

Block Online Expectation Maximization for the SLAM problem

Gersende Fort

LTCI, CNRS & Telecom ParisTech, France

Joint work with Sylvain Le Corff and Eric Moulines.

Work supported by the French National Research Agency under the program ANR-07-ROBO

SLAM: Simultaneous Localization and Mapping

- **Goal:** in the landmark-based SLAM, a robot has to simultaneously (a) localize static landmarks and, (b) estimate its position.
- **Classical approach:** Introduce a linear Gaussian Hidden Markov model (HMM) where the hidden state both contains
 - a dynamic component: the position of the robot at the current time,
 - a static component: the collection of the positions of the landmarks.
- **Extensions:** How to solve the SLAM problem
 - i) when a **linear Gaussian** HMM is a poor model for the data
 - ii) in order to avoid degeneracy of the filters due to the **static** component?
- **Our answer:** the map is a **parameter** of the **non linear and non gaussian** HMM with hidden state collecting the position of the robot.

↔ How to solve **online** inference in non linear and non Gaussian HMM?

Block Online Expectation Maximization algorithm

We propose a new algorithm

- based on **EM** for solving inference in models with latent variables,
- combined with **Particle Filtering**, for solving the E-step in (non linear non Gaussian) HMM with general state space,
- which is an **online** algorithm: each observation is used only once and need not to be stored.

and illustrate its behavior when applied to the SLAM.

↪ **Poster # 12**

Out of the scope of the poster but available: characterization of the limiting points of the algorithm as the stationary points of the limiting normalized log-likelihood of the observations.