

## State Space Model

$$y_i = H_i x_i + v_i$$

$H_i, F_i, \text{ and } G_i$  are known matrices

$$x_{i+1} = F_i x_i + G_i u_i$$

What kind of estimates

If we have  $x_i$  (i.e. observe it),  
~~can we get~~ what kind of estimates  
of  $x_{i+1}$  are possible?

Can we estimate  $x_{i+2}$  from  $x_i$ ? What kind of estimates are possible?

Can we estimate  $y_{i+1}$  from  $x_i$ ? What kind of estimates are possible?

Can we estimate  $y_{i+1}$  from  $x_i$ ?

In a state-space model,

$$y_i = H_i x_i + v_i$$

$$x_{i+1} = F_i x_i + G_i u_i$$

we usually observe  $y_0, y_1, \dots, y_N$

and we would like to estimate  $x_0, x_1, \dots, x_N$

Given  $y_i$ , what kind of estimates of  $x_0$  are possible?

Linear MMSE?

Linear

MMSE?

Optimum

MMSE?

?  
?

Can  $y_0$  help me estimate  $x_1$ ?

estimate

?  
?

Can  $y_1$  help me estimate  $x_2$ ?

estimate

We need to make some assumptions about the statistics of  $v_i$  &  $n_i$

What is the easiest thing?

What does this mean?

Make assume

$$E \begin{bmatrix} n_i \\ v_i \\ x_i \end{bmatrix} = \begin{bmatrix} n_i^* & v_i^* & x_i^* \end{bmatrix} = \begin{bmatrix} Q_i^* & S_i^* & 0 \\ S_i^* & R_i & 0 \\ 0 & 0 & \pi_0 \end{bmatrix}$$

Are  $v_i$  &  $x_i$  orthogonal?

$\hat{w_i}$  &  $y_i$

?

$v_i$  &  $w_i$

?

$v_i$

&  $x_{i+1}$

?

$v_i$

&  $y_j$  ( $j < i$ )

?