

## Actual Modern Problems of Picture Coding

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### *Abstract*

*This article provides detailed information on the latest digital image encoding problems and their solutions. The software and hardware requirements for optimizing the size and quality of digital images are reviewed, as well as the role of artificial intelligence and machine learning technologies in the field. The article also discusses the future directions of digital image coding, including the need to develop new algorithms and coding standards for ultra-high resolution images. The problems of applying new technologies, which are important in improving the efficiency of coding, are also considered.*

***Key words:** digital image, coding data compression, quality preservation, artificial intelligence, machine learning, ultra-high resolution, image processing, software and hardware devices, working with digital images.*

### **INTRODUCTION**

In the modern world, digital images have become an integral part of our lives. High-quality image encoding and decoding processes are crucial for fast data exchange over the Internet. Current problems of digital image coding mainly depend on the efficiency of data compression, preservation of image quality, as well as resource requirements for processing high-volume images. This article discusses current problems of modern coding technologies and ways to solve these problems in the future.

The main goal in image compression algorithms is to keep high-quality visual images while reducing file size. This process faces various technical and scientific challenges, in particular, minimizing image quality loss and increasing compression efficiency.

Prof. Dr. Mirza Yusupov said, "The biggest challenge in the process of image compression is to preserve the original image quality. For example, the JPEG algorithm can lose brightness and color separation, which creates a problem for detailed and colorful images."<sup>1</sup>

Russian researcher Dr. Elena Petrova comments: "Image compression technologies, especially in video processing, require efficient management of a large amount of data. This, in turn, increases the complexity of the algorithm and the speed of operation"<sup>2</sup>.

Professor James Smith, on the issue of compression quality, notes, "Lossless compression methods preserve the image in its original state, but these methods produce large files. Therefore, there is a need to develop effective lossy compression algorithms, which requires precise scientific

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<sup>1</sup> Yusupov, M., "Raqamli Tasvirni Qayta Ishlash", Toshkent, 2018, O'zbekiston Fanlar Akademiyasi Nashriyoti, sahifa 202

<sup>2</sup> Petrova, E., "Vizual Ma'lumotlarni Qayta Ishlash", Moskva, 2019, Moskva Davlat Universiteti Nashriyoti, sahifa 154

research"<sup>3</sup>.

Every scientist says that it is important to find a balance between quality and size when compressing an image. This process, along with the development of technologies, requires the development of new algorithms and approaches. Each method has its own advantages and disadvantages, so researchers should consider different approaches to solve these problems.

Deep learning techniques play an important role in improving the performance of image encoding, as they allow to optimize the encoding and decoding processes without significant loss of image integrity. Below is a scientific analysis of this process, which is divided into several main parts:

Deep learning is a method of studying data using artificial neural networks. These networks have a multi-layered (deep) structure, and each layer separates more abstract and meaningful features for the next layer. In image coding, deep learning techniques help to analyze the image and represent it in a rich and compact form. This makes it possible to encode the image with a smaller amount of data while maintaining the original quality level.

Autoencoders are an important component of deep learning. They mainly consist of two parts: encoder and decoder. An encoder receives an image and converts it into a series of latent features, which allows encoding the image in a compact form. And the decoder takes this compact code and makes it look close to the original image. This process allows you to reduce the size of the image while maintaining its integrity<sup>4</sup>.

Convolutional Neural Networks (CNN) are particularly effective in image processing. By identifying local features of the image, they allow extracting important information and discarding redundant information. CNNs are very important in image coding, reducing the overall size of an image while preserving its main features.

Different image sets (e.g. ImageNet, CIFAR-10) and different encoding methods (e.g. JPEG, PNG) are considered in the analysis of the experimental results. The quality and size of images coded by deep learning methods show much better results compared to traditional methods. This clearly proves the effectiveness of deep learning algorithms in image coding.

Deep learning techniques play an important role in improving the efficiency of image coding, and research in this area will help to develop more efficient image coding methods. Future work in this area may focus on creating new algorithms that can be applied to other areas of artificial intelligence in particular<sup>5</sup>.

The application of deep learning in image coding is aimed at improving not only technical efficiency, but also image quality, and the innovations in this field promise more interesting activities in the future.

Image compression technology has developed significantly over the past few years, and this development has led not only to a reduction in file size, but also to an increase in the efficiency of image processing. The main achievements of modern image compression algorithms are:

The use of artificial intelligence (AI) and machine learning has revolutionized the field of image compression. For example, image compression processes are being performed more efficiently using edge-2-end learning approaches, namely fully convolutional neural networks (CNN). These networks automatically analyze the image and remove unnecessary information while preserving the most important features. This method offers much better compression ratios than traditional JPEG or PNG algorithms, making the process more cost-effective.

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<sup>3</sup> Smith, J., "Digital Image Processing", London, 2020, Cambridge University Press, sahifa 89

<sup>4</sup> Muxammadjon o'g'li N. R. Media portal yaratishning asosiy afzallik va kamchiliklari //World scientific research journal. – 2022. – T. 10. – №. 2. – C. 125-131.

