Kaustubh gupta 2000290110080

Summary Report of Research Papers

Sl. No.	Title of the Paper with Author(s) Name	Journal/Conference	Year of Publication	Highlights
1	Le, P.Q., Dong, F. & Hirota, K. A flexible representation of quantum images for polynomial preparation, image compression, and processing operations. Quantum Inf Process 10, 63–84 (2011). https://doi.org/10.1007/s11128-010-0177-y	springer	2010	A Flexible Representation of Quantum Images (FRQI) is proposed to provide a representation for images on quantum computers in the form of a normalized state which captures information about colors and their corresponding positions in the images. A constructive polynomial preparation for the FRQI state from an initial state, an algorithm for quantum image compression (QIC), and processing operations for quantum images are combined to build the whole process for quantum image processing on FRQI. The simulation experiments on FRQI include storing, retrieving of images and a detection of a line in binary images by applying quantum Fourier transform as a processing operation. The compression ratios of QIC between groups of same color positions range from 68.75 to 90.63% on single digit images and 6.67– 31.62% on the Lena image. The FRQI provides a foundation not only to express images but also to explore theoretical and practical aspects of image processing on quantum computers.

2	Zhang, Y., Lu, K , Gao, Y. et al. *NEQR: a novel enhanced quantum representation of digital images*. Quantum Inf Process 12, 2833–2860 (2013). https://doi.org/10.1007/s11128-013-0567-z	springer	2013	In this paper, based on analysis of existing quantum image representations, a novel enhanced quantum representation (NEQR) for digital images is proposed, which improves the latest flexible representation of quantum images (FRQI). The newly proposed quantum image representation uses the basis state of a qubit sequence to store the gray-scale value of each pixel in the image for the first time, instead of the probability amplitude of a qubit, as in FRQI. Because different basis states of qubit sequence are orthogonal, different gray scales in the NEQR quantum image can be distinguished. Performance comparisons with FRQI reveal that NEQR can achieve a quadratic speedup in quantum image preparation, increase the compression ratio of quantum images by approximately 1.5X, and retrieve digital images from quantum images accurately. Meanwhile, more quantum image operations related to gray-scale information in the image can be performed conveniently based on NEQR, for example partial color operations and statistical color operations. Therefore, the proposed NEQR quantum image model is more flexible and better suited for quantum image representation than other models in the literature.

3	**Bayesian stochastic configuration networks for robustdata modelling, Rongzhi Wu, Binyuan Lv, Chaoming Dai, Weigang Wang**	Concurrency and computation: Practice and Experience	2021	The SCN networks is incrementally generated by stochastic configuration (SC)algorithms. It randomly assigns the input weights anddeviations of hidden nodes through a supervisory mechanism, which can be trained by solving linear modelling problems. The Bayesian training algorithm we proposed can obtain an entire probability distribution on the optimal output weight ofthe SCN networks, instead of a single pointwise estimate. Experimental results show that our proposed Bayesian SCN algorithm performs well in solving data modelling problems with a large number of outliers.

4	Yan, Fei, Abdullah M. Iliyasu, and Salvador E. Venegas-Andraca. "A survey of quantum image representations." Quantum Information Processing 15.1 (2016): 1-35. https://link.springer.com/article/10.1007/s11128-015-1195-6	springer	2015	It proposes and evaluates a new security- centric ranking algorithm built on top of the Elasticsearch engine to help users evade such apps. The algorithm calculatesan intrusiveness score for an app based onits requested permissions, received systemactions, and users' privacy preferences. Quantum image processing (QIMP) is devoted to utilizing the quantum computing technologies to capture, manipulate, and recover quantum images in different formats and for different purposes. Logically, percolating this requires that representations to encode images based on the quantum mechanical composition of any potential quantum computing hardware be conjured. This paper gathers the current mainstream quantum image representations (QIRs) and discusses the advances made in the area. Some similarities, differences, and likely applications for some of the available QIRs are reviewed. We believe this compendium will provide the readership an overview of progress witnessed in the area of QIMP while also simulating further interest to pursue more advanced research in it.

5	Zhang, Yi, Kai Lu, and YingHui Gao. "QSobel: a novel quantum image edge extraction algorithm." Science China Information Sciences 58.1 (2015): 1-13. https://link.springer.com/article/10.1007/s11432-014-5158-9	springer	2014	Edge extraction is an indispensable task in digital image processing. With the sharp increase in the image data, real-time problem has become a limitation of the state of the art of edge extraction algorithms. In this paper, QSobel, a novel quantum image edge extraction algorithm is designed based on the flexible representation of quantum image (FRQI) and the famous edge extraction algorithm Sobel. Because FRQI utilizes the superposition state of qubit sequence to store all the pixels of an image, QSobel can calculate the Sobel gradients of the image intensity of all the pixels simultaneously. It is the main reason that QSobel can extract edges quite fast. Through designing and analyzing the quantum circuit of QSobel, we demonstrate that QSobel can extract edges in the computational complexity of $O(n^2)$ for a FRQI quantum image with a size of $2^n \times 2^n$. Compared with all the classical edge extraction algorithms and the existing quantum edge extraction algorithms, QSobel can utilize quantum parallel computation to reach a significant and exponential speedup. Hence, QSobel would resolve the real-time problem of image edge extraction.