

Oct. 26, 2025

EE4140

$k=1 \dots N$ 1000
2¹⁰⁰⁰
 $\rightarrow 1000$

Viterbi Algorithm (VA) $\rightarrow$ MLSE

$\in \{1, 0\}$
 $\in \{\sqrt{E}, -\sqrt{E}\}$

$l=0 \dots L-1$
 $(L=3)$

$I(k)$
 $\in \{1, -1\}$

$\{f_0, f_1, f_2\}$

$n(k)$

$\oplus$

$\sigma(k)$

"hypothesis"

"noise free" estimates of $\sigma(k)$

$\frac{2}{\uparrow} \frac{2}{\uparrow} \frac{2}{\uparrow}$

$$\sigma(k) = \sum_{l=0}^{L-1} f_l I(k-l) + n(k)$$

$$\sigma(k) = f_0 I(k) + f_1 I(k-1) + f_2 I(k-2) + n(k)$$

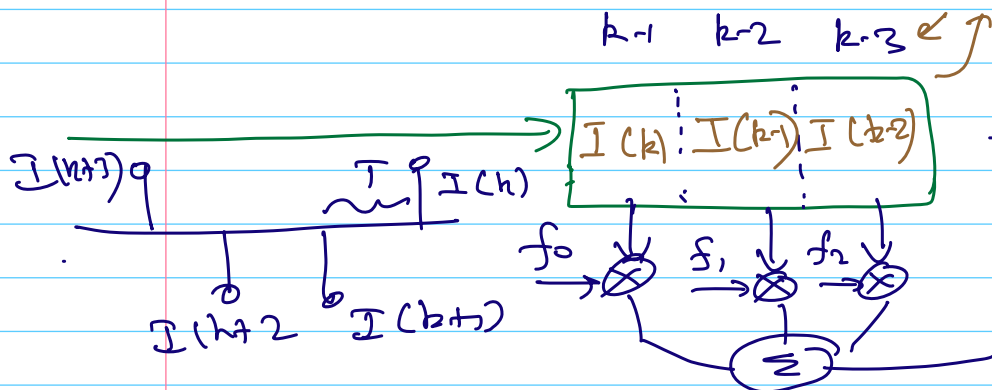
$L=3$
 Memory of the system $L-1=2$
 $k, k-1, k-2$

Distinct values $\rightarrow 2^L = 8$ values

sub-sequence of length $L=3$

"Signal cancellation"

severe ISI $\rightarrow$ MLSE



Trellis Structure

Symbol # (stage)

pruning "survivor selection"

$$CM_{k+1} = CM_k + TM_1$$

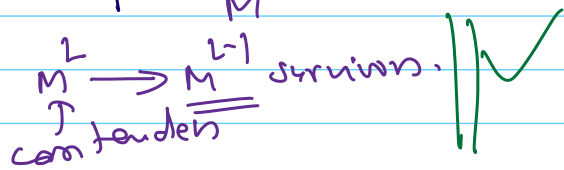
$L-1=4$
 $2^4=16$

State (Nodes) 2^L

Branch Cumulative Metric

Transition Metric (Branch)

2^N
 (M)



[illegible]

