

Rapid retinotopy mapping using functional ultrasound imaging of deep visual cortex in cats

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Functional ultrasound imaging (fUSI) has recently emerged as a new way to access brain activity. In contrast to optical imaging methods, fUSI can report changes in neuronal activity in deep layers of the cortex and beyond without the need for invasive elements like GRIN lenses. To demonstrate the unique value of fUSI in animal models with large brains, we have reconstructed retinotopy maps in Brodmann areas 17 and 18 in anaesthetised, head-fixed cats. We could achieve a high-enough signal-to-noise ratio to reliably detect single-trial responses. Utilising our novel motorised imaging chamber design, we can record functional maps across large distances and reconstruct a large volume 3D functional map. We implemented a short acquisition protocol and on-line data analysis that offers significant experimental advantage by offering rapid feedback to the experimenter. Our rapid, large field-of-view functional mapping pipeline may become an indispensable method for understanding brain function in large-animal models.

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