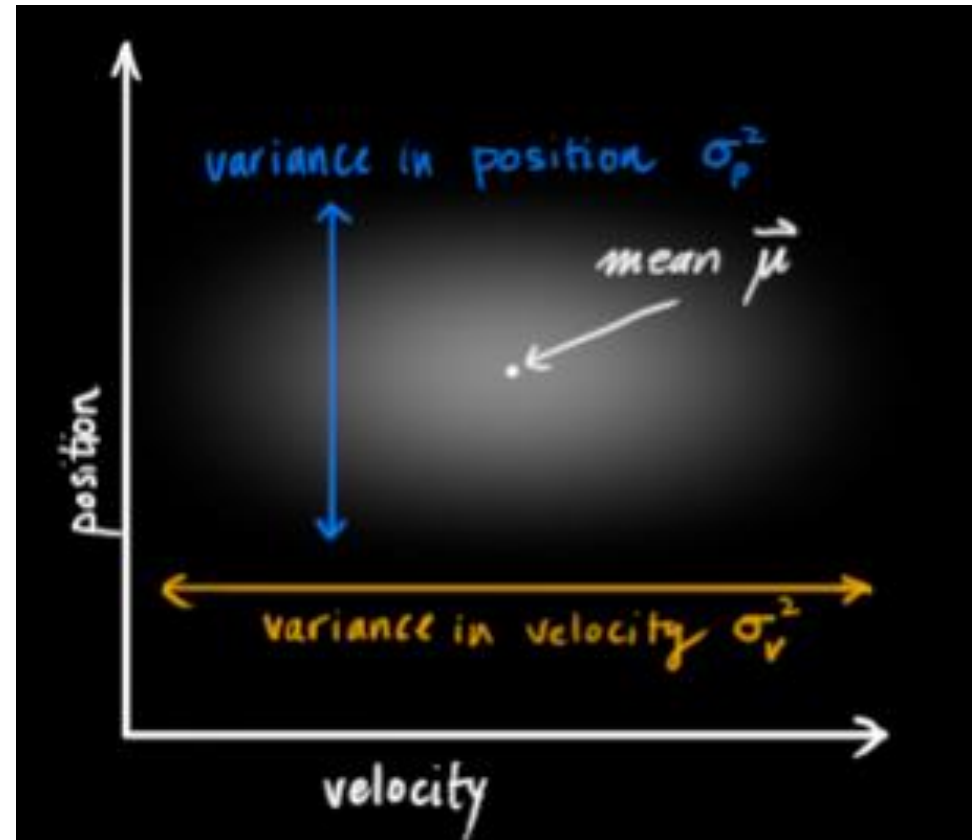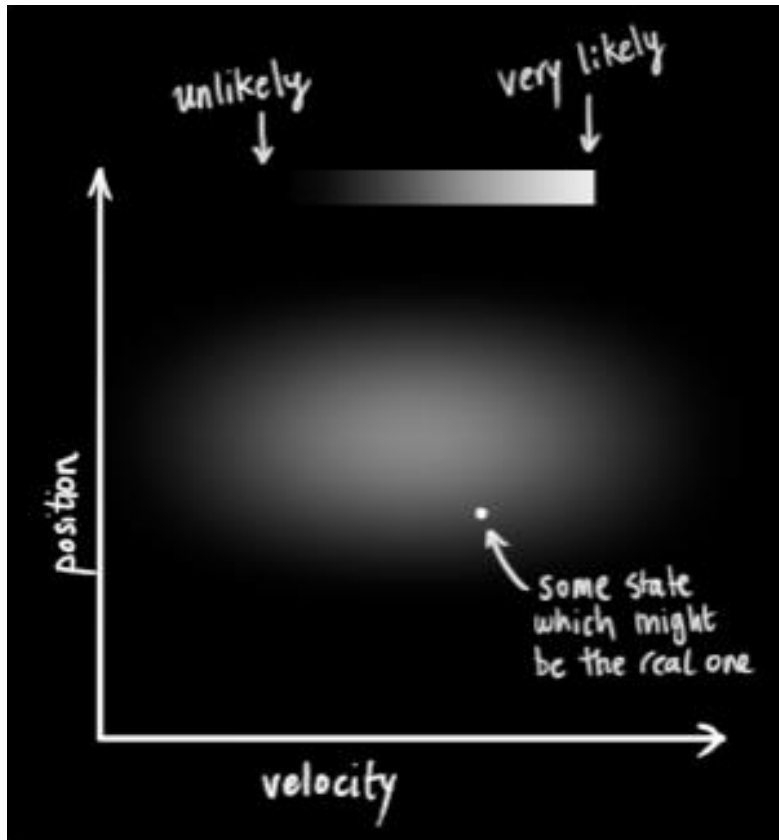