

# Towards Context-Aware User Guidance in Smart Environments



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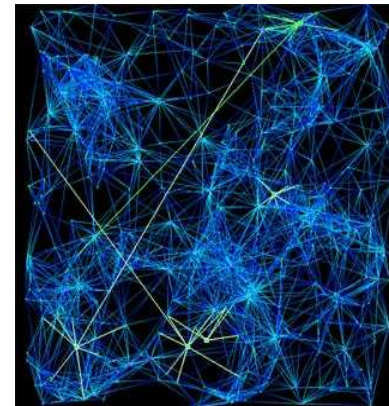


# Agenda



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- Vision
- SmartProducts
- Smart Interactive Guidance
- Problem Statement
- Sketch: Approach
- Conclusion

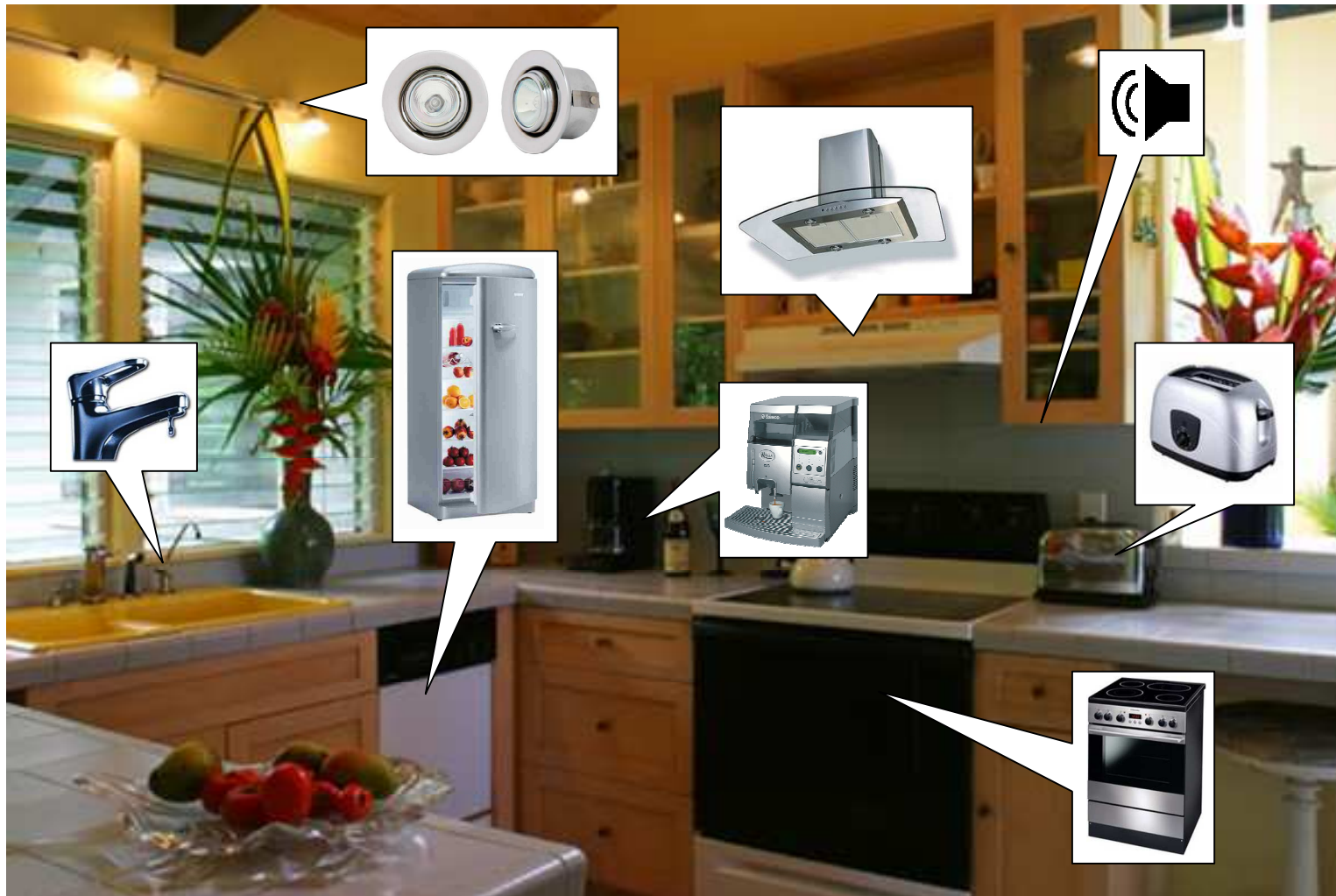




# Vision in UbiComp

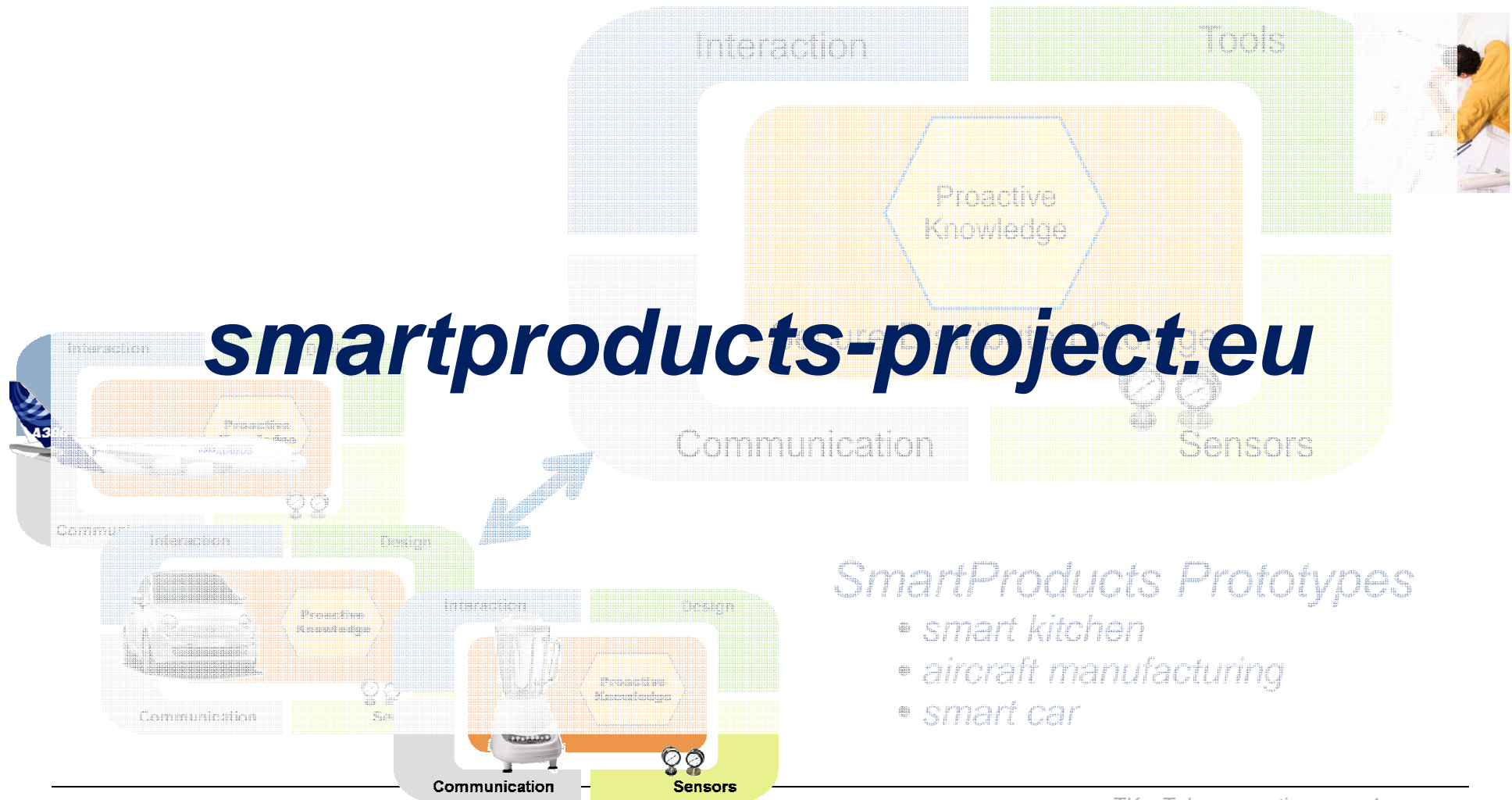


