Sinr Is A Constant

Signal-to-interference-plus-noise ratio

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In information theory and telecommunication engineering, the signal-to-interference-plus-noise ratio (SINR) (also known as the signal-to-noise-plus-interference ratio (SNIR)) is a quantity used to give theoretical upper bounds on channel capacity (or the rate of information transfer) in wireless communication systems such as networks. Analogous to the signal-to-noise ratio (SNR) used often in wired communications systems, the SINR is defined as the power of a certain signal of interest divided by the sum of the interference power (from all the other interfering signals) and the power of some background noise. If the power of noise term is zero, then the SINR reduces to the signal-to-interference ratio (SIR). Conversely, zero interference reduces the SINR to the SNR, which is used less often when developing mathematical models of wireless networks such as cellular networks.

The complexity and randomness of certain types of wireless networks and signal propagation has motivated the use of stochastic geometry models in order to model the SINR, particularly for cellular or mobile phone networks.

Stochastic geometry models of wireless networks

a path loss function, using a Poisson cellular network model with constant shadowing is equivalent (in terms of SIR, SINR, etc.) to assuming sufficiently

In mathematics and telecommunications, stochastic geometry models of wireless networks refer to mathematical models based on stochastic geometry that are designed to represent aspects of wireless networks. The related research consists of analyzing these models with the aim of better understanding wireless communication networks in order to predict and control various network performance metrics. The models require using techniques from stochastic geometry and related fields including point processes, spatial statistics, geometric probability, percolation theory, as well as methods from more general mathematical disciplines such as geometry, probability theory, stochastic processes, queueing theory, information theory, and Fourier analysis.

In the early 1960s a stochastic geometry model was developed to study wireless networks. This model is considered to be pioneering and the origin of continuum percolation. Network models based on geometric probability were later proposed and used in the late 1970s and continued throughout the 1980s for examining packet radio networks. Later their use increased significantly for studying a number of wireless network technologies including mobile ad hoc networks, sensor networks, vehicular ad hoc networks, cognitive radio networks and several types of cellular networks, such as heterogeneous cellular networks. Key performance and quality of service quantities are often based on concepts from information theory such as the signal-to-interference-plus-noise ratio, which forms the mathematical basis for defining network connectivity and coverage.

The principal idea underlying the research of these stochastic geometry models, also known as random spatial models, is that it is best to assume that the locations of nodes or the network structure and the aforementioned quantities are random in nature due to the size and unpredictability of users in wireless networks. The use of stochastic geometry can then allow for the derivation of closed-form or semi-closed-form expressions for these quantities without resorting to simulation methods or (possibly intractable or inaccurate) deterministic models.

Drive testing

plots of RSRQ, SINR, PUSCH, Coverage plot, Download and Upload throughput is accumulated. Operators use this data to get output which is further utilized

Drive testing is a method of measuring and assessing the coverage, capacity and Quality of Service (QoS) of a mobile radio network.

The technique consists of using a motor vehicle containing mobile radio network air interface measurement equipment that can detect and record a wide variety of the physical and virtual parameters of mobile cellular service in a given geographical area.

By measuring what a wireless network subscriber would experience in any specific area, wireless carriers can make directed changes to their networks that provide better coverage and service to their customers.

Drive testing requires a mobile vehicle outfitted with drive testing measurement equipment. The equipment is usually highly specialized electronic devices that interface to OEM mobile handsets. This ensures measurements are realistic and comparable to actual user experiences.

Signal-to-noise ratio

stands for geometric signal-to-noise ratio. SINR is the signal-to-interference-plus-noise ratio. While SNR is commonly quoted for electrical signals, it

Signal-to-noise ratio (SNR or S/N) is a measure used in science and engineering that compares the level of a desired signal to the level of background noise. SNR is defined as the ratio of signal power to noise power, often expressed in decibels. A ratio higher than 1:1 (greater than 0 dB) indicates more signal than noise.

SNR is an important parameter that affects the performance and quality of systems that process or transmit signals, such as communication systems, audio systems, radar systems, imaging systems, and data acquisition systems. A high SNR means that the signal is clear and easy to detect or interpret, while a low SNR means that the signal is corrupted or obscured by noise and may be difficult to distinguish or recover. SNR can be improved by various methods, such as increasing the signal strength, reducing the noise level, filtering out unwanted noise, or using error correction techniques.

SNR also determines the maximum possible amount of data that can be transmitted reliably over a given channel, which depends on its bandwidth and SNR. This relationship is described by the Shannon–Hartley theorem, which is a fundamental law of information theory.

