A VARIATIONAL MODEL FOR INCISIONS AND GLYPHS EXTRACTION

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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

$$\left(\mathbf{x}_s^*, \mathbf{x}_g^*\right) = \arg \min_{\mathbf{x}_s, \mathbf{x}_g \in \mathbb{R}^{n\times n}} \frac{1}{2} \left\| L^\alpha \mathbf{x}_s \right\|_2^2 + \mu \left\| \mathbf{x}_g \right\|_1,$$
$$\text{s.t. } \mathbf{x}_s + \mathbf{x}_g = \mathbf{x},$$

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 ADMM algorithm and we show the performances of the proposed method on synthetic data.