Reviewed tools, services and applications can help to increase the level of protection of users' sensitive data and prevent them from damage and leakage.

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QUANTIZATION AND ITS APPLICATION IN SIGNAL COMPRESSION

Belarusian State University of Informatics and Radioelectronics
The Republic of Belarus, Minsk

V.Y. Herasimovich

Liahushevich S.I. − Associate Professor

Abstract – This paper explains what quantization is. The types of quantization algorithms and their application in digital signal coding are considered.

The representation of a large set of elements with a much smaller set is called quantization. Quantization is widely used in data compression methods, such as audio, speech, image, video compression. Almost all coders utilize quantization algorithms as a final (or pre final) stage of compression. It is necessary to reduce storage space or transmission bandwidth. The process of quantization is accompanied by some data loss, which leads to quality loss. In this case, the central problem of quantization is the minimization of this loss for a given amount of available resources.

There are two types of quantization: scalar and vector, which are divided into several subtypes.

Scalar quantization is a mapping from the real number $x \in R$ into a finite set Y containing N output values (also known as codewords) y_i. With knowledge of output values amount we can measure the number of bits needed to uniquely specify the quantized value r by formula 1 [1].

$$r = \log_2 N \quad (1)$$

There are two subtypes of scalar quantizers: uniform and non uniform. Figure 1 shows the input-output characteristics of a uniform quantizer.

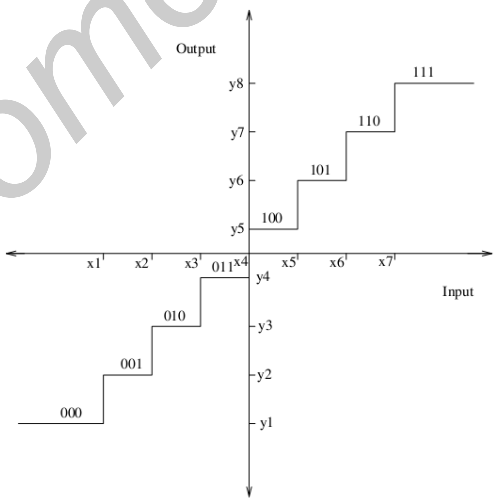

Figure 1. The input-output characteristics of a uniform quantizer.

As we can see at the input-output characteristics, all of the quantizer intervals (steps) are of the same width [2]. The difference of non uniform quantizers from uniform is the width of step – they are not the same.

Vector quantization (VQ) is the quantization process of values joint as a single vector. Basic VQ algorithm works as follows: a vector x with length equal to N mapped into vector y with the same length. The set of vectors y is assembled into a big collection – a codebook. All that is required to transfer (or store) is the index of corresponding vector y. A simple VQ algorithm is shown in figure 2.

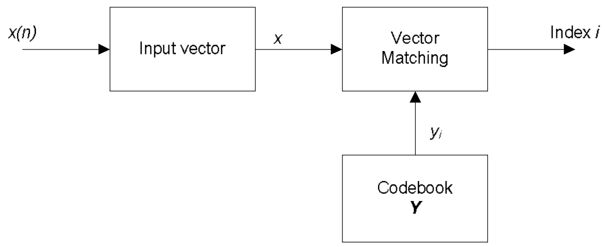

Figure 2. Block diagram of simple vector quantizer.

The collection of vectors Y – a codebook – is obtained with the help of special algorithm named k-means.

VQ allows exploiting dependencies among vector components. This fact is rather a big advantage over the scalar quantization.

VQ algorithms are divided into several subtypes. The main of them are: multistage VQ (MSVQ) and variable dimension vector quantization (VDVQ). VDVQ has become very popular recently because of its ability to work with input vectors with different length and this fact improves the efficiency of quantization.

The quantization is a very powerful tool for signal compression tasks. It can reduce data amount with rather small quality loss. The main problem of this tool utilization is to choose which type of algorithm is needed for specific information.

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CARBON NANOTUBE BASED DETECTOR OF MODULATED TERAHERZ RADIATION

Belarusian State University of Informatics and Radioelectronics
The Republic of Belarus, Minsk

Anton Yermalovich

Liahushevich S.I. − Associate Professor

Due to recent success in development and visualization of nanosized clusters and other metallic nanoparticles, a newbranch of nanooptics and nanotechnology quickly develops — nanoplasmonics. The most important feature of nanoplasmonicdevices is the combination of strong electromagnetic oscillation localization combined with high frequencies ofthese oscillations, which in turn leads to a gigantic amplification of local optical and electromagnetic fields [1]. The localizedplasmons parameters depend on the shape of the nanoparticles, which allows to fine tune their resonance systemto effectively interact with light and other quantum systems (quantum dots, molecules) [2].

Some of the possible applications of these effects are highly effective tunable fluorophores and nanosized lightsources as well as surface plasmon amplification by simulated emission of radiation. It is also possible to create micromechanicaloscillators(Fig. 1), using highly conducting microcantilevers and carbon nanotubes as mechanicaly floating gates [3].Such devices exhibit not only mechanical resonance, but also resonance at frequencies of plasma oscillations.

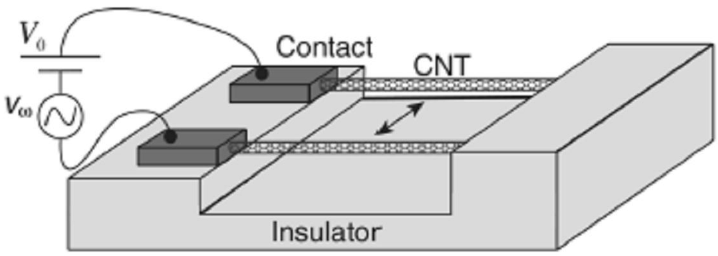

Fig. 1. General view of device under consideration