ABSTRACT

A Study Of Performance Measures Of Discrete Communication Systems

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This thesis involves a study of different types of performance measures of discrete communication systems. It is built around Shannon's fundamental concepts of channel-capacity and rate-distortion function, both of which are defined in terms of the rate of communication.

Channel-capacity is a theoretical limit which may never be achieved in practice because various extraneous factors, for example, time-, energy-, and money-constraints, govern the use of the channel. These factors are expressed as linear constraints and capacity subject to these constraints is then studied. This naturally gives a more realistic measure of channel-performance.

The rate-distortion function subject to a fidelity-criterion is found to be sufficiently limited if considered from the "multi-users" point of view, that is, from the point of view of several independent users of the reproduced information, each with his own separate definition of distortion. We adopt the "multi-users" approach and study the rate-distortion function subject to several fidelity criteria simultaneously applied.

Further, although channel-capacity and rate-distortion function are both defined in terms of the rate of communication, these two key

concepts have been developed in isolation and no effort has been made to synthesize them. We develop another type of performance measure by combining these two important concepts.

The three developments mentioned above are the main ones. Other types of performance measures are developed by a combination of them and these are also studied.

The computational aspects play a very significant role as we also develop methods and construct algorithms for the numerical evaluation of the performance measures discussed.