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# SmartProducts Software Platform





- **Products are getting very complex**
  - Not only novice users might be overwhelmed
  - Not everything might be automated



- **Actively support users with their task**
  - Instructions
  - Observation
  - Automation







## ▪ Smart Factory

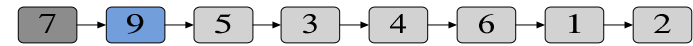
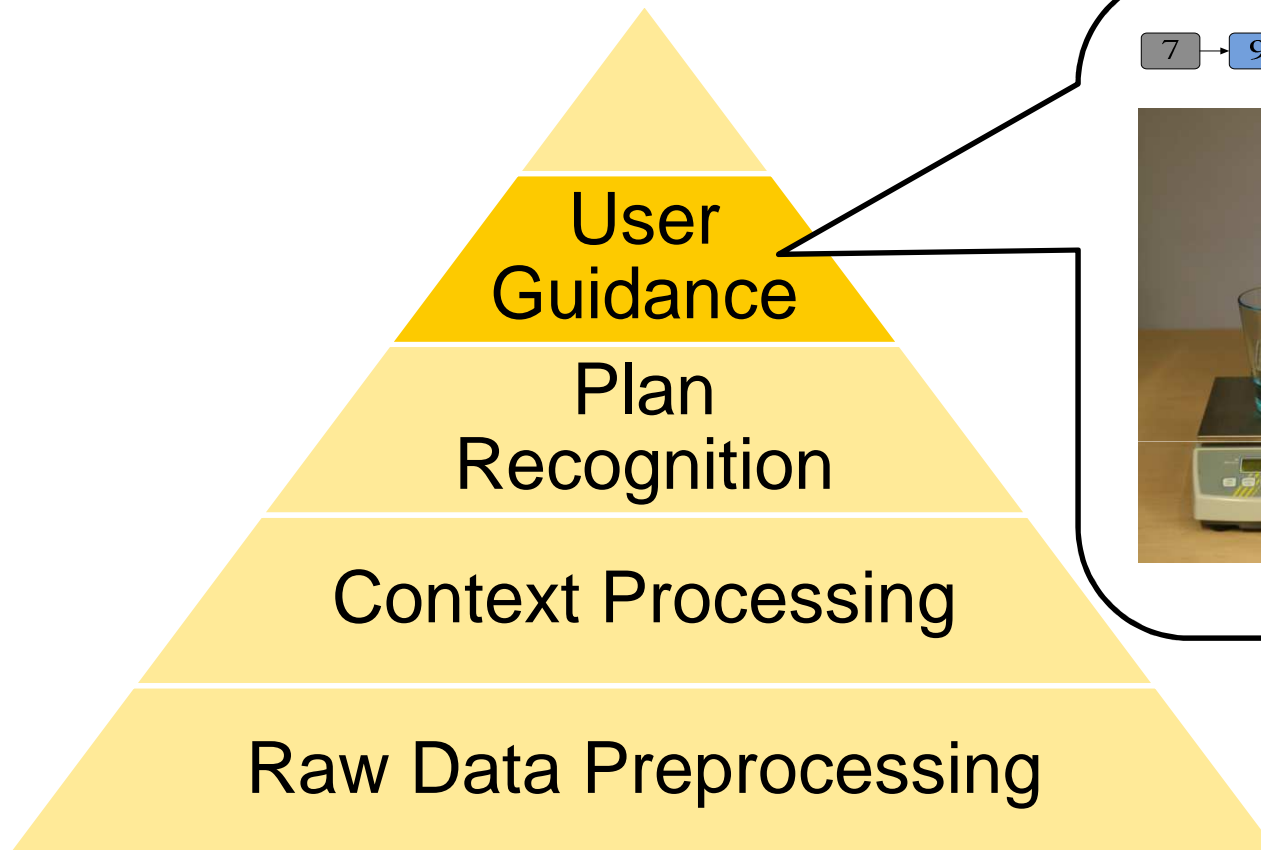
- Machine Configuration
- Quality Control
- Guidance
- ...

