



VII international scientific conference
Stockholm. Sweden
13-14.02.2024

THEORETICAL AND PRACTICAL PERSPECTIVES OF MODERN SCIENCE

Proceedings of the V International
Scientific and Practical Conference

13-14 February 2024

UDC 001.1

BBC 1

VII International Scientific and Practical Conference «Theoretical and practical perspectives of modern science», February 13-14, 2024, Stockholm. Sweden. 107 p.

ISBN 978-91-65423-55-8

DOI <https://doi.org/10.5281/zenodo.10689118>

Publisher: «SC. Scientific conferences»

Main organization: **artmedia**²⁴

Editor: Hans Muller

Layout: Ellen Schwimmer

The conference materials are in the public domain under the CC BY-NC 4.0 International license.

The publisher is not responsible for the materials published in the collection. All materials are provided in the author's edition and express the personal position of the participant of the conference.

The sample of the citation for publication is Sevda Aghayeva Aydin kizi, Aynur Rzayeva Elman kizi FAMOUS AZERBAIJAN WOMEN VII International Scientific and Practical Conference «Theoretical and practical perspectives of modern science», February 13-14, 2024, Stockholm. Sweden. Pp.19-22, URL: <https://sconferences.com>

Contact information

Website: <https://sconferences.com>

E-mail: info@sconferences.com

STOCKHOLM. SWEDEN

2024

Content

Agricultural sciences

Kovalenko Oleh Anatoliiovych, Hamayunova Valentyna Vasyilivna, Honenko Liubov Hryhorivna, Okhota Nina Viktorivna APPLICATION OF ANTISTRESS DRUGS ON MAIZE HYBRIDS UNDER DIFFERENT CULTIVATION TECHNOLOGIES	4
Sherstiuk Denys Mykhailovych INTEGRATION OF SATELLITE TECHNOLOGIES IN HUMAN AGRICULTURAL ACTIVITY	10
Qurbanov Huseyn Nuraddin KINEMATIC RESULTS OF A COMBINED MACHINE THAT PROVIDES MINERAL FERTILIZER UNDER PLOWING ON SLOPES	11

Arts

Abugali Nurkanat Merekeuly, Sadykova Zhanna Markovna THEORETICAL ASPECTS OF NOMADIC CULTURE IN MODERN DESIGN	18
--	----

Biological sciences

Huseynzade Gular Aydin EFFECTIVE SPECIES OF BUMBLEBEES (APOIDEA, APIDAE, BOMBUS LATREÏLLE) FOR POLLINATING VEGETABLE CROPS IN GREENHOUSES	21
---	----

Cultural sciences

Horbach Vladyslav, Zhou Tianyu DESIGN OF MODERN VISUAL NOVELS	23
---	----

Economic sciences

Mohammed Mohaisen Abdulridha, Jassim Mohammad Hussein THE ROLE OF PERFORMANCE MONITORING IN ACHIEVING SUSTAINABLE MANAGEMENT AND EFFICIENT USE OF NATURAL RESOURCES	25
Tuganbekova Nursuluv THE SUCCESS RATE OF SMALL ENTERPRISES AND THE FACTORS THAT INFLUENCE THEM	31

Jurisprudence

Mentor Isufaj LEGAL FRAMEWORK FOR THE CONFLICT OF INTEREST IN THE PUBLIC ADMINISTRATION IN ALBANIA	34
--	----

Medical sciences

Barmanasheva Z.E., Dzhakupov D.V., Kudaibergenov T.K. SURGICAL METHODS FOR TREATING UTERINE FIBROIDS	40
Jurakulova Shoxista Faxriddin kizi, Khalmatova Barno Turdihjojaeva FACTORS AFFECTING THE QUALITY OF MEDICAL STUDENTS' TRAINING	42

Pedagogical sciences

Aray Cetin BASIC FUNCTIONS AND METHODS OF WORKING WITH AUTHENTIC MATERIALS IN ENGLISH CLASSES	44
Fayzullaeva Zulfizar COMPETENCIES AS A FACTOR OF COMPREHENSIVE TRAINING OF FUTURE RUSSIAN LANGUAGE TEACHERS AT UNIVERSITY	49
Kochubei Mykola DEVELOPMENT OF THEORETICAL CONCEPTS ABOUT COMMUNICATION OF BUSINESS ENTITIES AND RELATED CONCEPTS	53
Kravchuk Olena THE ABILITIES OF FUTURE LAW ENFORCEMENT OFFICERS TO ESTABLISH A RELATIONSHIP OF TRUST WITH TEENAGERS AS A CONDITION FOR SUCCESSFUL PROFESSIONAL ACTIVITY	57
Novruzova Khumar Tofig MODERN ASPECTS IN TEACHING MATHEMATICS	60

