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Gridless curve reconstruction: divergence regularisation and untangling by (sub)Riemannian metric

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Recent years have seen the development of super-resolution variational optimisation in measure spaces. These so-called off-the-grid approaches offer both theoretical and numerical results, with very convincing results in biomedical imaging. However, the gridless variational optimisation is genereally formulated for reconstruction of point sources, which is not always suitable for biomedical imaging applications: more realistic biological structures such as curves should also be reconstructed. In the first part of this talk, we propose a new strategy for the reconstruction of curves in an image through an off-the-grid variational framework, thanks to the sharp characterisation of the extreme points of the unit ball of a new regulariser thus enabling new theoretical and numerical results for optical imaging. In a second part of the talk, we investigate a new strategy for off-the-grid curve untangling. Indeed, some latest developements in the gridless community enabled the reconstruction of moving Dirac, understood as point sources following some paths along the time. It was nevertheless by design difficult to recover crossing curves, a situation yet arising quite often in practical biomedical problem. We then present a new strategy, using a lift on the roto-translational space and a sub-Riemannian metric regularisation to untangle this crossing paths, with some practical results for Localisation Microscopy.

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