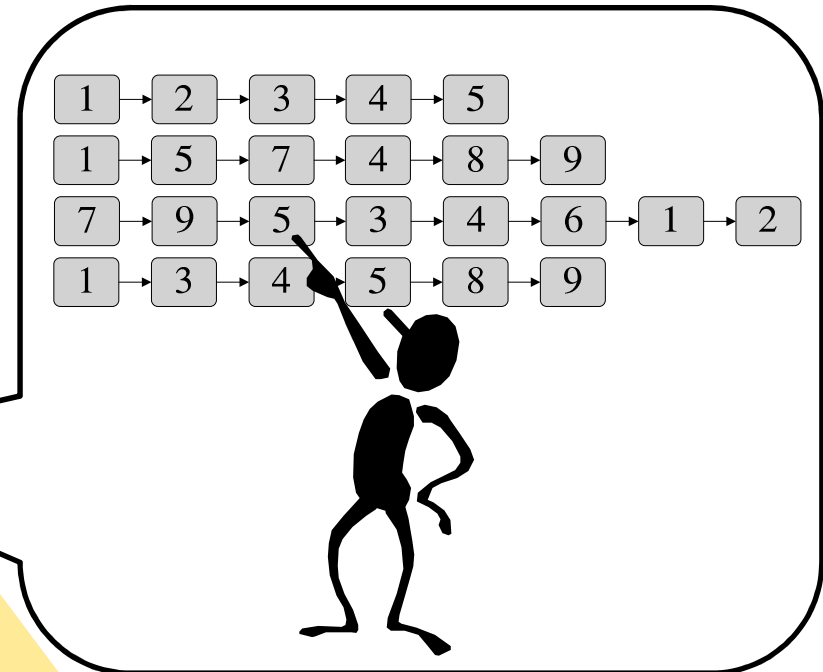
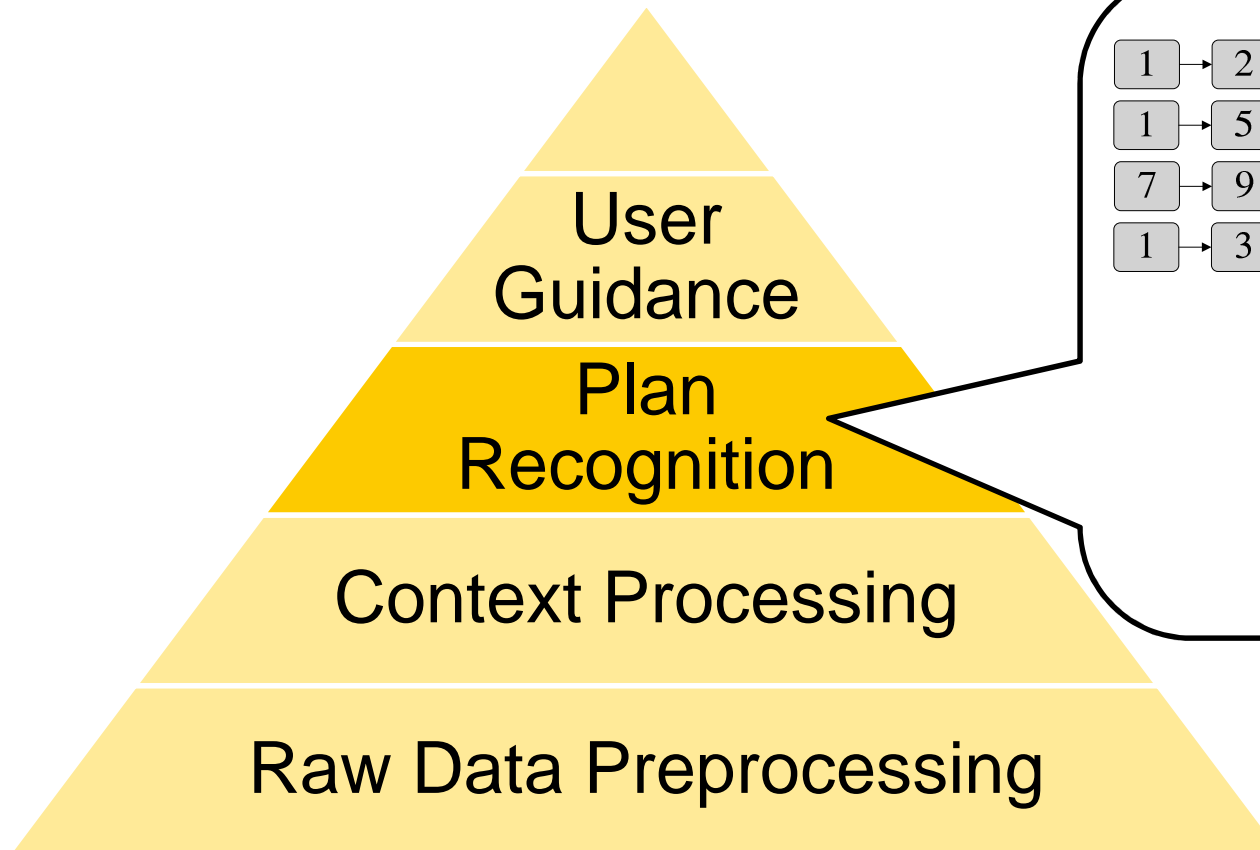


