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Towards a unified theory of Sobolev inequalities

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ABSTRACT: I will discuss a new approach to Sobolev inequalities, developed jointly with Joaquim Martín (UAB). Working in the context of metric spaces, we obtain new rearrangement inequalities that involve the associated isoperimetric profile. This leads to a reformulation, as well as an extension, of the classical equivalence between the Gagliardo-Nirenberg inequality and the isoperimetric inequality. In this fashion the isoperimetric profile associated with a given geometry determines the corresponding Sobolev inequalities. For example, in the Euclidean case we recover the usual Sobolev inequalities while for Gaussian measure we obtain logarithmic Sobolev inequalities. Using suitable variants of Peetre's K-functional we also obtain new fractional Besov-Sobolev inequalities and formulate a generalized Morrey-Sobolev theorem.

Despite the considerable techno jargon of the previous discussion I will try to focus on the general ideas and make the talk understandable to non specialists.