Philological sciences

Mammadova Turan Mehman COMPRESSING AND EXPANDING TEXT CONTENT	62
Narmina Elmir Gizi Sharifova CLASSIFICATION OF SPEECH ACTS IN ENGLISH	66
Zakirova Assel Seidullayevna LINGUACULTURAL AND COGNITIVE STRUCTURE OF THE CONCEPT OF "MOOD" IN KAZAKH LEGENDS	70

Technical sciences

Ganiyeva Sachli Abdulkhag SYMBOLIZATION OF DIGITAL CARTOGRAPHIC INFORMATION AND PREPARATION OF DIGITAL ELECTRONIC MAPS	74
Gaziyeva Parvana Chingiz, Jabiyeva Telli Elshad, Ganiyeva Sariya Nazir ANALYSIS OF THE ACCURACY OF DETERMINING THE COORDINATES OF THE CHARACTERISTIC POINTS OF THE BOUNDARIES OF LAND AREAS BY THE CARTOMETRIC METHOD	79
Kakharov Zaytzhon Vasidovich METHODS FOR CONSTRUCTING CALCULATION DIAGRAMS FOR WATER SUPPLY AND DISTRIBUTION SYSTEMS	83
Kondra Artur Ihorovych, Kunanets Nataliia Eduardivna, Pasichnyk Sergiy Oleksandrovych RECOMMENDATION SYSTEM FOR THE TOURISM INDUSTRY	88
Mukhamedieva Dilnoz Tulkunovna APPLICATION OF QUANTUM ALGORITHMS IN IMAGE PREPROCESSING	92
Mukhamedieva Dilnoz Tulkunovna QUANTUM FOURIER TRANSFORM OF IMAGES	95
Namig Mammadhuseyn Muradov FORMATION OF IRREGULAR STRUCTURED LOCAL SILICON THIN FILMS AND STUDY OF THEIR ELECTROPHYSICAL PROPERTIES	98
Mukhamedieva D.T., Raupova M.H. PROSPECTS FOR THE USE OF QUANTUM COMPUTERS	100
Mohira Zokirkhujayeva, Sherzod Mamatov, Sagdiyev Xasan CHANGES IN MILK POWDER PROTEINS UNDER THERMAL INFLUENCE	104
Durdona Matchaova, Rustam Mukhamedov CONTENT OF FREE AMINO ACIDS IN ATRIPLEX PRATOVII AND ATRIPLEX MONETA PLANTS	106

QUANTUM FOURIER TRANSFORM OF IMAGES

Mukhamedieva Dilnoz Tulkunovna

Tashkent Institute of Irrigation and Agricultural Mechanization Engineers National Research University, 39, Kari Niyazov ave., Tashkent, 100000, Uzbekistan

Abstract

This paper presents an approach to applying quantum Fourier transform (QFT) to image processing using quantum computing. The use of quantum computing for image analysis and processing is becoming increasingly relevant in modern science and technology. A quantum QFT circuit is presented, implemented using the Qiskit framework, which is a tool for programming quantum computers. The paper presents the basic steps of QFT and their application to a state vector representing the pixel intensities of an image. We explore the impact of quantum transformation on image structure and present the results in the form of graphs and visualizations. In addition, we are introducing the ability to infer the QFT quantum circuit for a more visual representation of the algorithm. The results highlight the potential of quantum computing in the field of image processing and open new prospects for the use of quantum technologies in the field of computer vision.

Keywords. Quantum computing, Fourier transform, image processing, quantum circuit.

1. Introduction. With the development of quantum technologies, new opportunities appear for solving computational problems, including in the field of image processing. Traditional image processing methods often face limitations in speed and efficiency, especially when dealing with large volumes of data. In this context, the application of quantum computing for image processing represents a promising research direction. Quantum algorithms, such as the Quantum Fourier Transform (QFT), can provide more efficient data processing by using the principles of quantum mechanics. With the development of quantum computing and the expansion of its scope, new opportunities in the field of data processing arise. One exciting area of research is the application of quantum methods to image processing. Traditional methods, although effective, often face limitations, especially when working with large amounts of information [1].

The purpose of this work is to review and analyze the application of QFT to images using quantum computing. We explore the key steps of quantum transformation in the context of image processing and consider the impact of this method on the structure of images. We also present a new aspect in the form of the output of the QFT quantum circuit for a clear demonstration of the algorithm. This work aims to expand understanding of the capabilities of quantum computing in the field of image processing and contribute to the development of new data analysis methods using quantum technologies [2].

2. Materials and methods.

To conduct the study, a digital image of interest for analysis was selected. The image can be either monochrome or color to view the effect of quantum transformation on different types of data. The image is converted into a format suitable for processing, such as black and white. The image size can also be reduced to the nearest lesser power of two for ease of application of the Quantum Fourier Transform (QFT). Each pixel in the image is converted to intensity and a state vector is generated. This vector is prepared for use in a quantum circuit. A quantum circuit is implemented to apply QFT to the image state vector. The Qiskit library for the Python programming language is used for this. Each element of the state vector represents the probability amplitude on the corresponding qubit [3].