## ▪ Smart Home Environments

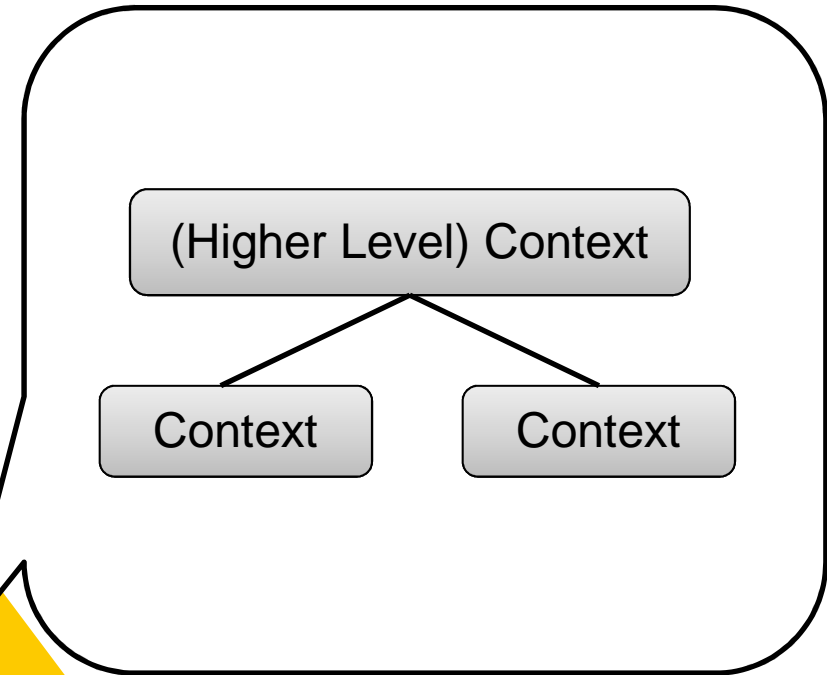
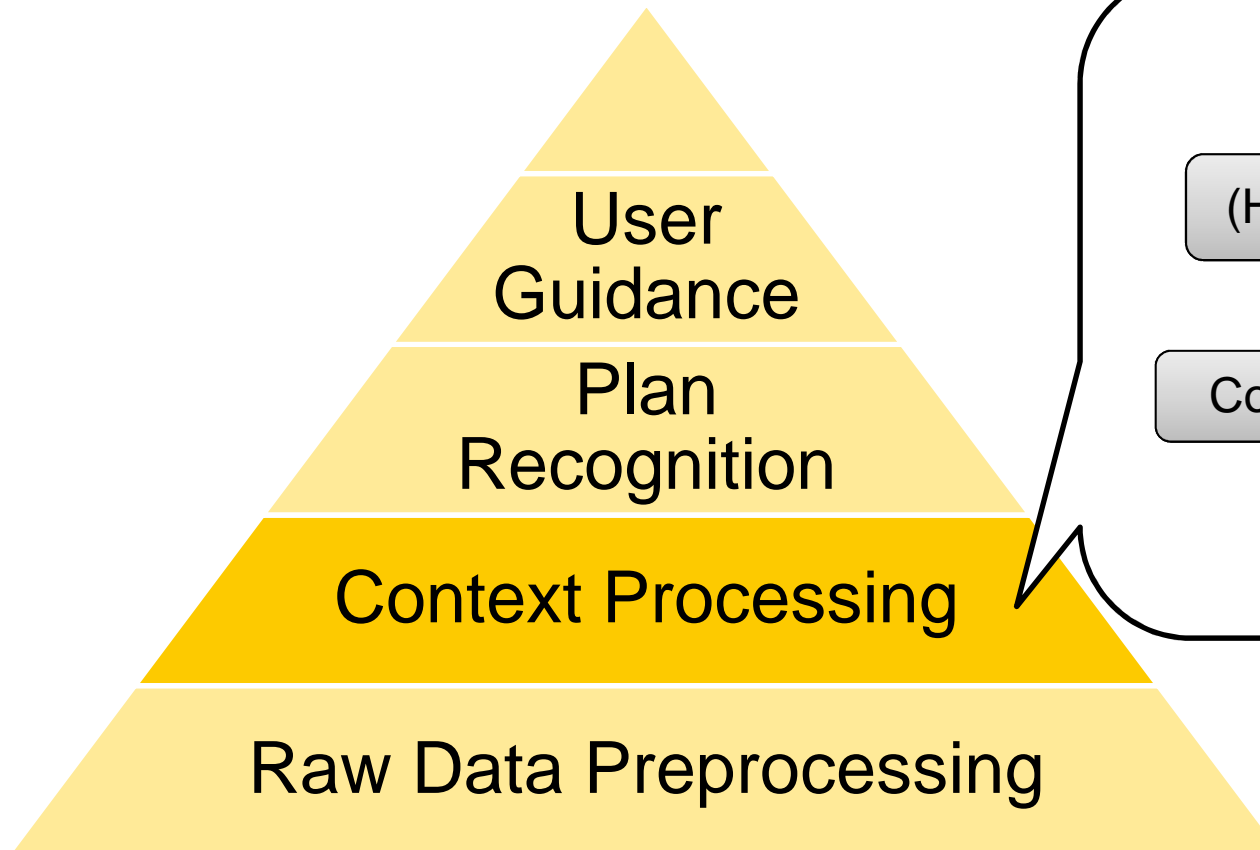
- Entertainment
- Energy Management
- Support / Ease of work
- ...

