Inclusion of Measure to the Concept of Latent Information, Information in Transit and Translators.

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Abstract:-Here we develop a succinct, comprehensive quantitative addition to the concept of information. We introduce the concepts of latent information (LI), information in transit (IT) and translators in the definition of information and include quantitative extensions for them. A mathematical model is proposed where the quantity of information is a function of the interdependence between intensive (e.g. numbers of bits) and extensive (e.g. the media that transmits them, the disk that contains them etc.) characteristics of the transmitted information. Our concept is an attempt to obtain a very general definition that applies to all kinds of systems and a mathematical improvement on the Shannon concept.

Key-word:**-** Information theory, Entropy, Latent Information, Information in Transit

1.Introduction

In a previous paper, two of us (J.P and R.S.) [1] proposed a new definition of information. Our first aim in that paper was to emphasize the error in the transmission of information that is produced in the source and in the channel as a consequence of physical phenomena. This idea forced us to introduce two new terms. The first **Latent information** (LI) is the information in its pristine state ready to be transmitted to a receiver or not. The difference with the common definition of information is that here nobody needs to receive the information. This information is stored and can have any kind of error creation by the act of being there. The common example is the information on a disk. This information can be jeopardized by any kind of phenomena and add its quota of entropy of information to the general communication channel. The second is **Information in Transit** (IiT). Information in transit is **a modulated flow of energy**. Here, the problem of entropy of information, as in Shannon, takes the principal role. The background, as we stated above is not modulated. This does not mean that it cannot receive parasitic modulation. Parasitic modulation will interfere with the produced modulation and this can deteriorate the quality of the information in transit by the serendipity of an added bit of information or by the subtraction of it.

2. The Mathematics of the New Concept.

The addition of these two new sources of change in the definition of information adds entropy to the definition generally used. **A note of caution**: What Shannon [2,3] calls information is what we prefer to call the entropy of information, and what Shannon calls information is not the information you sent but the information you should send. The Shannon definition of the entropy of information is given by [4,5]:

$$S = -\sum_i p_i \ln p_i \qquad (1)$$

Being S the entropy of information and p the bits needed to transfer the information If we now add our two new sources of entropy we get:

$$S = A(1 - e^{\omega t}) + B\sigma - \sum_i p_i \ln p_i \qquad (2)$$

The first term, $A(1 - e^{\omega t})$ is the **deterioration term**. This term we define as the time it takes the latent information to deteriorate. We propose this term as a descending exponential function because we believe that the latent information deteriorates greatly at the beginning and the afterward deterioration is slower. In this term, A stands for a constant related to the origin of the deterioration agent and ω the frequency of the deterioration of a bit of information. These constants can not be determined a priori and are a function of the media used to store the information. A similar behavior is seen in most other fields in engineering.

The other term, $B\sigma$, gives the relation of the serendipity of the addition or destruction of a bit of information and its nature is the same as the cross section in physics. Here B is a constant that takes care of the units, σ [6] the cross section of the interaction and t is the time passing since the beginning of the transmission.

3. Discussion

The existence of the new terms does not deviate from the definition of Shannon at the beginning of the process. This must be the case for any kind of communication. After that the entropy begins to grow. For the information in transit this mark the beginning of the deterioration of the storing device and is represented by the second term in equation

2. Once transmitted the information begins to deteriorate because of the existence of some kind of degradation in the channel used. This is reflected by the second term in equation 2.

4. Conclusions

These **two** new terms were added to the definition of entropy of information and these two terms produce an enhancement of the entropy, e.g. the need of more bits of information in order to transfer the desired information, putting the limit of the error in transmission higher.

References

[1] J. Portnoy and R. Steinitz Citsa Congress on Information Theory (in publication)

[2] C. E. Shannon Bell System Technical Journal July 1948

[3] T. M. Cover and J.A. Thomas; *Elements of Information Theory* 2ed. Wiley 2006

U.S.A.

[4] A. I. Khinchin *Mathematical Foundations of Information Theory* Dover 1957.U.S.A.

[5] D. A. Bell *Information Theory and its Engineering Applications* Pitman 1953 U.K.

[6] See for example M. L. Goldberger and K. M. Watson *Collision Theory* Dover 2004 U.S. A. for a general explanation for the **cross section.**