SNR can be calculated using different formulas depending on how the signal and noise are measured and defined. The most common way to express SNR is in decibels, which is a logarithmic scale that makes it easier to compare large or small values. Other definitions of SNR may use different factors or bases for the logarithm, depending on the context and application.

Median filter

histogram (typically this is 2 n {\displaystyle 2^{n}} , where n is the number of bits per channel), even though this in turn is a constant. Implementation written

The median filter is a non-linear digital filtering technique, often used to remove noise from an image, signal, and video. Such noise reduction is a typical pre-processing step to improve the results of later processing (for example, edge detection on an image). Median filtering is very widely used in digital image processing because, under certain conditions, it preserves edges while removing noise (but see the discussion below for which kinds of noise), also having applications in signal processing.

Code-division multiple access

CDMA technology: all users operate in the same frequency range that impacts SINR and, hence, reduces coverage and capacity. Torrieri, Don (2018). Principles

Code-division multiple access (CDMA) is a channel access method used by various radio communication technologies. CDMA is an example of multiple access, where several transmitters can send information simultaneously over a single communication channel. This allows several users to share a band of frequencies (see bandwidth). To permit this without undue interference between the users, CDMA employs spread spectrum technology and a special coding scheme (where each transmitter is assigned a code).

CDMA optimizes the use of available bandwidth as it transmits over the entire frequency range and does not limit the user's frequency range.

It is used as the access method in many mobile phone standards. IS-95, also called "cdmaOne", and its 3G evolution CDMA2000, are often simply referred to as "CDMA", but UMTS, the 3G standard used by GSM carriers, also uses "wideband CDMA", or W-CDMA, as well as TD-CDMA and TD-SCDMA, as its radio technologies. Many carriers (such as AT&T, UScellular and Verizon) shut down 3G CDMA-based networks in 2022 and 2024, rendering handsets supporting only those protocols unusable for calls, even to 911.

It can be also used as a channel or medium access technology, like ALOHA for example or as a permanent pilot/signalling channel to allow users to synchronize their local oscillators to a common system frequency, thereby also estimating the channel parameters permanently.

In these schemes, the message is modulated on a longer spreading sequence, consisting of several chips (0s and 1s). Due to their very advantageous auto- and crosscorrelation characteristics, these spreading sequences have also been used for radar applications for many decades, where they are called Barker codes (with a very short sequence length of typically 8 to 32).

For space-based communication applications, CDMA has been used for many decades due to the large path loss and Doppler shift caused by satellite motion. CDMA is often used with binary phase-shift keying (BPSK) in its simplest form, but can be combined with any modulation scheme like (in advanced cases) quadrature amplitude modulation (QAM) or orthogonal frequency-division multiplexing (OFDM), which typically makes it very robust and efficient (and equipping them with accurate ranging capabilities, which is difficult without CDMA). Other schemes use subcarriers based on binary offset carrier modulation (BOC modulation), which is inspired by Manchester codes and enable a larger gap between the virtual center frequency and the subcarriers, which is not the case for OFDM subcarriers.

Backpressure routing

ratio (SINR) can be carried out using randomization. Each node randomly decides to transmit every slot t (transmitting a "null" packet if it

In queueing theory, a discipline within the mathematical theory of probability, the backpressure routing algorithm is a method for directing traffic around a queueing network that achieves maximum network throughput, which is established using concepts of Lyapunov drift. Backpressure routing considers the situation where each job can visit multiple service nodes in the network. It is an extension of max-weight scheduling where each job visits only a single service node.

Graph coloring

(e.g. by measuring the SINR). This sensing information is sufficient to allow algorithms based on learning automata to find a proper graph coloring with

In graph theory, graph coloring is a methodic assignment of labels traditionally called "colors" to elements of a graph. The assignment is subject to certain constraints, such as that no two adjacent elements have the same color. Graph coloring is a special case of graph labeling. In its simplest form, it is a way of coloring the vertices of a graph such that no two adjacent vertices are of the same color; this is called a vertex coloring. Similarly, an edge coloring assigns a color to each edge so that no two adjacent edges are of the same color, and a face coloring of a planar graph assigns a color to each face (or region) so that no two faces that share a boundary have the same color.

Vertex coloring is often used to introduce graph coloring problems, since other coloring problems can be transformed into a vertex coloring instance. For example, an edge coloring of a graph is just a vertex coloring of its line graph, and a face coloring of a plane graph is just a vertex coloring of its dual. However, non-vertex coloring problems are often stated and studied as-is. This is partly pedagogical, and partly because some problems are best studied in their non-vertex form, as in the case of edge coloring.

