Higher-order Sobolev embeddings and isoperimetric inequalities

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ABSTRACT:

We present a recent result, obtained jointly with Andrea Cianchi and Luboš Pick, showing that optimal higher-order Sobolev type embeddings follow from isoperimetric inequalities. This establishes a higher-order analogue of a well-known link between first-order Sobolev embeddings and isoperimetric inequalities. We reduce Sobolev type embeddings of any order, involving arbitrary rearrangement-invariant norms, on open sets in $\mathbb{R}^n$, possibly endowed with a measure density, to much simpler one-dimensional inequalities for suitable integral operators depending on the isoperimetric function of the relevant sets. We also discuss the related question of compactness of these embeddings. Our results can be applied, in particular, to any-order Sobolev embeddings in regular (John) domains of the Euclidean space, in Maz'ya classes of (possibly irregular) Euclidean domains described in terms of their isoperimetric function, and in families of product probability spaces, of which the Gauss space is a classical instance.

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