Filtering Workout

1. introduction probabilities
2. define operations in probabilities (marginalization, conditioning, ...)
3. implement an dynamic system model only on "basic" operations of probabilities distributions

↓ not dependent on distribution type

4. histogram + Gaussian + particles = set samples ([how to represent probabilities distributions])

μ, σ ⇒

n, Ω ⇒

sigma points

Kalman filter, UKF → particle

(state, measurement, control, transition, observation)

1 determine | state, controls, measurements → transition function, observation → representation of the state in vector ⇒

5. Data association: gating, best, closely friends

However we ignored several things | image manipulation ... → feature extraction

Landmark initialisation

e.g., in the bearing-only case ⌣ only observe angle, not distance!

until no landmark ⇒ no data association

until no position-info ⇒ landmark does not have enough information

⇓

we need full characterisation of the landmark!

1 possibility: accumulate all possible readings of landmark

⇓

triangulation

⇕

we have to delay the initial start of the filter

LEAST-SQUARES: FROM THEORY TO PRACTICE

(special lectures for students)

Exercise:

EKF with bearing-only observations w/ and w/o data association

→ need additional filtering approaches → on the web?...

Which filter to use and when?

(specially, in data association)

- Gaussian — decent initial guess / when we can achieve initial guess; very simple, often Gaussian assumption approximate well ⇒ NOT ALWAYS
- histogram — low-dimensional, discrete (domain), cardinality of state is minimal
- particles — dimension ~ } may be good idea, if 99 dimension ⇒ 9999 particles

  ↳ there are variants
  - multi-hypothesis Kalman filter
  - if state space has special structure, describe part of state / sub-state described by a sample space ⊕

  Rao-Blackwellized PF ≡ a sample space ⊕ ⊕ remaining part described by a Gaussian