Multiple UAVs Sensor Optimization

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Introduction

My project is about **Detection Theory**:

Several cameras scan a unknown map, to find targets.

The detection algorithms extract feature points (edges, corners…) and process a binary representation of the possible targets location. False alarm probabilities and prior number of targets are unknown.

Three sub problems solved:

- Probabilities problem

- Two independent assets with a unknown probability to say the truth focus on the same environment
- ***Goal***: How find out the number of targets?
  How far each observer can be trusted?

- Simultaneous localisation and mapping (SLAM)

- A pltatform moves upon a binary unknown pattern
- ***Goal***: How simultaneously recover the pattern and the platform position?

- Targets tracking

- Three cameras in a cluttered environnent, with occlusion
- Ponctual targets, brownian movment. Targets can appear or disappear
- ***Goal***: Track targets

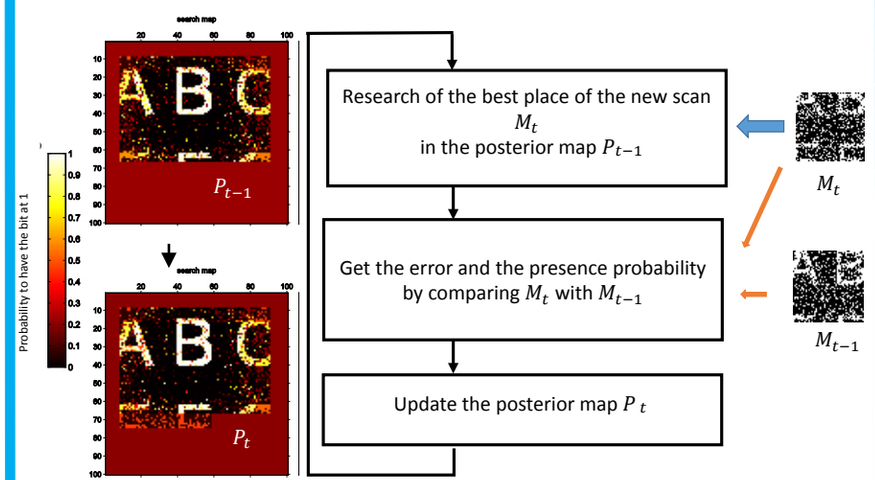
Approach to Problem

- Bird nests counting

- A potential nest by tree at most. Two independant observers with a unknown probability to say the truth report a nest map. Binary map (1 for a nest)
- Assumption on their measures at each tree m_i:
- $m_i = b \oplus e_i = b.\overline{e_i} + \overline{b}.e_i$ (*)
  - b true presence of nest
  - e_i The mistake made if at 1

- Simultaneous localisation and mapping

- Bayesinan Filter:



- Targets tracking

At each time step, three reports like that:

- Particle filter

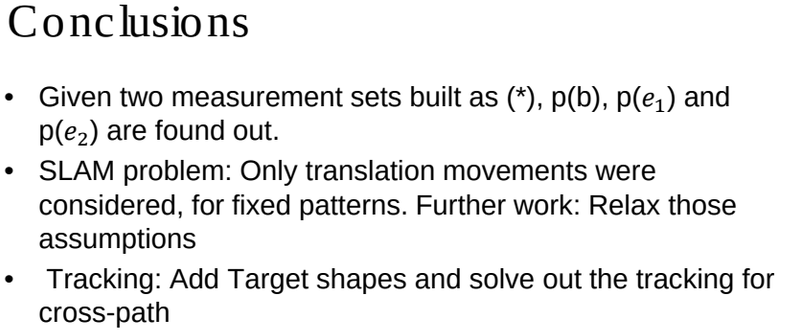
Summary of Results

- Bird nest counting

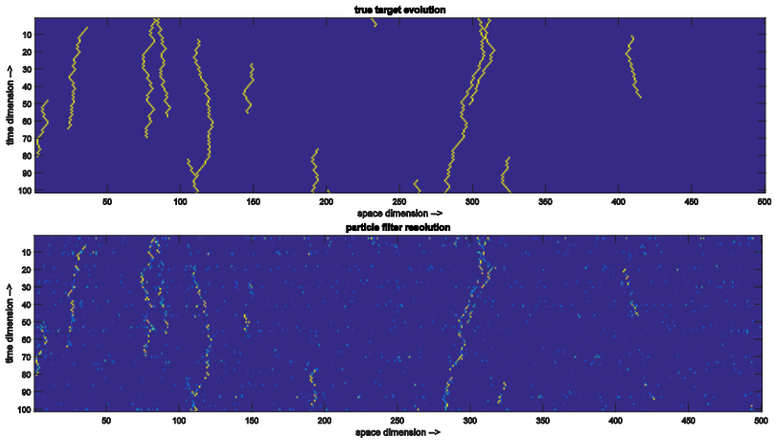
Observer	1	2
Nests counted	178	120

	True value	Estimate (68% of confidence)
Number of nests	50	52±38
Detection probabilities	0.81±0.06	0.8
	0.7±0.04	0.7

- Simultaneous localization and mapping



- Targets tracking



Conclusions

- Given two measurement sets built as (*), p(b), p(e_1) and p(e_2) are found out.
- SLAM problem: Only translation movements were considered, for fixed patterns. Further work: Relax those assumptions
- Tracking: Add Target shapes and solve out the tracking for cross-path