

Probabilistic Robotics Course

Course Map

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What will I learn?

Tools

- Filtering tools
 - Discrete
 - Gaussian
 - Particle
- Maximum Likelihood Estimation
 - Gauss-Newton
 - Sparse Least Squares
- Data Association
 - Greedy
 - Voting Schemes
 - Spectral Methods

Applications

Calibration

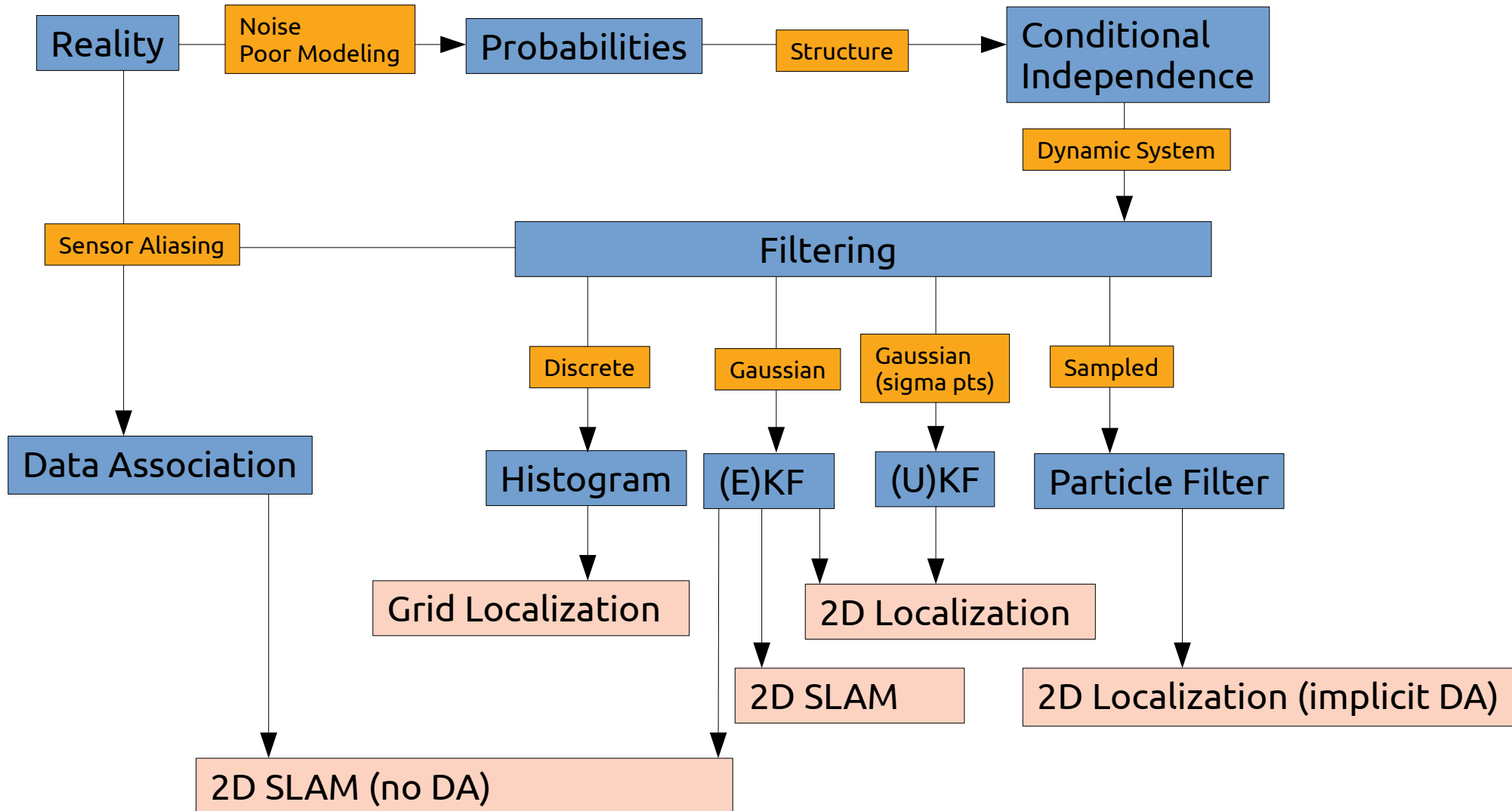
Tracking

Localization

Mapping

SLAM

Wrapup



*2D Problems include Bearing only version

Filtering: Methodology

Qualify the spaces (domain and parameterization)