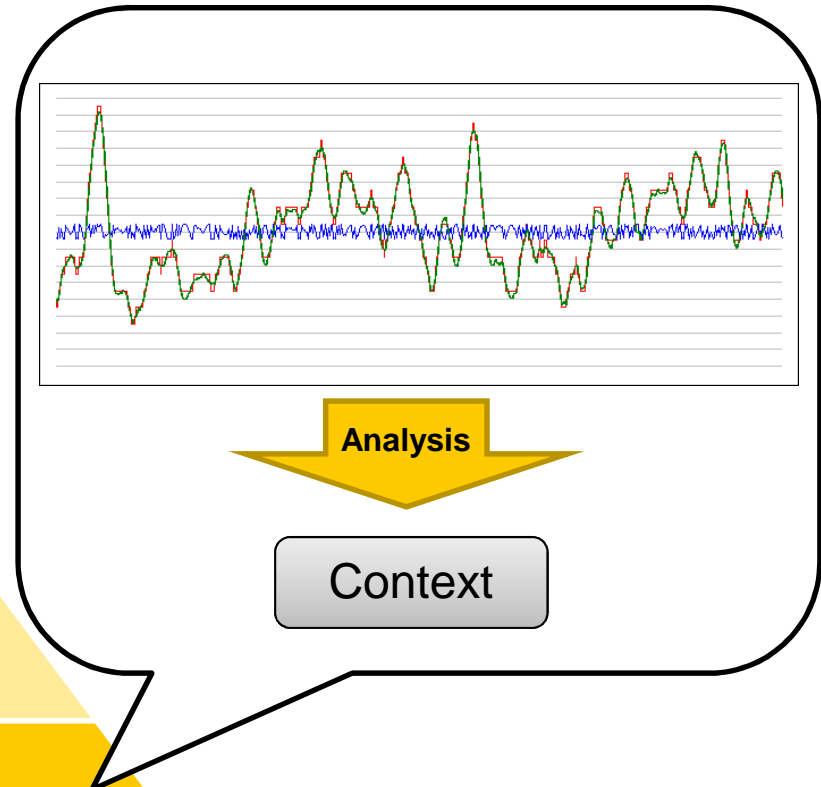
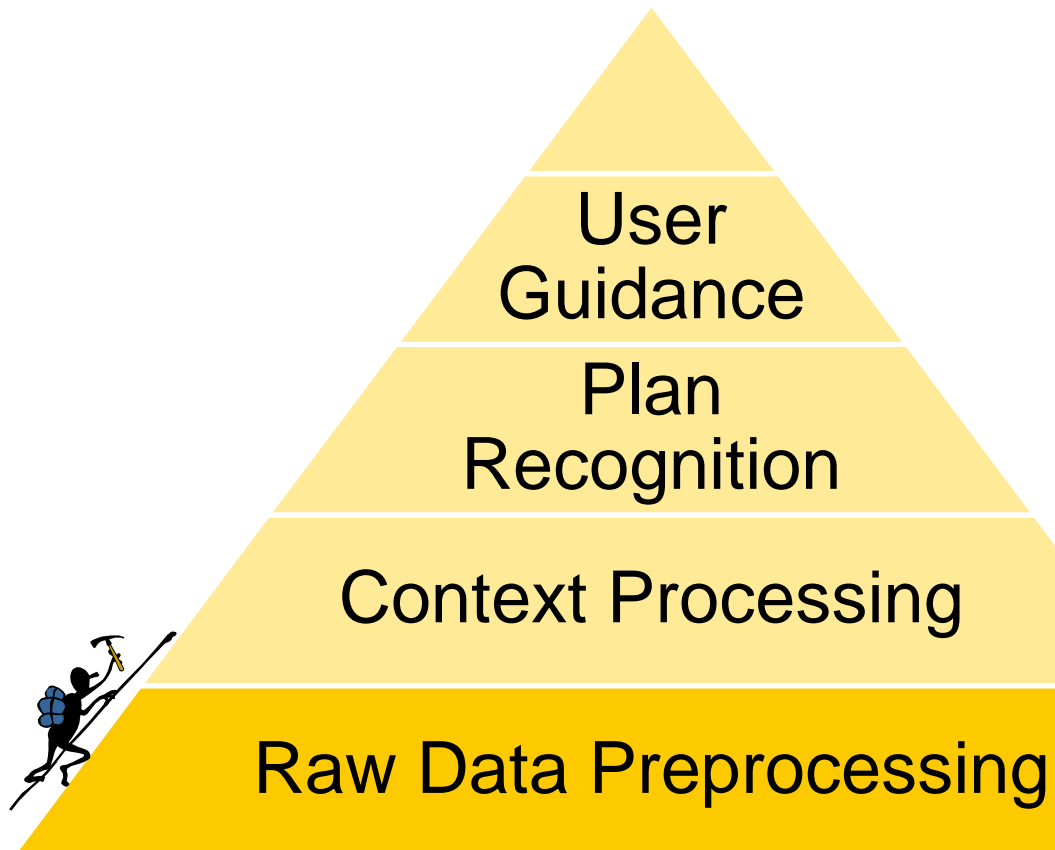














