

Accepted Manuscript

Convolution lattices

L. De Miguel, H. Bustince, B. De Baets

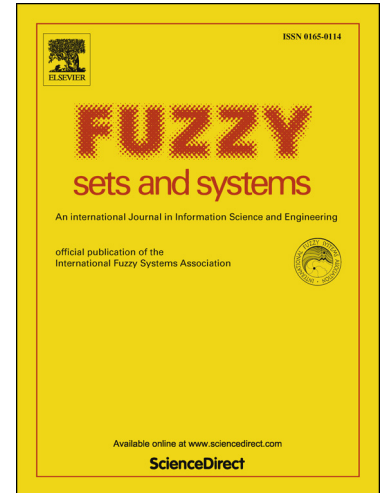
PII: S0165-0114(17)30183-5
DOI: <http://dx.doi.org/10.1016/j.fss.2017.04.017>
Reference: FSS 7215

To appear in: *Fuzzy Sets and Systems*

Received date: 24 November 2016
Revised date: 6 April 2017
Accepted date: 26 April 2017

Please cite this article in press as: L. De Miguel et al., Convolution lattices, *Fuzzy Sets Syst.* (2017), <http://dx.doi.org/10.1016/j.fss.2017.04.017>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Convolution lattices

L. De Miguel^{a,b,*}, H. Bustince^{a,b}, B. De Baets^c

^a*Departamento de Automatica y Computacion, Universidad Publica de Navarra, Campus Arrosadia s/n 31006 Pamplona, Spain*

^b*Institute of Smart Cities, Universidad Publica de Navarra, Campus Arrosadia s/n 31006 Pamplona, Spain*

^c*KERMIT, Department of Mathematical Modelling, Statistics and Bioinformatics, Coupure links 653, Ghent University, Ghent, Belgium*

Abstract

We propose two convolution operations on the set of functions between two bounded lattices and investigate the algebraic structure they constitute, in particular the lattice laws they satisfy. Each of these laws requires the restriction to a specific subset of functions, such as normal, idempotent or convex functions. Combining all individual results, we identify the maximal subsets of functions resulting in a bounded lattice, and show this result to be equivalent to the distributivity of the lattice acting as domain of the functions. Furthermore, these lattices turn out to be distributive as well. Additionally, we show that for the larger subset of idempotent functions, although not satisfying the absorption laws, the convolution operations satisfy the Birkhoff equation.

Keywords: Algebra, Convolution operations, Lattice

1. Introduction

The mathematical operation of convolution and related operations play a pivotal role in science, engineering and mathematics [1, 2]. In the standard setting, convolution takes two real functions as input and outputs a third real function that represents the integral of the pointwise multiplication of the two functions as a function of the amount that one of the original functions is translated. More formally, given two real functions f and g , their convolution is the function $f * g$ defined by

$$(f * g)(t) = \int f(\lambda)g(t - \lambda)d\lambda.$$

The convolution operation has applications in probability and statistics, differential equations, signal processing, natural language processing, image pro-

*L. De Miguel

Email addresses: laura.demiguel@unavarra.es (L. De Miguel), bustince@unavarra.es (H. Bustince), bernard.debaets@ugent.be (B. De Baets)

Download English Version:

<https://daneshyari.com/en/article/6855964>

Download Persian Version:

<https://daneshyari.com/article/6855964>

[Daneshyari.com](https://daneshyari.com)