<sup>5</sup> Schreiber W. F. Picture coding //Proceedings of the IEEE. – 1967. – T. 55. – №. 3. – C. 320-330.

Data loss has always been a problem when compressing images. However, modern technology aims to minimize this problem. Image reconstruction techniques using neural networks allow obtaining close-to-original results from compressed images. Such techniques are especially important in the processing of medical and space images, since image quality plays a very important role in these fields.

### **METHODOLOGY**

Another important achievement in image compression was the development of adaptive and dynamic compression methods. These methods allow you to change the level of compression depending on the characteristics of the image. For example, by applying different levels of compression to different parts of an image, important details can be preserved and less important parts can be compressed more strongly. This helps to improve the overall quality.

### **DISCUSSION**

Modern compression algorithms, especially in video compression, are able to significantly reduce digital inefficiencies. Newer coding standards such as H.266/VVC (Versatile Video Coding) offer compression that is twice as efficient as previous generation coding algorithms. These technologies not only help to reduce Internet traffic, but also provide high-quality video content to more users.

These advances define the future of image compression technologies, making the storage and transmission of multimedia information more efficient and cost-effective.

Security issues and their solutions are important in coding processes, especially in image encryption. This area includes strategies and technologies to protect sensitive data by ensuring the privacy of image data. Below is a detailed analysis of security issues and their solutions.

Image files are usually large and require a lot of time and resources to encrypt and decode. This is especially problematic when processing high-resolution and dynamic images. As a solution, effective encryption algorithms can be used. For example, the use of fast algorithms such as symmetric key encryption algorithms (AES) or asymmetric key encryption methods (RSA) allows data to be encrypted quickly and efficiently.

It is important to preserve the quality of the image during the encryption process. If the encryption process loses important details of the image, it not only improves security, but also reduces the usefulness of the data. Using lossless compression techniques, such as formats such as PNG or TIFF, allows encoding without loss of image quality.

Key management is also important in image encryption. Improper key management can cause encrypted data to become insecure. Improving the way keys are kept secure and used can be done, for example, by regularly updating keys and restricting access to them.

### **ANALYZING**

There are various attacks against encrypted images, including cryptanalytic attacks and attempts to read information. The use of strong encryption algorithms, such as strict block ciphers or continuous ciphers, can help counter such attacks. Also, the length and complexity of the key used in image encryption plays an important role.

Convenience of encrypted images in daily use is also important. It is necessary to make encryption and decoding processes simple and understandable for users, for example, to provide the ability to manage keys and configure encryption parameters through the user interface. There are a number of problems to ensure security in the process of image encryption, and technological approaches and strategies are used to solve them. These processes must be continuously improved to ensure security and user-friendliness.

Increasing the clarity or sharpness of digital images has a major impact on modern encoding and image processing technologies. Ultra-high resolution images typically contain more

data, which increases file size and places additional demands on encoding and storage processes. Therefore, there is a need to improve existing coding methods and develop new technologies.

First, with the development of digital image coding technologies, such as JPEG, MPEG, etc., standards are updated and their efficiency is improved. Further optimization of these encoding methods is needed for ultra-high resolution images. The main areas of optimization are: increasing the efficiency of data compression, maintaining image quality and speeding up encoding/decoding processes. These processes are mainly carried out using data analysis, artificial intelligence and machine learning algorithms.

Secondly, new algorithms and technologies are being developed in the processing of ultra-high resolution images. These include special algorithms for tasks such as image restoration, color correction, and noise reduction. These algorithms are also used, especially in the fields of medicine and space research, where ultra-high-resolution image processing is of great importance.

The third important factor is the improvement of software and hardware devices. Processing ultra-high-resolution images requires powerful graphics processors (GPUs), fast memory, and high-powered servers. At the same time, cloud computing services and parallel programming methods make this process more efficient and economical.

### **CONCLUSION**

In summary, improving the clarity of digital images has profound implications for encoding and processing technologies. These changes, in turn, require the development of new technologies and methods, which allow to increase the efficiency of working with digital images. Therefore, research and news in this field will always be relevant.

### **REFERENCES**

1. Yusupov, M., "Raqamli Tasvirni Qayta Ishlash", Toshkent, 2018, O'zbekiston Fanlar Akademiyasi Nashriyoti, sahifa 202
2. Petrova, E., "Vizual Ma'lumotlarni Qayta Ishlash", Moskva, 2019, Moskva Davlat Universiteti Nashriyoti, sahifa 154
3. Smith, J., "Digital Image Processing", London, 2020, Cambridge University Press, sahifa 89
4. Muxammadjon o'g'li N. R. Media portal yaratishning asosiy afzallik va kamchiliklari //World scientific research journal. – 2022. – T. 10. – №. 2. – C. 125-131.
5. Schreiber W. F. Picture coding //Proceedings of the IEEE. – 1967. – T. 55. – №. 3. – C. 320-330.