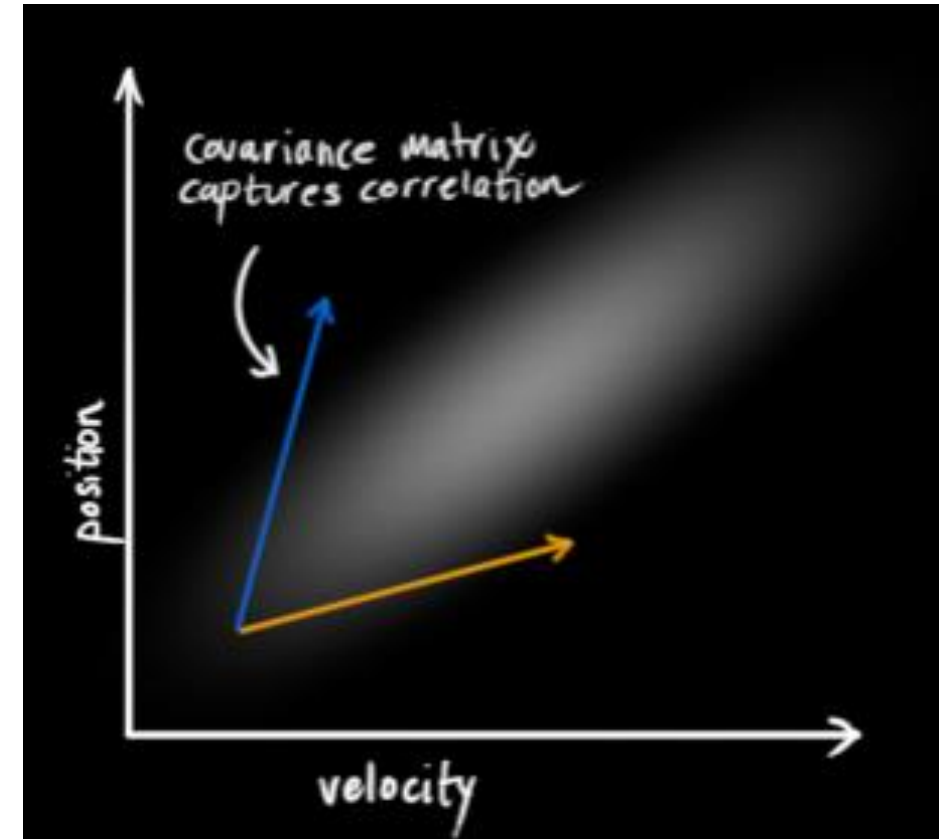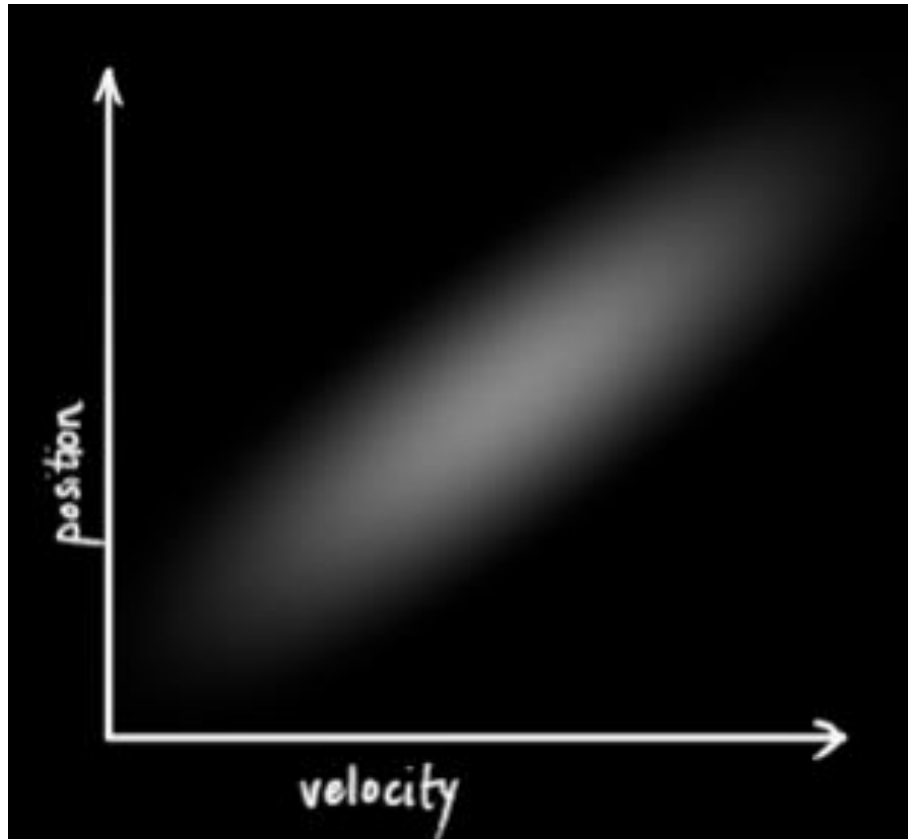# Kalman Filters