## 3 Critical Open Problems



### 1. The Problem of Modeling and Learning

- Model-Based
  - Predictable
  - Limited flexibility
- AI-Planner-Based
  - „Half-Unpredictable“
  - Flexible
  - Very hard to design
- Learner-Based
  - Unpredictable
  - High effort for labelling
  - Highly dependent on user and environment
  - Hard to generate guidance UIs



### 2. Coping with User Actions

- Users might deviate from the proposed solution
- Activity recognition unreliable

### 3. Recognizing Concurrent Processes

- Problem of assigning events to processes / users

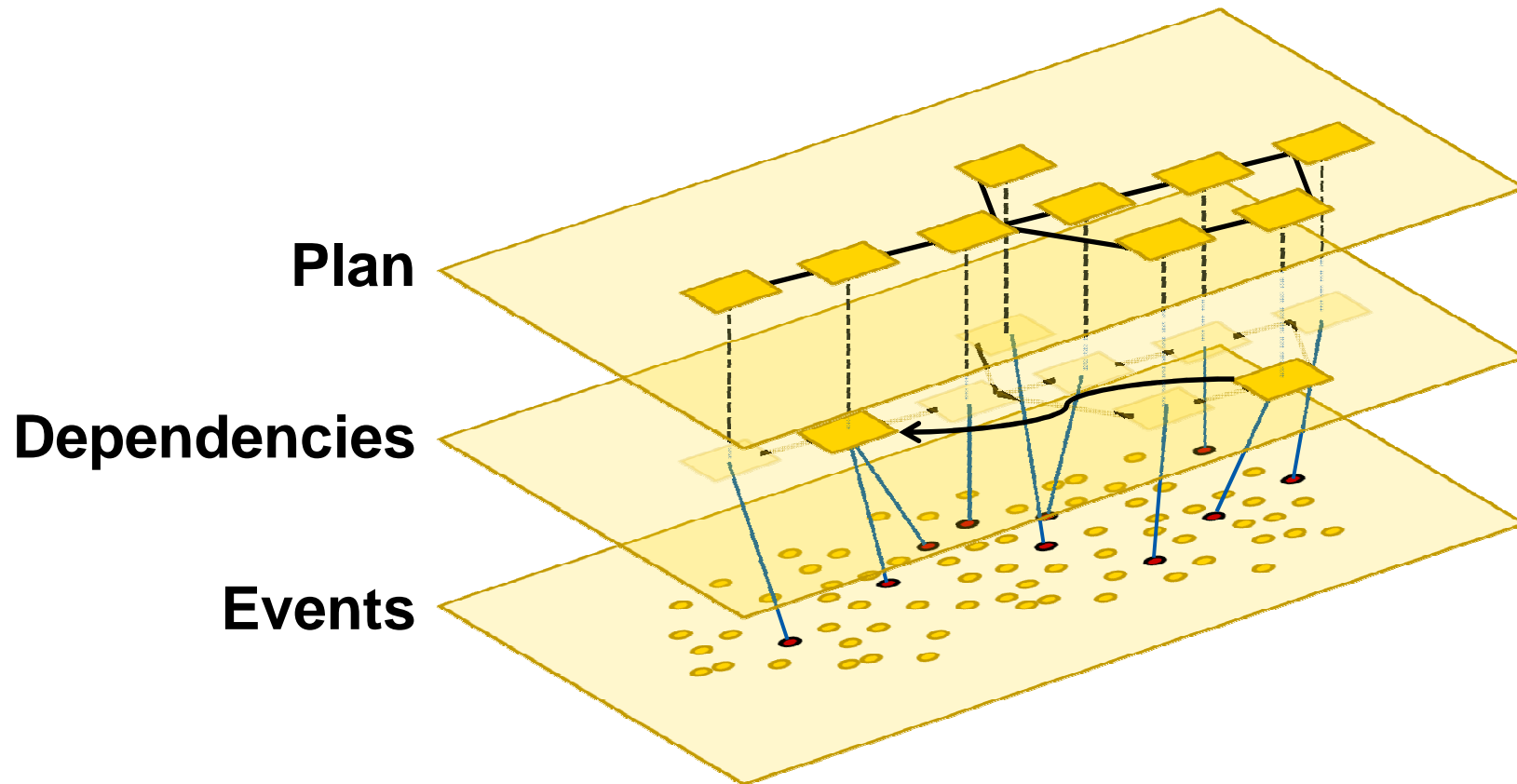
**Focussing on these two problems**



# Plan Recognition



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## ■ Problems with plan recognition: Uncertainty

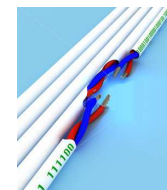
- Plan context **footprint** might vary

- **Which user** processed an activity



- **Activities** (e.g. cutting or hacking)

- **Hardware problem** (sensor, network)



