Quantum Inf Process (2015) 14:1535–1537
DOI 10.1007/s11128-015-1001-5

Introductory words: Special issue on quantum image processing published by Quantum Information Processing

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Published online: 30 April 2015
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Quantum computation and quantum information are transitioning from emerging branches of science into mature research fields in science and engineering. In addition to further advancing the mathematical and physical foundations of quantum computation and quantum information, a growing number of scientists and engineers are devoting their research efforts to identifying and developing cross-fertilizing initiatives of Quantum Information Processing in various fields such as artificial intelligence [1], military technology [2], machine learning [3], computational geometry [4], and image processing [5].

Due to our increasing need to extract information out of images and video, image processing is a pervasive field in many branches of science and engineering (e.g., computer vision [6], astrophysics [7], pattern recognition [8], and medicine [9]). Because of the restricted architecture of classical computers and the computational complexity of state-of-the-art classical algorithms in image processing and its applications, finding (more) efficient algorithms to manipulate visual information is a most important research area.

Quantum image processing is a discipline devoted to the development of novel quantum algorithms for storing, processing, and retrieving visual information. The field of quantum image processing was born with the publication of [10–13], and since then, a small yet vigorous community has focused on several key topics such as quantum methods for image storage and retrieval (e.g., [14]), image encryption/decryption (e.g., [15]), image segmentation (e.g., [16]), and image filtering (e.g., [17]), among many others. Quantum image processing is a field of research full of exciting open problems for physicists, mathematicians, computer scientists, and engineers.

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Our goal for this special issue on quantum image processing published by Quantum Information Processing was to present the readership with a selected collection of papers reflecting the state of the art on various aspects of image processing using quantum-mechanical computers/devices, including image storage and retrieval protocols on quantum systems, quantum algorithms for image processing, and mathematical transformations of visual information. If quantum image processing, as quantum computing in general, is meant to have a long-term success, it is compulsory to determine how exactly humankind will benefit from it. Hence, we sincerely hope that this special issue will encourage quantum scientists and quantum engineers to further advance this discipline.

The road that ends with the publication of our special issue on quantum image processing began with an e-mail by the late Dr. Howard Brandt who, in his capacity as Editor-in-Chief of Quantum Information Processing, kindly invited me to be the Guest Editor of this volume and gave me all his support until his untimely death. With his tremendous help and guidance, Dr. Yaakov Weinstein, the new Editor-in-Chief of Quantum Information Processing, has given me the boost I needed to successfully complete our special issue. My warmest thanks to both Dr. Brandt and Dr. Weinstein for granting me the opportunity to edit this special volume as well as for their never-ending patience, help, and support. I am also most grateful to the authors of the papers included in this special issue for their hard work and outstanding scientific contributions. I am deeply thankful for the opportunity to work with you all. Finally, I would like to thank my beloved family for unconditionally supporting me during the weekend and bank holiday hours I spent working on this special issue, as well as to gratefully acknowledge the financial support of Tecnológico de Monterrey - Escuela de Ciencias e Ingeniería, CONACyT (SNI member number 41594), and RAS project on: "Modeling the uncertainty: quantum theory and imaging processing," LR 7/8/2007.

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