Kalman Filter Pick 6 questions, 1 pts per question

Question 1

LetLaTeX: \text{ $x\_t$} x t be the observation and LaTeX: s\_ts t be the state at time LaTeX: tt, which of the following statements about Kalman filter is FALSE?

The summation of LaTeX: P(x\_t|s\_t)P ( x t | s t ) over all the LaTeX: s\_ts t is 1

The summation of LaTeX: P(s\_{t}|x\_{0:t-1})P ( s t | x 0 : t − 1 ) over all the LaTeX: s\_ts t is 1

The summation of LaTeX: P(s\_{t}|s\_{t-1})P(s\_{t-1}|x\_{0:t-1})P ( s t | s t − 1 ) P ( s t − 1 | x 0 : t − 1 ) over all the LaTeX: s\_{t-1}s t − 1 is 1

Correct Answer

1, 3

only 1

only 3

2, 3

Question

Suppose the measurement model of a system is a linear function of the state plus noise: LaTeX: \mathbf{z = Hx + n}z = H x + n. If the difference between the expected measurement LaTeX: \boldsymbol{\mathbf{H}\mu\_{x}} H μ x and the actual measurement LaTeX: \mathbf{\bar{z}}z ¯ is zero, then the update step of the Kalman Filter will:

Change the mean but not the variance

Correct Answer

Change the variance but not the mean

Change neither the variance nor the mean

Change both

Kalman filter

Which of the following statements about Kalman filter is FALSE?

The estimated state LaTeX: s\_ts t is dependent on all the observations LaTeX: x\_{0:t}x 0 : t.

The state transition function must be linear or linearazible.

Correct Answer

The observation LaTeX: x\_tx t is dependent on all the states LaTeX: s\_{0:t}s 0 : t.

The measurement function must be linear or linearazible.

Question

Which of the following are TRUE about Kalman Filter

The update step of the Kalman Filter increases the variance/covariance of the Gaussian state estimate.

The propagation step of the Kalman Filter reduces the uncertainty of the state estimate.

The Kalman Filter is a good choice for problems where the distribution of your state estimate can be multimodal, i.e. in cases where there are multiple hypotheses that are equally likely, or more generally, multiple local maxima in the posterior distribution.

All of them

only 1

only 3

1 and 3

2 and 3

Correct Answer

None of them

Question

Suppose your prior distribution for a 1D random variable is LaTeX: x \sim \mathcal{N}(0, 10^{2} )x ∼ N ( 0 , 10 2 ). You obtain a measurement LaTeX: z=10z = 10. You know that LaTeX: z = x + wz = x + w, LaTeX: w \sim \mathcal{N} (0, 1^2 )w ∼ N ( 0 , 1 2 ). Which of the following statements are true about the posterior distribution LaTeX: x|z \sim \mathcal{N} (\mu, \sigma^{2} )x | z ∼ N ( μ , σ 2 ), i.e your updated belief?

LaTeX: \muμ is closer to 10 than to 1.

LaTeX: \mu = 0.5μ = 0.5

LaTeX: \sigma \in (1,10)σ ∈ ( 1 , 10 )

LaTeX: \sigma > max(10, 1)σ > m a x ( 10 , 1 )

LaTeX: \sigma < min(10, 1)σ < m i n ( 10 , 1 )

only 1

2 and 3

Correct Answer

1 and 3

only 3

2 and 5

2 and 4

1 and 4

Question

The Kalman Filter is optimal under certain assumptions. In what sense is it optimal?

In terms of the number of computations used

With respect to the number of lines of code needed for the algorithm

In terms of the number of iterations needed to converge.

In terms of the L2 error of the estimated state

only 1

1 and 4

3 and 4

Correct Answer

only 4

Extended Kalman Filtering Pick 2 questions, 1 pts per question

EKF

Which of the following is true about Extended Kalman Filters?

The true function modeled by an EKF is usually bounded on either side by the approximation

Correct Answer

One limitation of EKFs is in dealing with fast-changing non-linearities

EKFs solve all issues with the original Kalman Filter formulation

Extensions to EKFs do not exist yet

Question

Which of the following are TRUE about EKF

The Extended Kalman Filter is an optimal estimator

The Extended Kalman Filter is a good choice for problems where the distribution of your state estimate can be multimodal, i.e. in cases where there are multiple hypotheses that are equally likely, or more generally, multiple local maxima in the posterior distribution

When the dynamics model and the measurement model are linear functions, the Extended Kalman Filter and the Kalman Filter are identical.

All of them

2 and 3

Correct Answer

only 3

only 1

1 and 3

None of them

Particle Filtering Pick 2 questions, 1 pts per question

Question

The particle filter has which of the following advantages over the Kalman Filter or EKF:

It allows for estimation of non-Gaussian probability densities

It allows for multi-modal predictions of the state

It needs resampling to work reliably

Discretizing the state spaces makes it less computationally expensive

1, 3, 4

only 1

only 3

All of them

Correct Answer

1, 2, 3

Question

Which of the following about particle filtering is CORRECT

For nongaussian noise, or nonlinear state or observation equations, the iterative state estimate rules for Kalman filters quickly become intractable.

Particle filters guarantee an accurate estimate of the a posteriori probability distribution for the states,

Particle filtering dynamically discretizes the state space at each time step, to keep the computation tractable

Once discretized, the state space remains discrete and no further discretization is necessary

Correct Answer

1 and 3

2 and 4

2 and 3

3 and 4

only 3

only 4