Position and Velocity Uncertainty
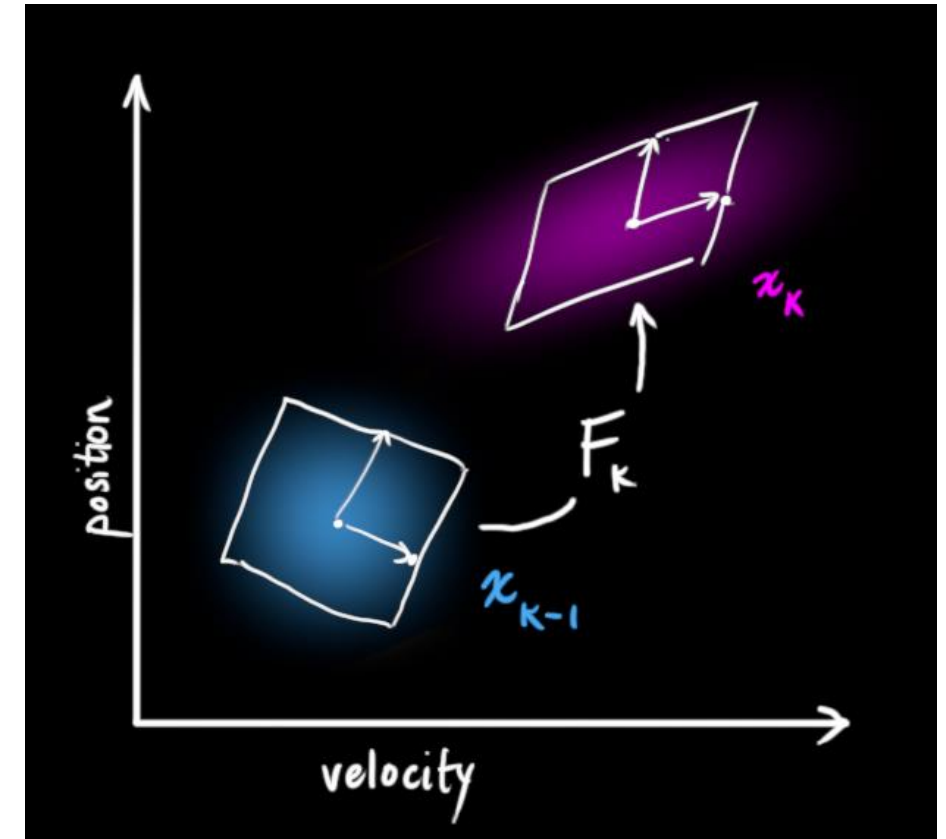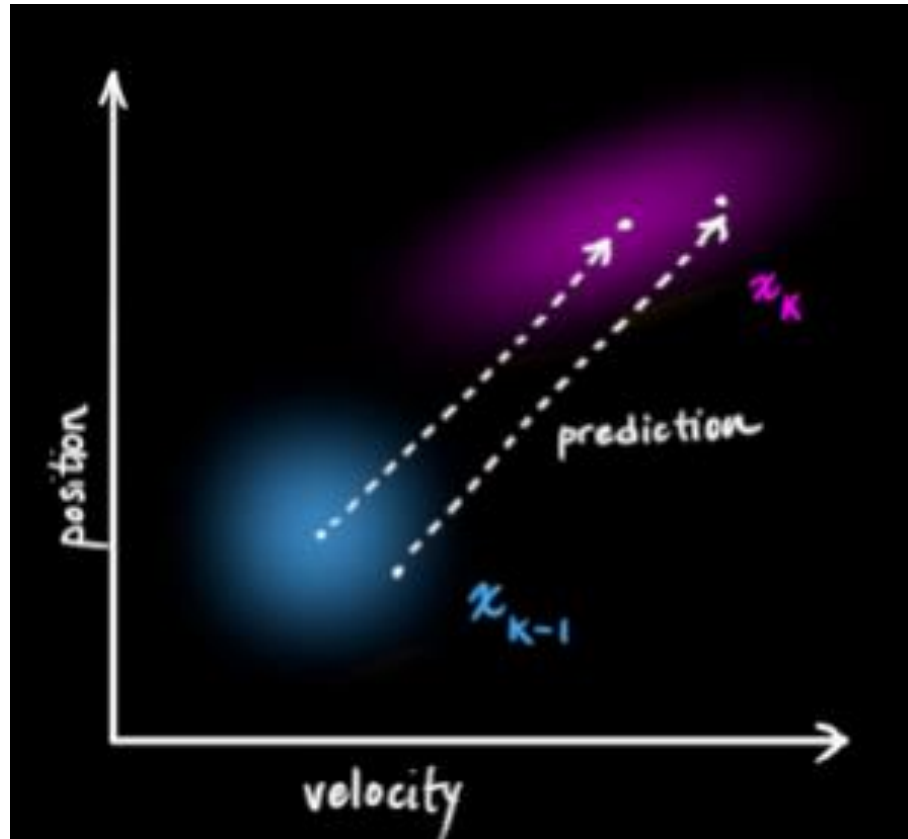
Correlated Variables & Covariance

Predicting Next State

Predicting Next State

$$\hat{\mathbf{x}}_k = \begin{bmatrix} \text{position} \\ \text{velocity} \end{bmatrix}$$

$$\mathbf{P}_k = \begin{bmatrix} \Sigma_{pp} & \Sigma_{pv} \\ \Sigma_{vp} & \Sigma_{vv} \end{bmatrix}$$

$$p_k = p_{k-1} + \Delta t v_{k-1}$$

$$v_k = \qquad\qquad v_{k-1}$$

In matrix form

$$\hat{\mathbf{x}}_k = \begin{bmatrix} 1 & \Delta t \\ 0 & 1 \end{bmatrix} \hat{\mathbf{x}}_{k-1}$$

$$= \mathbf{F}_k \hat{\mathbf{x}}_{k-1}$$

$$\hat{\mathbf{x}}_k = \mathbf{F}_k \hat{\mathbf{x}}_{k-1}$$

$$\mathbf{P}_k = \mathbf{F}_k \mathbf{P}_{k-1} \mathbf{F}_k^T$$