

COMPACT MANIFOLD REGRESSION WITH SOBOLEV REGULARIZATION

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Manifold regression generalizes the ideas of linear regression to include non-linear structures. Given n observations (points) in R^m , the goal is to construct a parameterized manifold embedded in R^m that “fits the data,” in some sense. Here we consider problems in which the topology of the manifold is known, and corresponds to some low dimensional compact manifold, like a closed loop, a torus, or a sphere. Sobolev regularization is used to control the overall curvature of the fitted manifold. We discuss some of the difficulties that arise, and some strategies to overcome them. For the simplest case, in which the manifold is a closed curve, we describe applications in single cell genomics and classification.