

Conversational Process-Oriented Case-Based Reasoning

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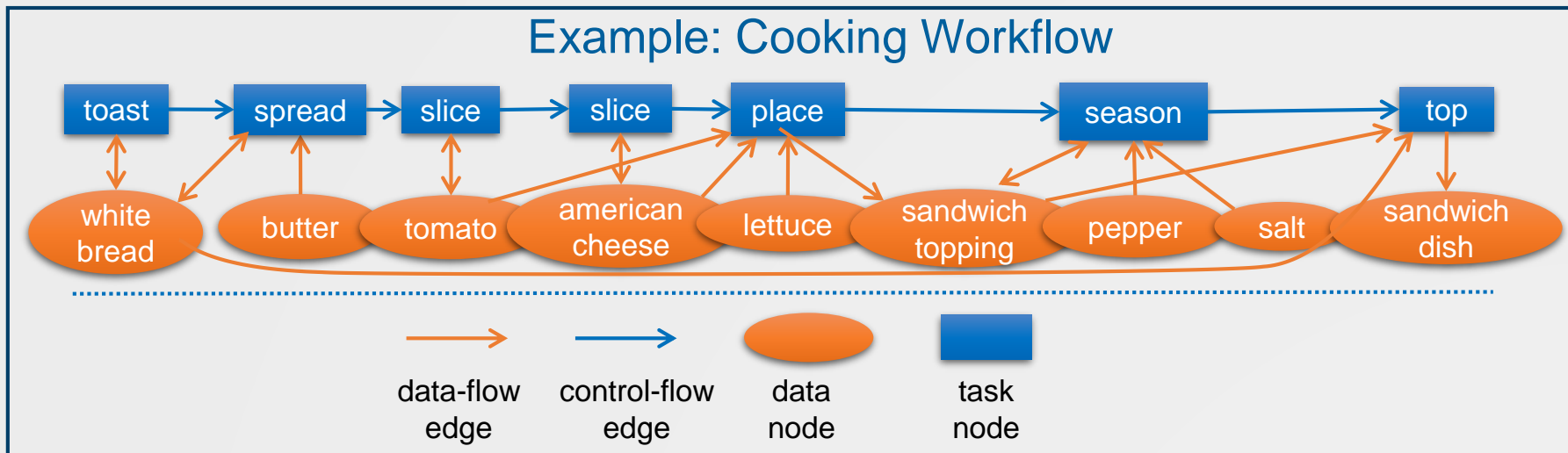
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Workflow Retrieval with Process-Oriented Case-Based Reasoning (POCBR)

- Integration of CBR with Process-Oriented Information Systems
- Cases are workflows, typically represented as graphs



- Formulating queries can become quite difficult
 - Requires understanding of the ontology
 - Requires an understanding of the desired result
 - Requires to provide a sufficient level of detail

Improving Workflow Retrieval

- Conversational CBR introduces user dialog into the CBR cycle
 - User poses an initial query only
 - Query is refined/extended in subsequent questions
 - After each question, possible solutions are shown
- Research Goal: Conversational Approach for POCBR
- Reduce communication effort for users during retrieval
 - Pose relevant questions in an appropriate order
- Avoid an increasing maintenance effort for case authors
 - Create questions automatically from the workflow repository

