Bayes Filters

\[ \text{Bel}(x_t) = P(x_t \mid u_1, z_1 \ldots, u_t, z_t) \]

Bayes

\[ = \eta \ P(z_t \mid x_t, u_1, z_1, \ldots, u_t) \ P(x_t \mid u_1, z_1, \ldots, u_t) \]

Markov

\[ = \eta \ P(z_t \mid x_t) \ P(x_t \mid u_1, z_1, \ldots, u_t) \]

Total prob.

\[ = \eta \ P(z_t \mid x_t) \int P(x_t \mid u_1, z_1, \ldots, u_t, x_{t-1})P(x_{t-1} \mid u_1, z_1, \ldots, u_t) \, dx_{t-1} \]

Markov

\[ = \eta \ P(z_t \mid x_t) \int P(x_t \mid u_t, x_{t-1}) P(x_{t-1} \mid u_1, z_1, \ldots, u_t) \, dx_{t-1} \]

Markov

\[ = \eta P(z_t \mid x_t) \int P(x_t \mid u_t, x_{t-1}) P(x_{t-1} \mid u_1, z_1, \ldots, z_{t-1}) \, dx_{t-1} \]

\[ = \eta \ P(z_t \mid x_t) \int P(x_t \mid u_t, x_{t-1}) \text{Bel}(x_{t-1}) \, dx_{t-1} \]