$CMA + TM \Rightarrow C$

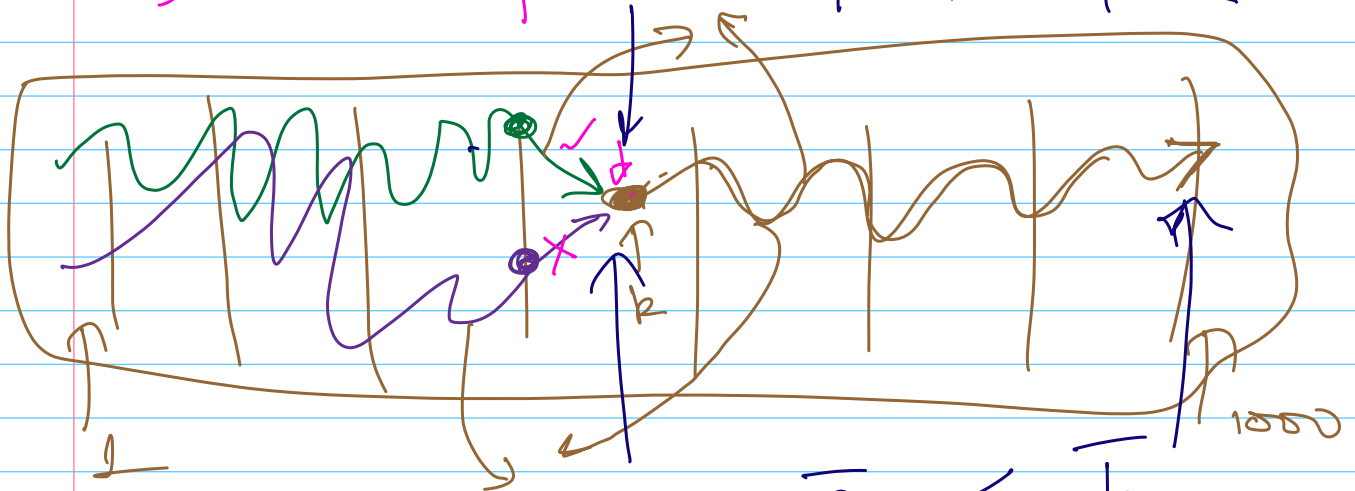
$\leftarrow$

$CMB + TM \Rightarrow C$

survivor metric
survivor sequence

$\parallel \frac{CMA}{\alpha} \checkmark$

$\parallel \frac{CMB}{\alpha} \checkmark$

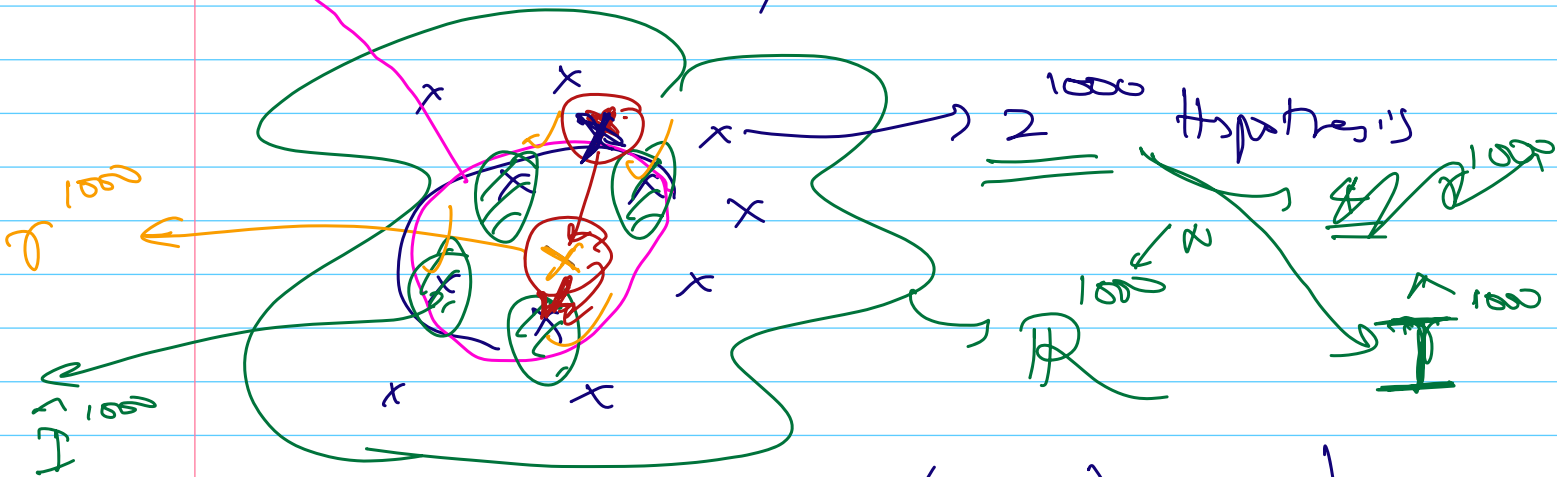


$$\bar{a} < \bar{b}$$

$$|a| < |b|$$

$$\Rightarrow |\bar{a} + \bar{c}| < |\bar{b} + \bar{c}|$$

top $M^{L-1} = 2^2 = 4$



$I_{MLSE} = I_{VA}$

$\rightarrow$ Fano Stack

$\nwarrow$ BER

$\uparrow$

$I_{Suboptimal MLSE}$

2×10^{-3} 2×10^{-3}
 same BER

"Finite" Truncation Depth in the VA

$$L' = 5L \text{ to } 6L$$

$\Rightarrow$ the survivor sequence length
can only be L' (and not N)