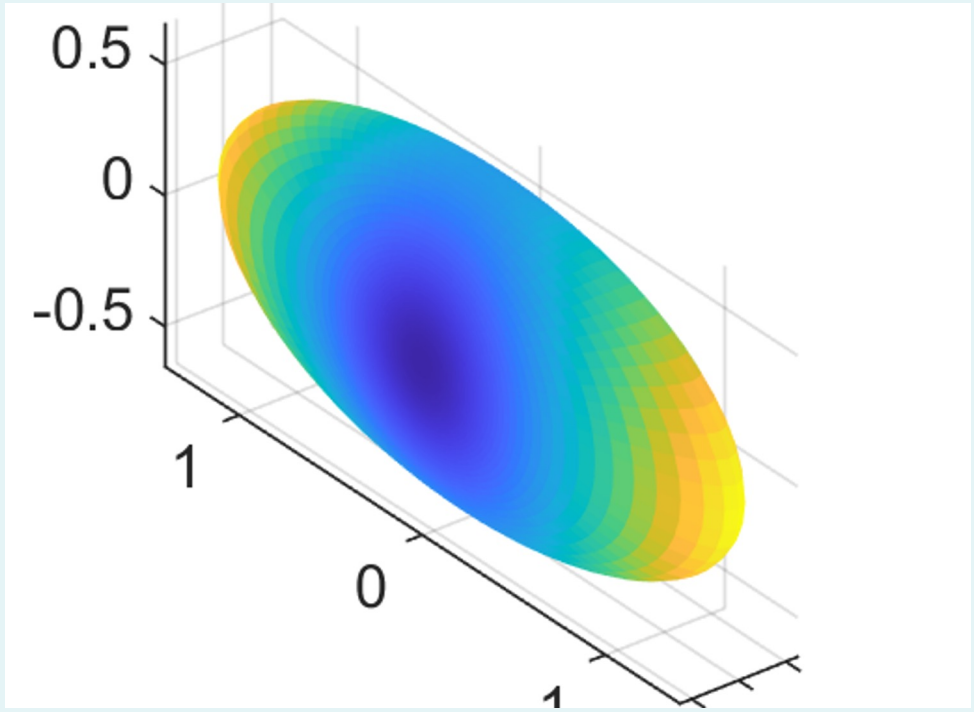
Jones sampling scheme

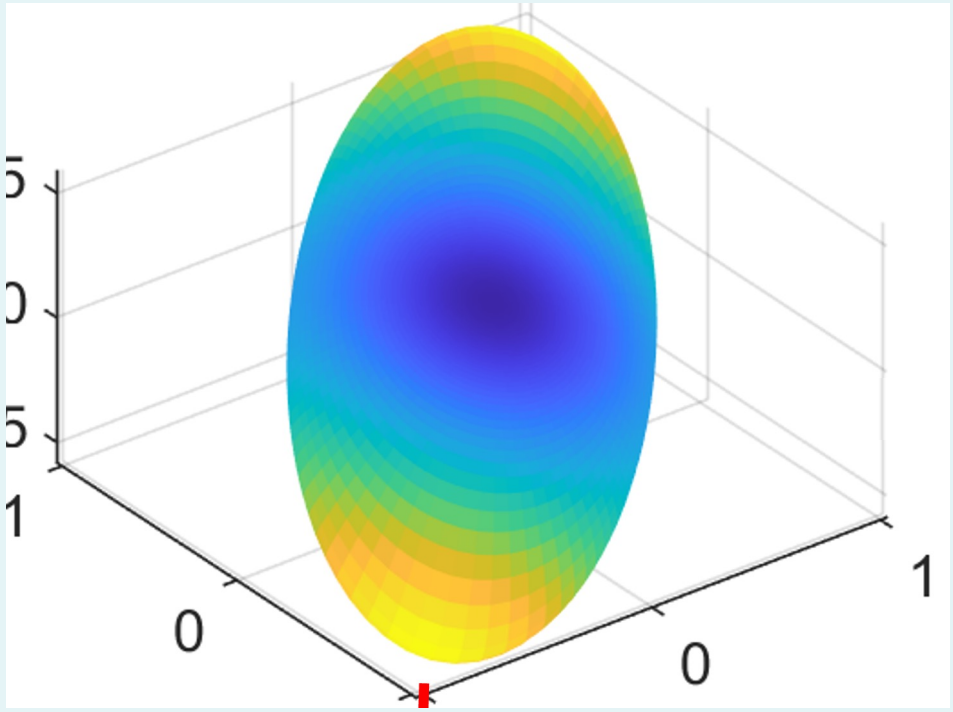
Skare sampling scheme

?

?

