

INFORMATION THEORY AND CODING*

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Abstract

An overview of information theory, beginning with a quantifiable definition of information using entropy and leading to ideas in reliable transmission of information using source coding and channel coding.

In the previous chapters, we considered the problem of digital transmission over different channels. Information sources are not often digital, and in fact, many sources are analog. Although many channels are also analog, it is still more efficient to convert analog sources into digital data and transmit over analog channels using digital transmission techniques. There are two reasons why digital transmission could be more efficient and more reliable than analog transmission:

1. Analog sources could be compressed to digital form efficiently.
2. Digital data can be transmitted over noisy channels reliably.

There are several key questions that need to be addressed:

1. How can one model information?
2. How can one quantify information?
3. If information can be measured, does its information quantity relate to how much it can be compressed?
4. Is it possible to determine if a particular channel can handle transmission of a source with a particular information quantity?



Figure 1

Example 1

The information content of the following sentences: "Hello, hello, hello." and "There is an exam today." are not the same. Clearly the second one carries more information. The first one can be compressed to "Hello" without much loss of information.

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In other modules, we will quantify information and find efficient representation of information (Entropy¹). We will also quantify how much ² information can be transmitted through channels, reliably. Channel coding³ can be used to reduce information rate and increase reliability.

¹"Entropy" <<http://cnx.org/content/m10164/latest/>>

²"Channel Capacity" <<http://cnx.org/content/m10173/latest/>>

³"Channel Coding" <<http://cnx.org/content/m10174/latest/>>