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authors	• SavarÃ©, G.
title	Sobolev Spaces in Extended Metric-Measure Spaces
publication_date	2021-08-08 00:00:00
source	SupportedSources.CROSSREF
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volume	
doi	10.1007/978-3-030-84141-6_4
urls	• https://link.springer.com/content/pdf/10.1007/978-3-030-84141-6_4 • http://dx.doi.org/10.1007/978-3-030-84141-6_4
id	id-4922831965962503920
abstract	
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authors	• Giuseppe SavarÃ©
title	Sobolev spaces in extended metric-measure spaces
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id	id-999904594403901115
abstract	These lecture notes contain an extended version of the material presented in the C.I.M.E. summer course in 2017, aiming to give a detailed introduction to the metric Sobolev theory. The notes are divided in four main parts. The first one is devoted to a preliminary study of the underlying topological, metric, and measure-theoretic aspects of a general extended metric-topological measure space $\mathbb X=(X,\tau,\mathsf d,\mathfrak m)$. The second part is devoted to the construction of the Cheeger energy, initially defined on a distinguished unital algebra of Lipschitz functions. The third part deals with the basic tools needed for the dual characterization of the Sobolev spaces: the notion of p-Modulus of a collection of (nonparametric) rectifiable arcs and its duality with the class of nonparametric dynamic plans, i.e.~Radon measures on the space of rectifiable arcs with finite q-barycentric entropy with respect to $\mathfrak m$. The final part of the notes is devoted to the dual/weak formulation of the Sobolev spaces $W^{1,p}(\mathbb X)$ in terms of nonparametric dynamic plans and to their relations with the Newtonian spaces $N^{1,p}(\mathbb X)$ and with the spaces $H^{1,p}(\mathbb X)$ obtained by the Cheeger construction. In particular, when $(X,\mathsf d)$ is complete, a new proof of the equivalence between these approaches is given by a direct duality argument. A substantial part of these Lecture notes relies on well established theories. New contributions concern the extended metric setting, the role of general compatible algebras of Lipschitz functions and their density w.r.t.~the Sobolev energy, a compactification trick, the study of reflexivity and infinitesimal Hilbertianity inherited from the underlying space, and the use of nonparametric dynamic plans for the definition of weak upper gradients.
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