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LNCS 4370

Pixelization Paradigm

First Visual Information Expert Workshop, VIEW 2006
Paris, France, April 2006
Revised Selected Papers

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Library of Congress Control Number: 2007920819

CR Subject Classification (1998): I.4, I.5, I.2.10, I.3, I.2.6, F.2.2, J.3

LNCS Sublibrary: SL 6 – Image Processing, Computer Vision, Pattern Recognition, and Graphics

ISSN 0302-9743
ISBN-10 3-540-71026-4 Springer Berlin Heidelberg New York
ISBN-13 978-3-540-71026-4 Springer Berlin Heidelberg New York

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 11945543 06/3142 5 4 3 2 1 0

Lecture Notes in Computer Science 4370

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

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Preface

The pixelization paradigm states as a postulate that pixelization methods are rich and are worth exploring as far as possible. In fact, we think that the strength of these methods lies in their simplicity, in their high-density way of information representation property and in their compatibility with neurocognitive processes.

- Simplicity, because pixelization belongs to two-dimensional information visualization methods and its main idea is identifying a "pixel" with an informational entity in order to translate a set of informational entities into an image.
- High-density way of information representation property, firstly because pixelization representation contains a third dimension—each pixel's color—and secondly because pixelization is a "compact" (two-dimensional) way of representing information compared with linear one-dimensional representations (Ganascia, p.255) .
- Compatibility with neurocognitive processes, firstly because we are three-dimensional beings and thus we are intrinsically better at grasping one- or two-dimensional data, and secondly because the cerebral cortex is typically a bi-dimensional structure where metaphorically the neurons can be assimilated to "pixels," whose activity plays the role of color (Lévy, p.3).

The pixelization paradigm may be studied along two related directions: *pixelization and its implementation* and *pixelization and cognition.*

The first direction—*pixelization and its implementation*—may be divided into two parts: *pixelization theory* and *pixelization application.*

Pixelization theory can itself be decomposed into three parts:

- Pixelization's mathematics (Lévy, p.3), which aims at formalizing and understanding the pixelization process. The potential fall-outs of this research axis are the creation of new automatic algorithms capable of building pregnant pixelized images and the application to neurocognitive processes understanding.
- Pixelization per se: this deals with the various methods, specific to pixelization, which improve its results. This concerns the grouping of data (Keim, p.12) or ordering of attributes (Abdullah, p.36), the reduction of large databases in order to pixelize and display them (Keim p.12, Poulet p.25), the association with statistical studies with spreadsheet software (Vidmar, p.50), the implementation in the context of an interactive temporal pixelized system (Gershkovich, p.57).
- Pixelization and multidimensional data: the relevance of this research direction lies in the high-density pixelization method property; and this is

clearly correlated with the problem of multidimensional data representation. The proposed approaches deal with the grouping of multidimensional data (Choong, p.65), the stacking of dimensions (Langton, p.79), the one-to-one mapping from a multidimensional space (Castro p.94) and the projection from this multidimensional space (Priam, p.108).

Pixelization applications can be decomposed into:

- Spatial pixelization where the support of the image has a spatial meaning. In the first paper the problem is to "build" the value of the pixel in a medical image fusion process (Montagner, p.121). The second paper proposes a pixel processing method to compare medical images (Ouchchane, p.136) and the third paper allows computing two-dimensional supports for shape matching of two molecules (Tripathi, p151).
- Temporal pixelization, where the support of the image has a temporal meaning. Various approaches are presented. The first paper proposes a "spiral" representation of time applied to course usage monitoring (Mazza, p.163), the second one proposes a linear representation of time applied to neural network activity displaying (Vibert, p.173) and the third one shows a bi-dimensional representation of time applied to the measurement of uterine electromyographic signal in sheep (Vidmar, p.183).
- Qualitative pixelization, where the support of the image has a purely qualitative meaning (i.e., neither temporal nor spatial). The first paper (Le Guillou, p.189) translates data and knowledge bases into pixelized images, the second paper (Jourdan, p.202) considers a two-dimensional scatter plot as an image and the last paper (Darago, p.217) proposes to identify medical information to a qualitative map.

The second direction corresponds to *neurocognitive processes*. The first paper uses pixelization as a tool to link high-level cognitive processes to low-level neurophysiological processes (Bernard p. 229, see also [1]). The second paper uses pixelization to visualize the activity of cortical layers (Abramov, p.242). The third paper (Ganascia, p.255) proposes a method for translating a text or a medium into a "color cognitive map." Finally the last paper (Trzaska, p.266) proposes a method allowing the evaluation of information visualization methods in general and pixelization methods in particular.

All these papers were the result of a rigorous reviewing process: all the papers were reviewed by at least three referees, 30 were accepted as oral communication and 23 were accepted for publication in the paper proceedings. Fifteen countries were represented.

Indeed this first workshop was a success and we wish to thank very sincerely all the members of the International Program Committee for their thorough review. It was a challenging approach and we think that new ways are now open. We are also

very grateful to Springer for agreeing to publish these proceedings in their *Lecture Notes in Computer Science* series.

November 2006

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Bénédicte Le Grand
François Poulet
Michel Soto
Laszlo Darago
Laurent Toubiana
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[1] Lévy PP. Graduated Substrata. Information Processing & Management. Vol 24 n°6 pp 693-702, 1988.

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