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Daniel Otero, Davide La Torre, Oleg Michailovich, Edward R. Vrscay



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On the theory of function-valued mappings and its application to the processing of hyperspectral images

Daniel Otero* Davide La Torre[†] Oleg Michailovich[‡]
Edward R. Vrscay*[§]

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Abstract

The concept of a mapping, which takes its values in an infinite-dimensional functional space, has been studied by the mathematical community since the third decade of the last century. This effort has produced a range of important contributions, many of which have already made their way to applied sciences, where they have been successfully used to facilitate numerous practical applications across various fields. Surprisingly enough, one particular field, which could have benefited from the above contributions to a much greater extent, still relies on finite-dimensional models and approximations, thus missing out on numerous advantages offered through adopting a more general framework. This field is image processing, which is in the focus of this study. In particular, in this paper, we introduce an alternative approach to the analysis of multidimensional imagery data based on the mathematical theory of function-valued mappings. In addition to extending various tools of standard functional calculus, we generalize the notions of Fourier and fractal transforms, followed by their application to processing of multispectral imaging data. Some applications and future extensions of this work are discussed as well.

*Department of Applied Mathematics, University of Waterloo, ON, Canada
dotero,ervrscay@uwaterloo.ca

[†]Department of Economics, Management, and Quantitative Methods, University of Milan, Milan, Italy davide.latorre@unimi.it and Department of Mathematics, Nazarbayev University, Astana, Kazakhstan davide.latorre@nu.edu.kz

[‡]Department of Electrical and Computer Engineering, University of Waterloo, ON, Canada olegm@uwaterloo.ca

[§]Corresponding author: ervrscay@uwaterloo.ca

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