- Users find solutions **not foreseen** by designers







### ▪ Increase plan state recognition

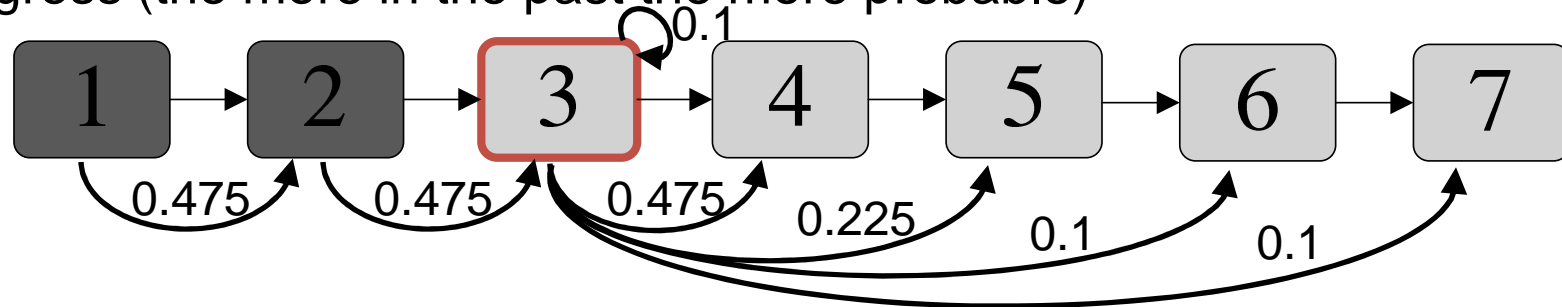


- Generate **sets** of possible plans (logically correct for the system)
- **Adjust** these behaviors for more flexibility (maybe logically incorrect)
- AT runtime evaluate which behavior is **most probable**

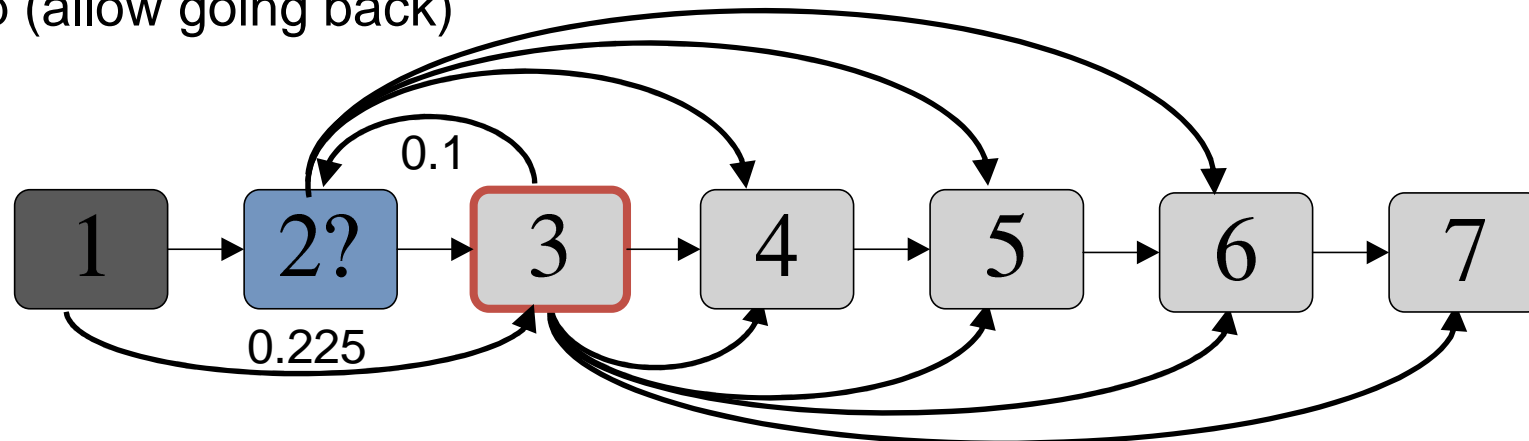


## ▪ Probabilities to skip change on

- progress (the more in the past the more probable)



- skip (allow going back)

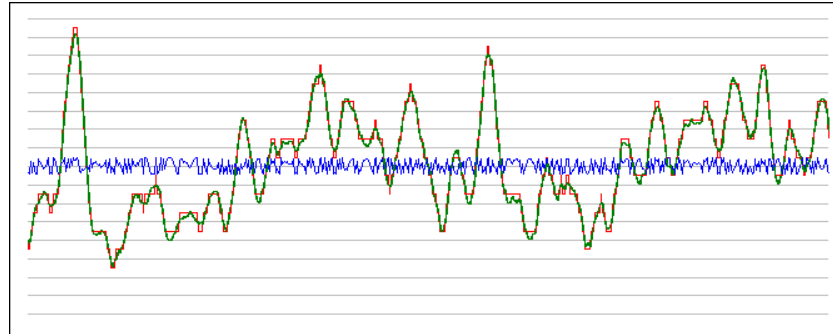




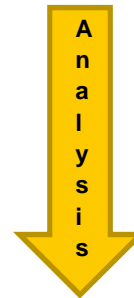
# Traditional Activity Recognition



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Support: improve recognition



