KŌDAI MATH. SEM. REP
20 (1968), 355–373

PATTERN RECOGNITION BY RANDOM NET

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1. Introduction.

It might be said that the significance of the role played by random transmission of information or signal transmission through a random net in the large scale information processing systems such as pattern recognizing learning systems has become to be recognized through a kind of simulation of a certain part of the information processing mechanism in some living organisms. Especially in the perceptron theory [2], which, getting out of the experimental stages, has attracted various theoretical attentions, e.g. [1], [5], [6], [7], [8], [12], one considers a random connection structure by such a simulation. The theory, however, does not use any essential property of "randomness", i.e. mathematically this random connection only transforms input stimuli (or patterns) into another forms of patterns, and therefore one may consider only on these transformed patterns as if they were original input patterns.

The work of the random net in such systems might be said not to be clarified particularly from the theoretical view point.

Generally a random net consists of, like neural nets, a large number of elements which might be called "basic organs" corresponding to neurons in neural nets and emit signals after transforming their input signals by certain operations, and a large number of random "connections" which transmit signals among the basic organs. A subset I of the set of all basic organs contained in the random net receives stimulus signals from the outer world of the net. The signals, then, propagate along connections through the whole net. They are transformed many times by basic organs, and eventually reach another specified subset O of basic organs which output final signals. The net in the whole, therefore, has a general character of transforming input signals into output ones except for the random signal transformations.

Now suppose that a signal has a multi-dimensional vector form and each component signal in the vector signal is received by each basic organ in the subset I of our random net. Correlations or dependences among component signals may easily be seen to be generally strong if we only consider our visual patterns as vector signals. One of the important roles of the random net is "to tear these dependences into independent pieces" to gain statistical independences among component signals. In other words, as a vector signal passes through the net, it

Received December 7, 1967.