Issue 2: Cannot generalise from limited fibre orientations





Spherical CNNs are a possible solution

- Spherical CNNs still only see one voxel at a time[1]

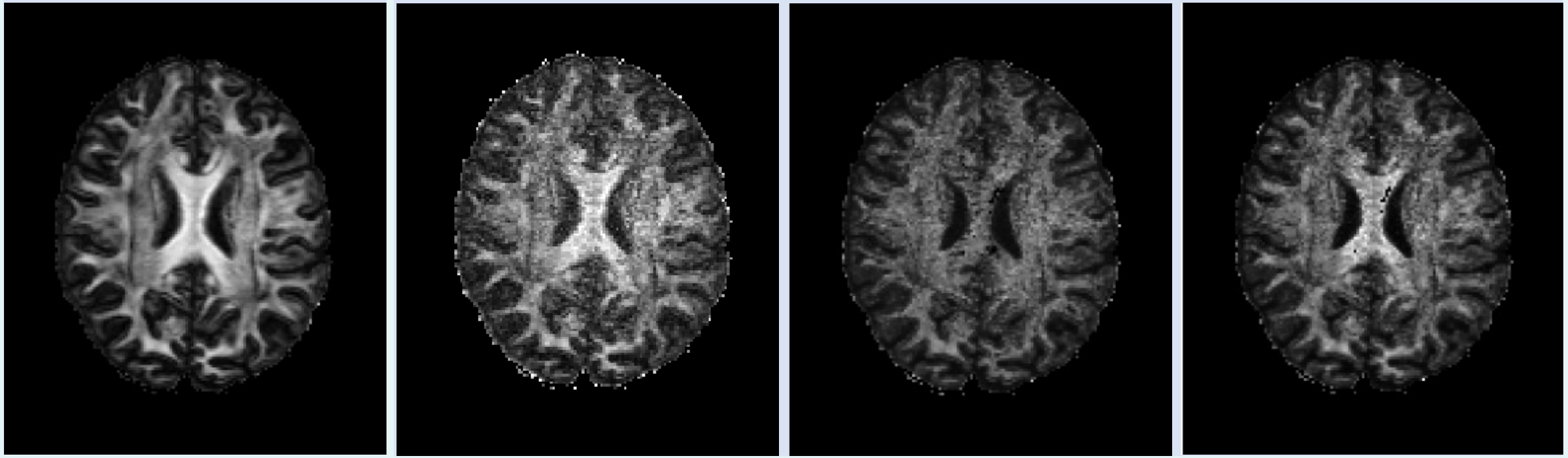
- Spherical geometry of the input is inbuilt
- Can theoretically generalise to unseen fibre orientations due to rotational equivariance[2]

[1] Chen, 2020, MICCAI
[2] Cobb, 2021, ICLR

We show S-CNN robust to new sampling schemes

Train and test on a different sampling scheme

90 DWI	**6 DWI**		
Ground Truth	Model Fit	FCN	Spherical CNN

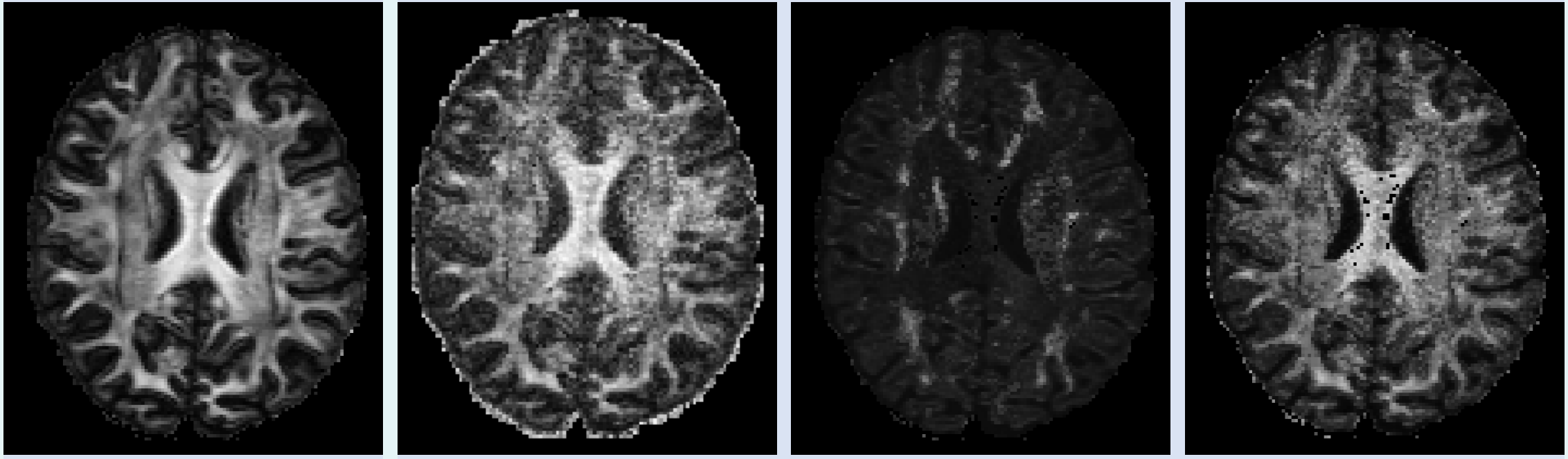


We show spherical CNN robust to new orientations

UCL

Fibre orientation limited to AP direction in training dataset

90 DWI	**6 DWI**		
Ground Truth	Model Fit	FCN	Spherical CNN



Conclusions

Standard ML shown to lack beneficial properties that Spherical CNNs have:

a) Robust to sampling scheme

b) Robust to training set distribution of primary fibre orientation

Come find me!!

Abstract Num	2605
Session	Quantitative Imaging II
Category	Acquisition & Analysis
Module	5: Machine Learning/Artificial Intelligence
Room	Exhibition Hall:S8 & S9
Computer	46
Day	Thursday
Time	10:15 AM - 11:15 AM

UKRI Engineering and Physical Sciences Research Council

i4health intelligent integrated imaging

cmic Centre for Medical Image Computing

CIG