

$$\begin{aligned}
 & p(u_{0:k} | y_{1:k}) \\
 &= p(u_{0:k} | y_k, y_{1:k-1}) \\
 &= \frac{p(y_k | u_{0:k}, y_{1:k-1}) p(u_{0:k} | y_{1:k-1})}{\int \text{---} \text{---} \text{---} du_{0:k}}
 \end{aligned}$$

$$\begin{aligned}
 & \propto \underbrace{p(y_k | u_{0:k}, y_{1:k-1})}_{\text{doesn't simplify}} \underbrace{p(u_{0:k} | y_{1:k-1})}_{\text{does not simplify}} \\
 &= p(y_k | u_{0:k}, y_{1:k-1}) \underbrace{p(u_k | u_{0:k-1}, y_{1:k-1})}_{\text{posterior dist. at } k-1} \\
 & \quad \cdot \underbrace{p(u_{0:k-1} | y_{1:k-1})}_{\text{posterior dist. at } k-1}
 \end{aligned}$$

$$\begin{aligned}
 \pi(u_{0:k} | y_{1:k}) &= \pi(u_k | u_{0:k-1}, y_{1:k}) \\
 & \quad \cdot \pi(u_{0:k-1} | y_{1:k-1})
 \end{aligned}$$

$$\begin{aligned}
 w_k^{(i)} & \propto \frac{p(y_k | u_{0:k}^{(i)}, y_{1:k-1}) p(u_k^{(i)} | u_{0:k-1}^{(i)}, y_{1:k-1})}{\pi(u_k^{(i)} | u_{0:k-1}^{(i)}, y_{1:k})} \\
 & \quad \times w_{k-1}^{(i)}
 \end{aligned}$$

details:

$$\begin{aligned}
 w_k^{(i)} & \propto \frac{\text{---}}{\text{---}} \\
 &= \frac{p(y_k | u_{0:k}^{(i)}, y_{1:k-1}) p(u_k^{(i)} | u_{0:k-1}^{(i)}, y_{1:k-1}) p(u_{0:k-1}^{(i)} | y_{1:k-1})}{\pi(u_k^{(i)} | u_{0:k-1}^{(i)}, y_{1:k}) \pi(u_{0:k-1}^{(i)} | y_{1:k-1})}
 \end{aligned}$$

$\alpha W_{R-1}^{(1)}$

