Cognitive Robotics

Assignment 7

7.1) Consider two features f_1 and f_2 extracted from an observation z_t, and a map $m_t = (l_1, l_2, l_3)$ with three landmarks. An assignment Ψ associates each observed feature f_i to a map landmark l_j, or marks it as a false detection or as a new landmark.

(a) Write down all possible assignments for the two observed features f_1 and f_2 and the three map landmarks l_1 ... l_3. Note that in an assignment an observed feature can be associated to at most one map landmark.

6 points

(b) Suppose now that for a given assignment, every observed feature marked as a new landmark is added to the map. For each map m_{t+1} derived from the assignments in (a), write down all possible assignments for a singe feature f_3 extracted from the observation z_{t+1}.

4 points

7.2) In bearing-only SLAM, the initialization of new landmarks (mean, covariance) is difficult, because the robot can only measure the angle between its orientation and the landmark, but not the landmark distance.
Find a method in the literature that has been proposed to overcome the 'delayed initialization' problem. (Hint: Perform undelayed initialization).

5 points

7.3) Consider FastSLAM with a 6D robot pose (3 position coordinates, 3 rotation coordinates) and M 3D landmark positions. How many independent variables are needed to represent the state and its uncertainty?

5 points