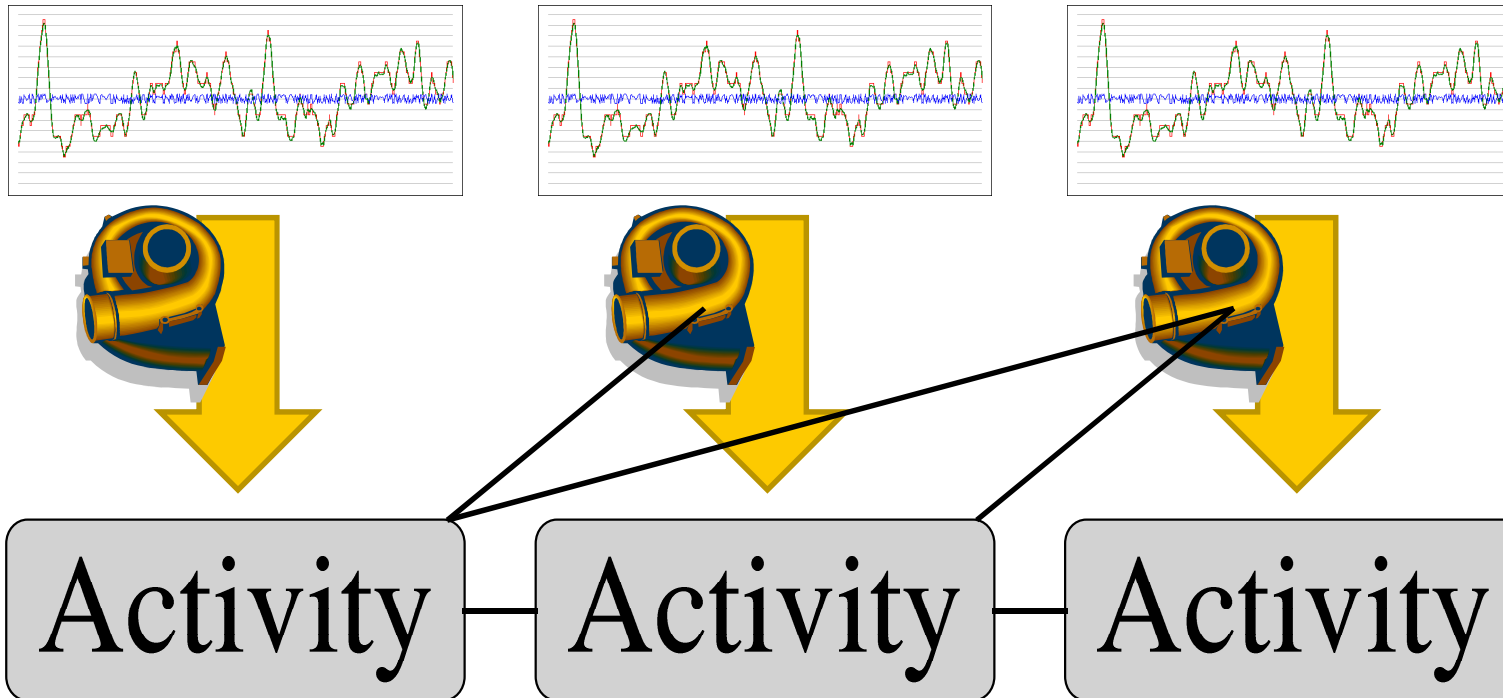
Activity



## Bijjective Recognition?



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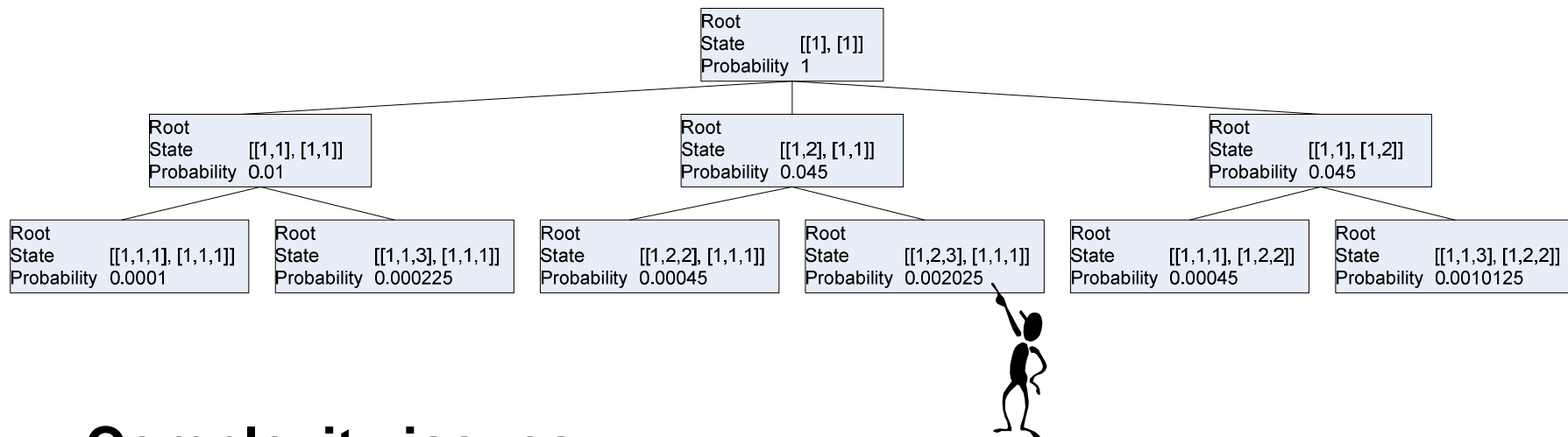
- **For activities that are hard to...**
  - distinguish
  - correlate



- **OK for one process**
- **What with different processes?**
  - Exclusive events
  - Optimization problem
- **What with different users?**
  - Basically the same



## MultiDimensional Tree (MDT)



## Complexity issues

- MDT only for processes-of-interest
- Pruning
- Preprocessing of context (clustering)





- **Especially „expert“ users never do what you tell them.**
- **Human instructor can adapt**
  - An Aml system must also be able to adapt!
- **No final / „efficient“ solutions**
  - How to model „behavior“
  - How to recognize best what the user does



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# Thank you!

**QUESTIONS – SUGGESTIONS – DISCUSSION**