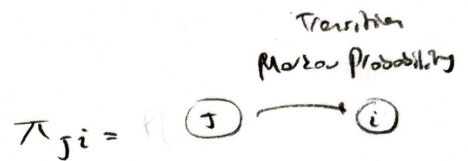


# IMM Filter

$$p_{k-1|k-1}^{ji} \stackrel{\Delta}{=} P(r_{k-1}=j | r_k=i, y_{0:k-1})$$

• Mixing

$$p_{k-1|k-1}^{ji} = \frac{\pi_{ji} p_{k-1}^j}{\sum_{l=1}^{N_r} \pi_{li} p_{k-1}^l}$$



$$\hat{x}_{k-1|k-1}^{0i} = \sum_{j=1}^{N_r} p_{k-1|k-1}^{ji} \hat{x}_{k-1|k-1}^j$$

$$\Sigma_{k-1|k-1}^{0i} = \sum_{j=1}^{N_r} p_{k-1|k-1}^{ji} \left[ \Sigma_{k-1|k-1}^j + (\hat{x}_{k-1|k-1}^j - \hat{x}_{k-1|k-1}^{0i})(\hat{x}_{k-1|k-1}^j - \hat{x}_{k-1|k-1}^{0i})^T \right]$$

• Mode Matched Prediction Update:

$$\hat{x}_{k|k-1}^i = A(i) \hat{x}_{k-1|k-1}^{0i}$$

$$\Sigma_{k|k-1}^i = A(i) \Sigma_{k-1|k-1}^{0i} A^T(i) + B(i) Q B^T(i)$$

• Mode Matched Measurement Update: For  $i$ th model,  $i = 1, \dots, N_r$

$$\hat{x}_{k|k}^i = \hat{x}_{k|k-1}^i + k_k^i (y_k - \hat{y}_{k|k-1}^i), \quad \Sigma_{k|k}^i = \Sigma_{k|k-1}^i - k_k^i S_k^i k_k^{iT}$$

→ Calculate the updated mode probability

$$p_k^i = \frac{N(y_k; \hat{y}_{k|k-1}^i, S_k^i) \sum_{j=1}^{N_r} \pi_{ji} p_{k-1}^j}{\sum_{l=1}^{N_r} N(y_k; \hat{y}_{k|k-1}^l, S_k^l) \sum_{j=1}^{N_r} \pi_{jl} p_{k-1}^j}$$

• Output Estimate Calculation:

$$\hat{x}_{k|k} = \sum_{i=1}^{N_r} p_k^i \hat{x}_{k|k}^i$$

$$\Sigma_{k|k} = \sum_{i=1}^{N_r} p_k^i \left[ \Sigma_{k|k}^i + (\hat{x}_{k|k}^i - \hat{x}_{k|k})(\hat{x}_{k|k}^i - \hat{x}_{k|k})^T \right]$$