

# Applied Digital Signal Processing M

## Digital signal processing

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Digital signal processing (DSP) is the use of digital processing, such as by computers or more specialized digital signal processors, to perform a wide variety of signal processing operations. The digital signals processed in this manner are a sequence of numbers that represent samples of a continuous variable in a domain such as time, space, or frequency. In digital electronics, a digital signal is represented as a pulse train, which is typically generated by the switching of a transistor.

Digital signal processing and analog signal processing are subfields of signal processing. DSP applications include audio and speech processing, sonar, radar and other sensor array processing, spectral density estimation, statistical signal processing, digital image processing, data compression, video coding...

## Signal processing

*and the processing of signals for transmission. Signal processing matured and flourished in the 1960s and 1970s, and digital signal processing became widely*

Signal processing is an electrical engineering subfield that focuses on analyzing, modifying and synthesizing signals, such as sound, images, potential fields, seismic signals, altimetry processing, and scientific measurements. Signal processing techniques are used to optimize transmissions, digital storage efficiency, correcting distorted signals, improve subjective video quality, and to detect or pinpoint components of interest in a measured signal.

## Audio signal processing

*digital approach as the techniques of digital signal processing are much more powerful and efficient than analog domain signal processing. Processing*

Audio signal processing is a subfield of signal processing that is concerned with the electronic manipulation of audio signals. Audio signals are electronic representations of sound waves—longitudinal waves which travel through air, consisting of compressions and rarefactions. The energy contained in audio signals or sound power level is typically measured in decibels. As audio signals may be represented in either digital or analog format, processing may occur in either domain. Analog processors operate directly on the electrical signal, while digital processors operate mathematically on its digital representation.

## Digital image processing

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Digital image processing is the use of a digital computer to process digital images through an algorithm. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and distortion during processing. Since images are defined over two dimensions (perhaps more), digital image processing may be modeled in the form of multidimensional systems. The generation and development of digital image processing are mainly affected by three factors: first, the development of computers; second, the development of mathematics (especially the creation and improvement of discrete mathematics theory); and third, the...

## Signal

*multiple subject fields including signal processing, information theory and biology. In signal processing, a signal is a function that conveys information*

A signal is both the process and the result of transmission of data over some media accomplished by embedding some variation. Signals are important in multiple subject fields including signal processing, information theory and biology.

In signal processing, a signal is a function that conveys information about a phenomenon. Any quantity that can vary over space or time can be used as a signal to share messages between observers. The IEEE Transactions on Signal Processing includes audio, video, speech, image, sonar, and radar as examples of signals. A signal may also be defined as any observable change in a quantity over space or time (a time series), even if it does not carry information.

In nature, signals can be actions done by an organism to alert other organisms, ranging from the release...

## Parallel multidimensional digital signal processing

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Parallel multidimensional digital signal processing (mD-DSP) is defined as the application of parallel programming and multiprocessing to digital signal processing techniques to process digital signals that have more than a single dimension. The use of mD-DSP is fundamental to many application areas such as digital image and video processing, medical imaging, geophysical signal analysis, sonar, radar, lidar, array processing, computer vision, computational photography, and augmented and virtual reality. However, as the number of dimensions of a signal increases the computational complexity to operate on the signal

increases rapidly. This relationship between the number of dimensions and the amount of complexity, related to both time and space, as studied in the field of algorithm analysis...

#### Image processor

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An image processor, also known as an image processing engine, image processing unit (IPU), or image signal processor (ISP), is a type of media processor or specialized digital signal processor (DSP) used for image processing, in digital cameras or other devices.

Image processors often employ parallel computing even with SIMD or MIMD technologies to increase speed and efficiency. The digital image processing engine can perform a range of tasks.

To increase the system integration on embedded devices, often it is a system on a chip with multi-core processor architecture.

#### Speech processing

*so speech processing can be regarded as a special case of digital signal processing, applied to speech signals. Aspects of speech processing includes the*

Speech processing is the study of speech signals and the processing methods of signals. The signals are usually processed in a digital representation, so speech processing can be regarded as a special case of digital signal processing, applied to speech signals. Aspects of speech processing includes the acquisition, manipulation, storage, transfer and output of speech signals. Different speech processing tasks include speech recognition, speech synthesis, speaker diarization, speech enhancement, speaker recognition, etc.

#### Quantization (signal processing)

*Quantization, in mathematics and digital signal processing, is the process of mapping input values from a large set (often a continuous set) to output*

Quantization, in mathematics and digital signal processing, is the process of mapping input values from a large set (often a continuous set) to output values in a (countable) smaller set, often with a finite number of elements. Rounding and truncation are typical examples of quantization processes. Quantization is involved to some degree in nearly all digital signal processing, as the process of representing a signal in digital form ordinarily involves rounding. Quantization also forms the core of essentially all lossy compression algorithms.

The difference between an input value and its quantized value (such as round-off error) is referred to as quantization error, noise or distortion. A device or algorithmic function that

performs quantization is called a quantizer. An analog-to-digital...

Sonar signal processing

*Echosounder Digital signal processing Mazur, Martin. Sonar Signal Processing (PDF). Penn State Applied Research Laboratory. p. 14. William C. Knight. Digital Signal*

Sonar systems are generally used underwater for range finding and detection. Active sonar emits an acoustic signal, or pulse of sound, into the water. The sound bounces off the target object and returns an echo to the sonar transducer. Unlike active sonar, passive sonar does not emit its own signal, which is an advantage for military vessels. But passive sonar cannot measure the range of an object unless it is used in conjunction with other passive listening devices. Multiple passive sonar devices must be used for triangulation of a sound source. No matter whether active sonar or passive sonar, the information included in the reflected signal can not be used without technical signal processing. To extract the useful information from the mixed signal, some steps are taken to transfer the raw...

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