The impact of QFT on image structure is studied. State vectors before and after transformation, as well as the resulting images, are analyzed. Visualization of results is used for a clearer understanding of the process. To visually represent the QFT algorithm in a quantum circuit, the Qiskit library is used. A quantum circuit is derived by applying QFT to the input data. The experiment is carried out with various variants of images and QFT parameters to identify the features and influence of quantum transformation on the structure of the input data [4].

To implement a quantum circuit, the program uses the Qiskit library, which provides the ability to work with quantum circuits in the Python programming language. Quantum bits are created that will be used to represent the input image state vector. The number of qubits is equal to the nearest lesser power of two to the image size (for example, if the image size is 64x64, then 6 qubits are used). The quantum

circuit presented in this program performs the Fourier transform on quantum bits (quantum qubits). The Fourier transform is a mathematical transformation that has applications in various fields, including classical and quantum information science [5].

3. Results. A quantum circuit uses quantum bits, which are the quantum analogues of classical bits. Qubits can be in a linear combination of the states $|0\rangle|0\rangle$ and $|1\rangle|1\rangle$ due to the phenomenon of quantum interference. The Fourier transform in this context is performed on quantum bits. This transform is the quantum analogue of the classical Fourier transform, which is applied to a sequence of values. The circuit uses quantum gates such as Hadamard gates H , controlled phase gates $R(\phi)$, and controlled phase gates C (Fig. 1).



Fig. 1. Quantum circuit Fourier transform to qubit state

The initial state of the quantum system is initialized with an image, and then a quantum transformation is performed. After this, qubits are measured to obtain classical information. The results of quantum transformation are visualized using graphs, allowing you to see how the state vector and image change after the transformation (Fig. 2).

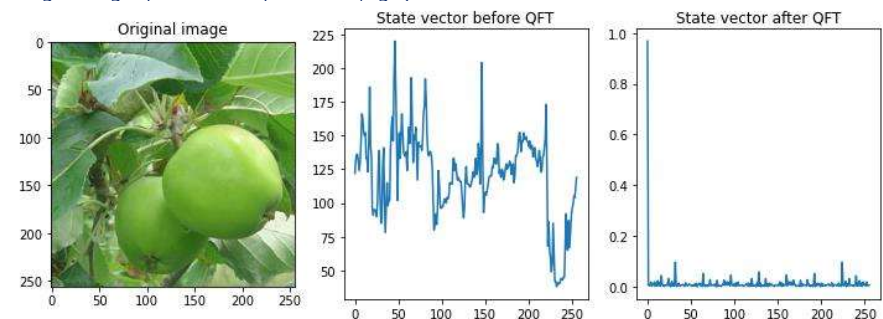


Fig. 2. State vector before and after QFT

Such a quantum circuit can be used to study quantum transformations in images and in the context of quantum data processing algorithms.

4. Conclusion. In this work, the application of Quantum Fourier Transform (QFT) in the context of image processing was analyzed. Experimental results show that quantum transformation can affect the structure of images, leading to changes in pixel amplitudes. The efficiency of quantum conversion was assessed using images using different numbers of quantum bits. Increasing the number of bits resulted in higher transformation granularity, but required more computational resources.

The amplitude histogram after QFT can serve as an indicator of important image characteristics. However, it must be taken into account that the results can greatly depend on the image itself and the parameters of the quantum circuit. It also highlighted areas of application where quantum image processing techniques could be most useful, such as highlighting singular points and patterns. However, it should be noted that quantum image processing methods have their limitations, and the performance

of such approaches can be improved with further research and optimization. These results highlight the promise of using quantum approaches in image processing, providing new opportunities for analyzing and modifying visual data. Further research in this area will help optimize the parameters of quantum circuits and expand the scope of their application in practical image processing problems.

References

1. Potapov V., Gushanskiy S., Polenov M. *The Methodology of Implementation and Simulation of Quantum Algorithms and Processes*, 11th International Conference on Application of Information and Communication Technologies (AICT). Institute of Electrical and Electronics Engineers, 2017, pp. 437-441.
2. Boneh D., Zhandry M. *Quantum-secure message authentication codes*, In *Proceedings of Eurocrypt*, 2013, pp. 592-608.
3. Potapov V., Gushansky S., Guzik V., Polenov M. *Architecture and Software Implementation of a Quantum Computer Model*, *Advances in Intelligent Systems and Computing*. Springer Verlag, 2016, Vol. 465, pp. 59-68.
4. Bennett C.H., Shor P.W., Smolin J.A., Thapliyal A.V. *Entanglement-assisted Capacity of a Quantum Channel and the Reverse Shannon Theorem*, *IEEE Transactions on Information Theory*, 2002, Vol. 48, pp. 26-37.
5. Kleppner D., Kolenkow R. *An Introduction to Mechanics (Second ed.)*. Cambridge: Cambridge University Press, 2014, 49 p