Fractional Laplacian and ADMM for glyph extraction

Tuesday, 21 January 2025 15:20 (20 minutes)

In archaeology it is a common task to extract incisions or glyphs from a surface. This procedure is usually done manually and, therefore, it is prone to errors and it can be extremely time consuming. In this talk we present a variational model to automatically extract these incisions from a smooth surface.

We model this problem in the following way. Let $\mathbf{x} \in \mathbb{R}^n$ be a vector containing a sampling of the archaeological surface, we wish to find two vectors $\mathbf{x}_s^*$ and $\mathbf{x}_g^*$ such that $\mathbf{x} = \mathbf{x}_s^* + \mathbf{x}_g^*$, where $\mathbf{x}_s^*$ is smooth and contains the background and $\mathbf{x}_g^*$ is sparse and contains the glyph. To this aim we consider the model
where $\mu > 0$, $\alpha \in [1,2]$, $\|\mathbf{x}\|_p^p = \sum_{i=1}^n |\mathbf{x}_i|^p$, and $L \in \mathbb{R}^{n \times n}$ denotes the Laplacian operator. To perform the minimization,
we employ the Alternating Direction Multiplier Method (ADMM). We provide a procedure to generate realistic synthetic data and we show the performances of the proposed method on this kind of data.

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2. E. Di Nezza, G. Palatucci, E. Valdinoci, Hitchhiker's guide to the fractional Sobolev spaces, Bulletin des sciences mathématiques 136 (2012) 521–573.

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