- State
- Controls
- Measurements

Qualify transition function: how to move to next state

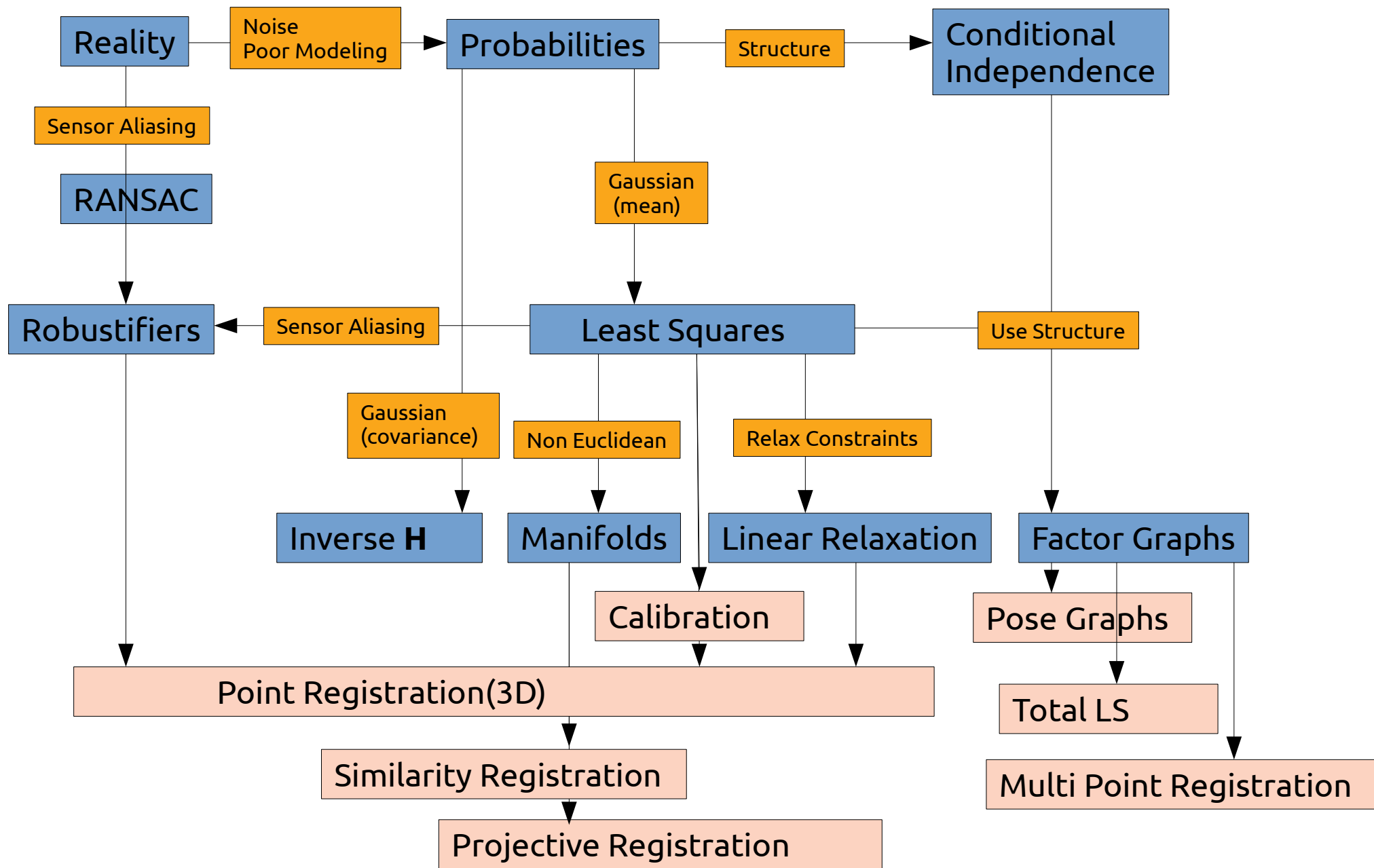
Qualify the measurement function: how to predict the observations?

Questions

- Are the parameters conformant with the operations of the filter ($h(x)-z$) and $x+dx$? Do I need normalizations?
- Is the state rich enough?
 - To predict the transition
 - To compute the measurement

If not, what should I add?

Wrapup



LS: Methodology

State space **X**

- Qualify the Domain
- Define an Euclidean parameterization for the perturbation
- Define boxplus operator

Measurement space(s) **Z**

- Qualify the Domain
- Define an Euclidean parameterization for the perturbation
- Define boxminus operator

Identify the prediction functions **h(X)**

Define the error functions **e(X)**

RANSAC: Methodology

- Define:

- A procedure to seek for correspondences (the better the procedure, the less iterations N are needed)
- A procedure to smartly select a set of pseudo-random set (worst case: uniform) between candidate correspondences
- A procedure to compute a solution, immune to poor initial guesses
- A procedure to count the inliers

Analysis

What are the weak points of my system?

- Suffers from high noise
- Sensitive to outliers
- Sensitive to poor initial guess
- Breaks if there are under determined variables

What are the possible workarounds?

- Is it worth to seek for workarounds or should I design the system based on a different concept?

Recommendations

Visualize the data

The error in zero should be zero

The easiest a function, the more likely to make an error

Don't write all on paper and implement all at once