The convention of using colors originates from coloring the countries in a political map, where each face is literally colored. This was generalized to coloring the faces of a graph embedded in the plane. By planar duality it became coloring the vertices, and in this form it generalizes to all graphs. In mathematical and computer representations, it is typical to use the first few positive or non-negative integers as the "colors". In general, one can use any finite set as the "color set". The nature of the coloring problem depends on the number of colors but not on what they are.

Graph coloring enjoys many practical applications as well as theoretical challenges. Beside the classical types of problems, different limitations can also be set on the graph, or on the way a color is assigned, or even on the color itself. It has even reached popularity with the general public in the form of the popular number puzzle Sudoku. Graph coloring is still a very active field of research.

Note: Many terms used in this article are defined in Glossary of graph theory.

Anisotropic diffusion

the diffusion coefficient, instead of being a constant scalar, is a function of image position and assumes a matrix (or tensor) value (see structure tensor)

In image processing and computer vision, anisotropic diffusion, also called Perona–Malik diffusion, is a technique aiming at reducing image noise without removing significant parts of the image content, typically edges, lines or other details that are important for the interpretation of the image. Anisotropic diffusion resembles the process that creates a scale space, where an image generates a parameterized family of successively more and more blurred images based on a diffusion process. Each of the resulting images in this family are given as a convolution between the image and a 2D isotropic Gaussian filter, where the width of the filter increases with the parameter. This diffusion process is a linear and space-invariant transformation of the original image. Anisotropic diffusion is a generalization of this diffusion process: it produces a family of parameterized images, but each resulting image is a combination between the original image and a filter that depends on the local content of the original image. As a consequence, anisotropic diffusion is a non-linear and space-variant transformation of the original image.

In its original formulation, presented by Perona and Malik in 1987, the space-variant filter is in fact isotropic but depends on the image content such that it approximates an impulse function close to edges and other structures that should be preserved in the image over the different levels of the resulting scale space. This formulation was referred to as anisotropic diffusion by Perona and Malik even though the locally adapted filter is isotropic, but it has also been referred to as inhomogeneous and nonlinear diffusion or Perona–Malik diffusion by other authors. A more general formulation allows the locally adapted filter to be truly anisotropic close to linear structures such as edges or lines: it has an orientation given by the structure such that it is elongated along the structure and narrow across. Such methods are referred to as shape-adapted smoothing or coherence enhancing diffusion. As a consequence, the resulting images preserve linear structures while at the same time smoothing is made along these structures. Both these cases can be described by a generalization of the usual diffusion equation where the diffusion coefficient, instead of being a constant scalar, is a function of image position and assumes a matrix (or tensor) value (see structure tensor).

Although the resulting family of images can be described as a combination between the original image and space-variant filters, the locally adapted filter and its combination with the image do not have to be realized in practice. Anisotropic diffusion is normally implemented by means of an approximation of the generalized diffusion equation: each new image in the family is computed by applying this equation to the previous image. Consequently, anisotropic diffusion is an iterative process where a relatively simple set of computation are used to compute each successive image in the family and this process is continued until a sufficient degree of smoothing is obtained.

Noise reduction

With a spatially constant diffusion coefficient, this is equivalent to the heat equation or linear Gaussian filtering, but with a diffusion coefficient

Noise reduction is the process of removing noise from a signal. Noise reduction techniques exist for audio and images. Noise reduction algorithms may distort the signal to some degree. Noise rejection is the ability of a circuit to isolate an undesired signal component from the desired signal component, as with common-mode rejection ratio.

All signal processing devices, both analog and digital, have traits that make them susceptible to noise. Noise can be random with an even frequency distribution (white noise), or frequency-dependent noise introduced by a device's mechanism or signal processing algorithms.

In electronic systems, a major type of noise is hiss created by random electron motion due to thermal agitation. These agitated electrons rapidly add and subtract from the output signal and thus create detectable noise.

In the case of photographic film and magnetic tape, noise (both visible and audible) is introduced due to the grain structure of the medium. In photographic film, the size of the grains in the film determines the film's sensitivity, more sensitive film having larger-sized grains. In magnetic tape, the larger the grains of the magnetic particles (usually ferric oxide or magnetite), the more prone the medium is to noise. To compensate for this, larger areas of film or magnetic tape may be used to lower the noise to an acceptable level.