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THE RANDOM NET WHICH HAS BASIC ORGANS REALIZING PARITY BOOLEAN FUNCTIONS

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This paper is a revised and modified version of the foregoing paper [1] in the sense that the ability of pattern discrimination is much more increased than [1].

1. Brief review of the general concept.

We briefly review the fundamental concept of pattern recognition by random net proposed in [1] (See [1] for detail).

I is the set of n "input points". Denoting by $\pi(A)$ the number of elements belonging to a finite set A, we have $\pi(I)=n$. Any subset $f\subset I$ will be called *(input) pattern* which may be interpreted as a binary 0, 1 sequence of length n. The 2^n possible patterns constitute the *(input) pattern space* F. To say that there are given K categories on F is to say that K probability distributions

$$\mathcal{P}_n=\{P_n^{(1)}, P_n^{(2)}, \cdots, P_n^{(K)}\}$$

are defined on F, considering them to depend on n.

A random net transforms F randomly into another pattern space (output pattern space) G comprising of patterns which are subsets of the set of N output points. Then the random net defines a mapping (assumed deterministic in the present study) φ: $F\to G$. We have thus $\pi(G)\leqq 2^n$.

Given a category $k\in C=\{1, 2, \cdots, K\}$, denote by $Q_{l0}^{(k)}$ the probability that the l-th output point emits signal 0. If the random net has the property that the N output component signals are mutually *independent*, the probability that the corresponding output pattern $\varphi(f)\in G$ is observed, given category k, is given by

$$q_{\varphi(f)}^{(k)}\equiv \prod_{l\in\varphi(f)} (1-Q_{l0}^{(k)}) \prod_{l\notin\varphi(f)} Q_{l0}^{(k)}. \tag{1}$$

If we assume a learning mechanism which can estimate the matrix $\mathcal{M}=(Q_{l0}^{(k)})$ and the probabilities $p^{(1)}, p^{(2)}, \cdots, p^{(K)}$ on the category space C, then the *a posteriori* probability method to recognize patterns may be as follows:

(A) An unknown input pattern $f\in F$ is given and the $\varphi(f)\in G$ is observed at the output level.

(B) By (1) $p^{(k)}\cdot q_{\varphi(f)}^{(k)}$, $k=1, 2, \cdots, K$, are calculated.

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