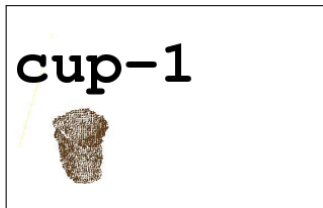


Probabilistic Multiple Hypothesis Anchoring

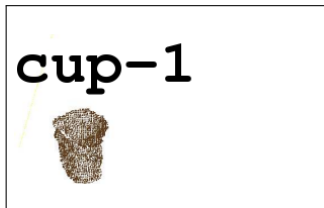
Jos Elfring
Sjoerd van den Dries

September 25, 2011

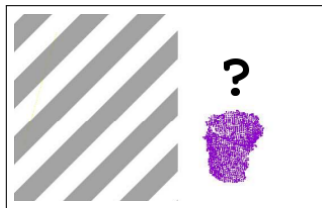
Workshop on Knowledge Representation for Autonomous Robots



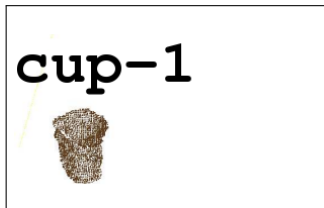
$k - 1$



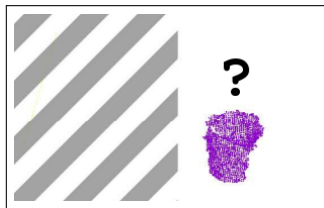
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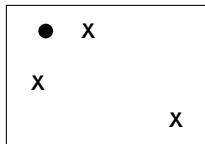
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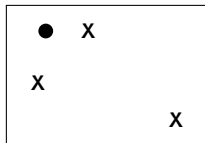
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- ▶ A **world model** is needed to deal with the uncertainties in unstructured environments

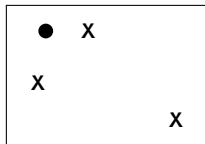
- ▶ Data association in presence of:
 - Unknown and varying number of objects
 - Dynamic scenarios
 - Inaccurate, false and missed detections



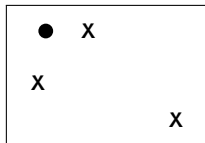
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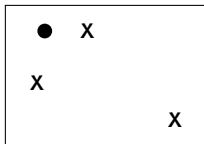
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- ▶ Exploiting (object specific) prior knowledge
- ▶ Probabilistic framework to deal with uncertainties



Inspired by:

- ▶ Multiple Hypothesis Tracking
 - Reid (1979)¹, Cox & Hingorani (1996)²
- ▶ Anchoring
 - Coradeschi & Saffiotti (2003)³

- ¹ D. B. Reid, An algorithm for tracking multiple targets, IEEE Transactions on Automatic Control AC-24 (6), (1979), pp 843-854
- ² I. J. Cox, S. L. Hingorani, An efficient implementation and evaluation of reid's multiple hypothesis tracking algorithm for visual tracking, IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 18, (1996), pp. 138-150
- ³ S. Coradeschi, A. Saffiotti, An introduction to the anchoring problem, Robotics and Autonomous Systems 43, (2003), pp. 85-96

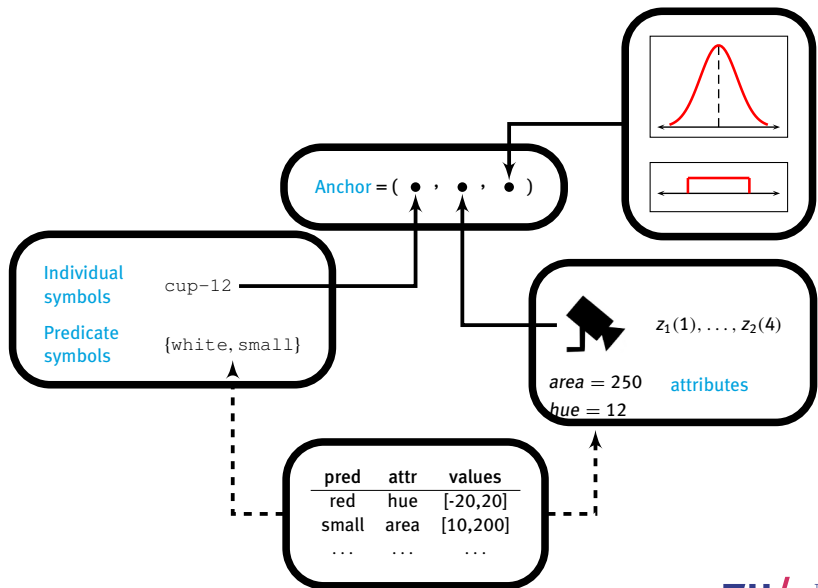
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- ▶ *Predicate grounding relations* link attribute values of measurements to predicate symbols



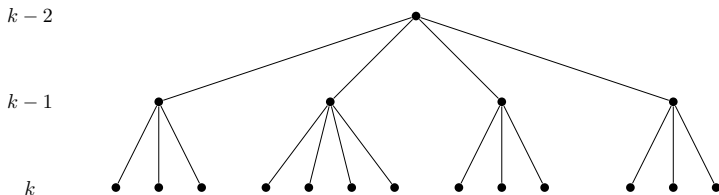
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All possible associations are considered \rightarrow hypothesis tree:



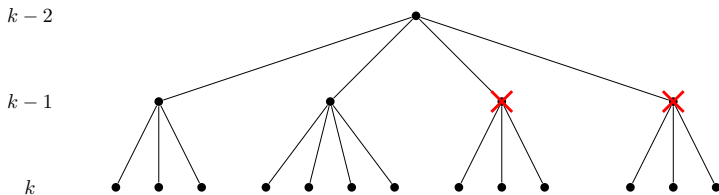
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- ▶ How often are false positives detected? **Reliability object detector**

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 - ? "How many cups on the table"
 - › 3 ($p = 0.8$) or 4 ($p = 0.2$)
 - ? "Where is John's cup"
 - › On the table ($p = 0.75$) or on the sink ($p = 0.25$)

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Future work:

- ▶ Preparing ROS implementation
- ▶ Extend, learn, share probabilistic models

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