
workshop

Inside Data Association

plenary discussion

The data-association problem:

Can we solve it? Can we circumvent it?



UNIVERSIDAD DE
ZARAGOZA



Universität Bremen



SFB/TR 8
SPATIAL COGNITION

Question Areas

Questions we received span four areas:

- **Problem characteristics**

What are appropriate problem definitions?

- **Modeling**

What are universal approaches, what are their parameters?

- **Evaluation**

What does good performance mean, how can we measure it?

- **Using DA**

How to incorporate DA into Gaussian SLAM?

Problem Characteristics

DA is employed in different tasks:

- Active vs. passive DA
 - Can we exploit coarse knowledge, e.g., disjunctive associations?
 - Do we need to compute “best” match only, or 2nd best etc. too?
How to undo DA decisions?
- ~> What are similarities of these varieties, what are their differences?

Modeling

Concrete aims of DA and the knowledge used to achieve these aims

- Are there universal strategies?
- Feature configuration knowledge
How can we distinguish features purely by their local arrangement?
- Association criteria
What are sensible criteria? Are there counterexamples? Can DA be decided correctly at all?

Evaluation

Benchmarking, setting realistic aims

- Strategy evaluation

What are the tradeoffs between e.g., JCBB and RANSAC based approaches?

- Realistic aims

Is it actually decidable which solution is best?

- Quantitative measures

Should we have benchmark data sets? If so, which?

Using DA (in Gaussian SLAM)

- Representing DA uncertainty
- Which hypotheses need to be maintained, how to update Gaussians most efficiently?

~> For the discussion, we propose focusing on the fundamental question areas **evaluation**, **modeling**, and **problem characteristics**

Questions en détail: evaluation

- How can we evaluate DA performance, particularly considering ambiguities?
- Is it worth having a benchmark data set?
- How can we compare different methods? (feature based vs. whole image, JCBB vs. RANSAC)?
- Is it actually decidable which solution is best for DA?
- Do we look for the **best** or the **right** solution?

Questions en détail: modeling

- What is the best way to characterize the local arrangement of point landmarks that have no distinguishing features of their own?
- Is it possible to prove that a DA match is unique considering (large-scale) self-similar environments?
- Are there ill-posed examples where a reasonable DA criterion would result in a solution which is definitely wrong?
- Which kind of background knowledge do we want to use in our DA algorithms?
- Is there a “universal” data association strategy independent of application/sensor setup?

Questions en détail: problem characteristics

- If we know it was feature A **or** B , can we exploit that information without spawning two hypotheses (in particular, if A and B are close) ?
- How to undo an already made association in the context of SLAM?
- Should one rather take decisions generously and undo wrong decisions later or be cautious and in case of doubt prefer to view 2 features as distinct?
- How to generate actions that could confirm already made data associations?

Questions en détail: Using DA (in Gaussian SLAM)

- How to decide how many potential DA hypotheses should be maintained in parallel?
- Can two modes of a Gaussian corresponding to two DA hypotheses be joined into one Gaussian in a “conservative” way?
- How to represent that a somewhat uncertain data association decision has been made? Is that a prerequisite for undoing decisions?
- Is there a cheap multihypothesis solution for Gaussian SLAM?