



MATHEMATICS FOR APPLICATIONS IN IMAGING

FOREWORD

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This special issue is devoted to topics related to mathematics for applications in imaging – a field with increasing importance employed in areas as diverse as medicine, robotics, defense, and security, environmental studies, astronomy, material science, and manufacturing.

The papers either contribute to the theoretical foundations of the field or develop mathematical models and methods for solving such problems. As a rule, the processed data are discrete and therefore, in most of the cases a discrete approach is applied, which often features various advantages (in terms of efficiency and accuracy) over the more traditional approaches based on continuous models requiring numeric computation.

The works have initially been presented at two related conferences: IWCIA 2015 held in Kolkata, India, November 24–27, 2015 and CompIMAGE 2016 held in Niagara Falls, USA, September 21–23, 2016. Of over 55 works presented at both conferences, after a regular review process, five substantially extended articles are included in this special issue.

The first paper *A modified Block Matching 3D algorithm for additive noise reduction* by Monagi H. Alkinani and Mahmoud R. El-Sakka proposes a patch-based image filtering algorithm for high additive noise reduction through a modification of the block matching 3D algorithm with an adaptive thresholding. The presented results of experiments demonstrate that this algorithm outperforms the original one for various noise levels.

The second paper *Two-dimensional jumping finite automata* by S. James Immanuel and D.G. Thomas introduces a new concept called the jumping finite automata in the framework of the two-dimensional picture languages used in image processing. Some of the basic properties of these automata are discussed and the family of languages accepted by these automata are compared with the family of Siromoney matrix languages and with the recognizable picture languages.

The third paper *On Farey table and its compression for space optimization with guaranteed error bounds* by Biswajit Paria, Sanjoy Pratihar, and Partha Bhowmick presents some novel theoretical results and efficient algorithms for representation through a table of Farey sequences. The latter find applications in areas such as digital geometry, image processing, and computer vision. Two schemes for lossy compression up to a permissible error of Farey tables are proposed and studied.

The fourth paper *A tabu search approach for the reconstruction of binary images*

without empty interior region by Alain Billionnet, Fethi Jarray, Ghassen Tlig, and Ezzeddine Zagrouba deals with a discrete tomography problem, in which one aims to reconstruct a binary image from its orthogonal projections minimizing the number of holes while satisfying the projections. The results of the experiments carried out over random binary images show that the proposed algorithm produces near-optimal solutions for all test problems.

The fifth paper *North Atlantic right whale localization and recognition using very deep and leaky neural network* by AbdulWahab Kabani and Mahmoud R. El-Sakka describes a practical application based on a deep learning model that can be used to recognize individual right whales in aerial images.

We would like to thank the staff of the journal *Mathematics for Applications* and especially the Editor-in-Chief Prof. Josef Šlapal for the publication of this special issue. We hope that the readers will find it useful and that it will serve as a catalyst for further research in the area of imaging.

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