Information theory and error control coding/Teoria da informação e códigos corretores de erros

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Tutorial Questions/Lista de Exercícios - 4

1. Consider the continuous random variable $Y$ defined by

$Y=X+N$,

where$X$ and $N$ are statistically independent. Show that the conditional differential entropy of $Y$ given $X$ equals

$$h\left(X\right)=h(N)$$

where$h(N)$is the differential entropy of $N$.

1. Alphanumeric data are entered into a computer from a remote terminal through a voice-grade telephone channel. The channel has a bandwidth of 3.4 kHz and output signal-to-noise ratio of 20 dB. The terminal has a total of 128 symbols. Assume that the symbols are equiprobable and the successive transmissions are statistically independent.
2. Calculate the capacity of the channel
3. Compute the maximum symbol rate for which error-free transmission over the channel is possible

 3. Prove the channel coding theorem with regards to achievability using the asymptotic equipartition property and typical sequences. Hint: see Cover´s book.

 4. Consider a source X uniformly distributed on the set {1, 2, . . . ,m}. Find the rate distortion function for this source with Hamming distortion; that is,

$$d\left(x,\hat{x}\right)=\left\{\begin{matrix}0&if x=\hat{x}\\1&if x\ne \hat{x}\end{matrix}\right.$$