INFORMATION DIFFUSION PRINCIPLE AND APPLICATION IN FUZZY NEURON

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ABSTRACT

In this paper, we demonstrate that the fuzziness of fuzzy information can come not only from the measuring scale, but also from the incompleteness of sample knowledge. Fundamentally, by developing the method of information distribution to information diffusion principle, we establish the embryonic form of the theory of fuzzy information optimization processing, which is connected with incompleteness. An application in fuzzy neuron to estimate earthquake intensity shows that information diffusion methods have obvious advantages and future applications.

1 INTRODUCTION

In the early 19th century, the classical deterministic laws of Isaac Newton led Pierre Simon de Laplace to believe that the future of the Universe could be determined forever. Then quantum mechanics came along. One of the controversial features of quantum mechanics was that it introduced probability and randomness at a fundamental level into physics. Then surprisingly, the modern study of nonlinear dynamics showed us that even the classical physics of Newton had randomness and unpredictability at its core. The theory of chaos revealed how the notion of randomness and unpredictability is beginning to look like a unifying principle.

It seems that the same principle even extends to fuzzy mathematics. Randomness is discovered firstly and which elicits Shannon's narrow theory
of information. Here, information is defined as the uncertainty which is cleared out, and regarded as negentropy. The definition of entropy in statistical thermodynamics

\[ H(x_i) = \sum_{i=1}^{n} p(x_i) h(x_i) = - \sum_{i=1}^{n} p(x_i) \log p(x_i) \]

becomes the foundation of the edifice of the narrow theory of information.

Many problems in the communication field are solved by using the narrow theory of information. However, this classical theory is useful only to study the problems of information transfer, but it can do nothing for seeking the structure of information, which would be very important for recognizing relationships among factors. Therefore, the general theory of information is studied by many people. The theory of fuzzy information is an important part of it.

At the beginning, the people who are going to set up the theory of fuzzy information were only interested in using the definition of the entropy of fuzzy events to study the quantification index of a fuzzy set and the problems of decision. Obviously, along the train of thoughts, the narrow theory of fuzzy information is the only one which would be established. It cannot describe general fuzzy information touched by the common people.

In order to establish a general theory of fuzzy information, we ought to remove the restriction that information is relative to communications. We define information as the reflection of motion state and existential fashion of objective reality. This reflection is revealed in the form of material or energy, and is perceived by human sense organs directly or indirectly. For example, the indication of a thermometer, the flight speed of an airplane, a sentence, a letter, a cipher, a seismogram, a train timetable, a mathematical formula, and a cardiogram are information.

The range of information is so wide that we have to set a limit to it when we analyse information practically. In this paper, we limit the information to what can be accumulated to become experience or knowledge. Our main interest is not to study the measurement of information, but to analyse the structure of information, from which we would know what it tells us, and by which we would discover some useful laws of nature.

Any information which is not quite exact or is a bit vague can be called fuzzy information. However, in the past, people only dealt with the fuzzy infor-