Source localization in electromyography using the inverse potential problem

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We describe an efficient method for reconstructing the activity in human muscles from an array of voltage sensors on the skin surface. MRI is used to obtain morphometric data which is segmented into muscle tissue, fat, bone and skin, from which a finite element model for volume conduction is constructed. The inverse problem of finding the current sources in the muscles is solved using a careful regularization technique which adds a priori information, yielding physically reasonable solutions from among those that satisfy the basic potential problem. Several regularization functionals are considered and numerical experiments on a 2D test model are performed to determine which performs best. The resulting scheme leads to numerical difficulties when applied to large scale 3D problems. We clarify the nature of these difficulties and provide a method to overcome them, which is shown to perform well in the large scale problem setting.

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