# 情報伝送基礎レポート

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## 1 Viterbi algorithm for ISI

In the prescence of ISI, the Viterbi algorithm can be used to determine the most likely bit sequence at the receiver end. For the case where the information symbols are M-ary, the channel is described as an $M^L$-state trellis and the Viterbi algorithm is used to determine the most likely path through the trellis. The procedure involved in using the Viterbi algorithm is described below.

1. As each sample signal is received, the computation of $M^{L+1}$ probabilities is carried out using the equation below.

$$\ln p(v_{L+k}|I_{L+k,\dots}, I_k) + PM_{k-1}(I_{L+k-1}) \tag{1}$$

This corresponds to the $M^{L+1}$ sequence which form the continuation of the $M^L$ surviving sequences from the previous stage of the decoding process.
2. The $M^{L+1}$ sequences are then subdivided into $M^L$ groups. Each group contains M sequences that terminate in the same set of symbol $I_{L+k}, ..., I_{k+1}$ and differ in the symbol $I_k$
3. From each group, we select the sequence which has the largest probability using the equation below

$$PM_k(I_{L+k}) = \max_{I_k}[\ln p(v_{L+k}|I_{L+k,\dots}, I_k) + PM_{k-1}(I_{L+k-1})] \tag{2}$$

The remaining $M-1$ sequences are discarded. This leaves $M^L$ sequences having the metrics $PM_k(I_{L+k})$
4. The same process is repeated as subsequent samples are received.

There is a variable delay incurred using the above procedure. Practically, this delay is fixed by truncating the sequence that survives to the $q$ most recent received sequence, where $q \gg L$.