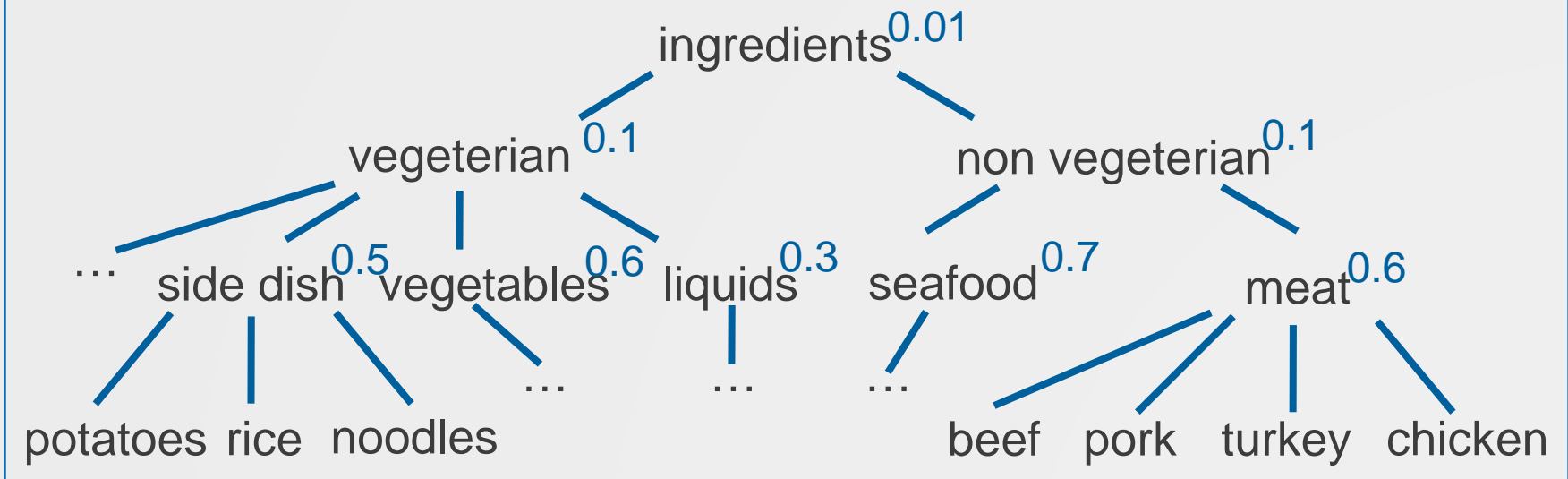
Outline

1. Workflow Retrieval in POCBR
2. Conversational POCBR
3. Experimental Evaluation
4. Conclusions

Domain Ontology

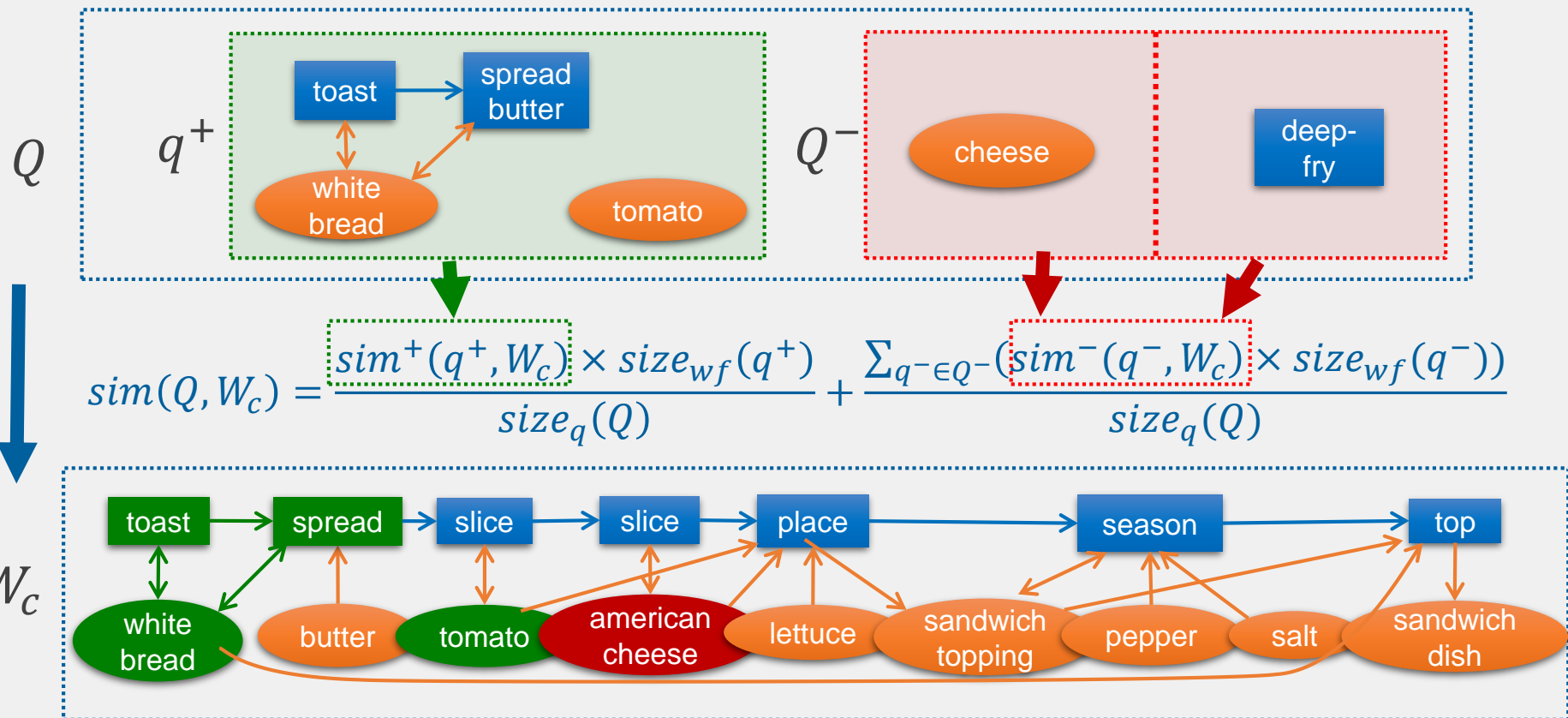
- Task taxonomy
- Data taxonomy

Example: Data taxonomy of ingredients



Workflow Query and Similarity

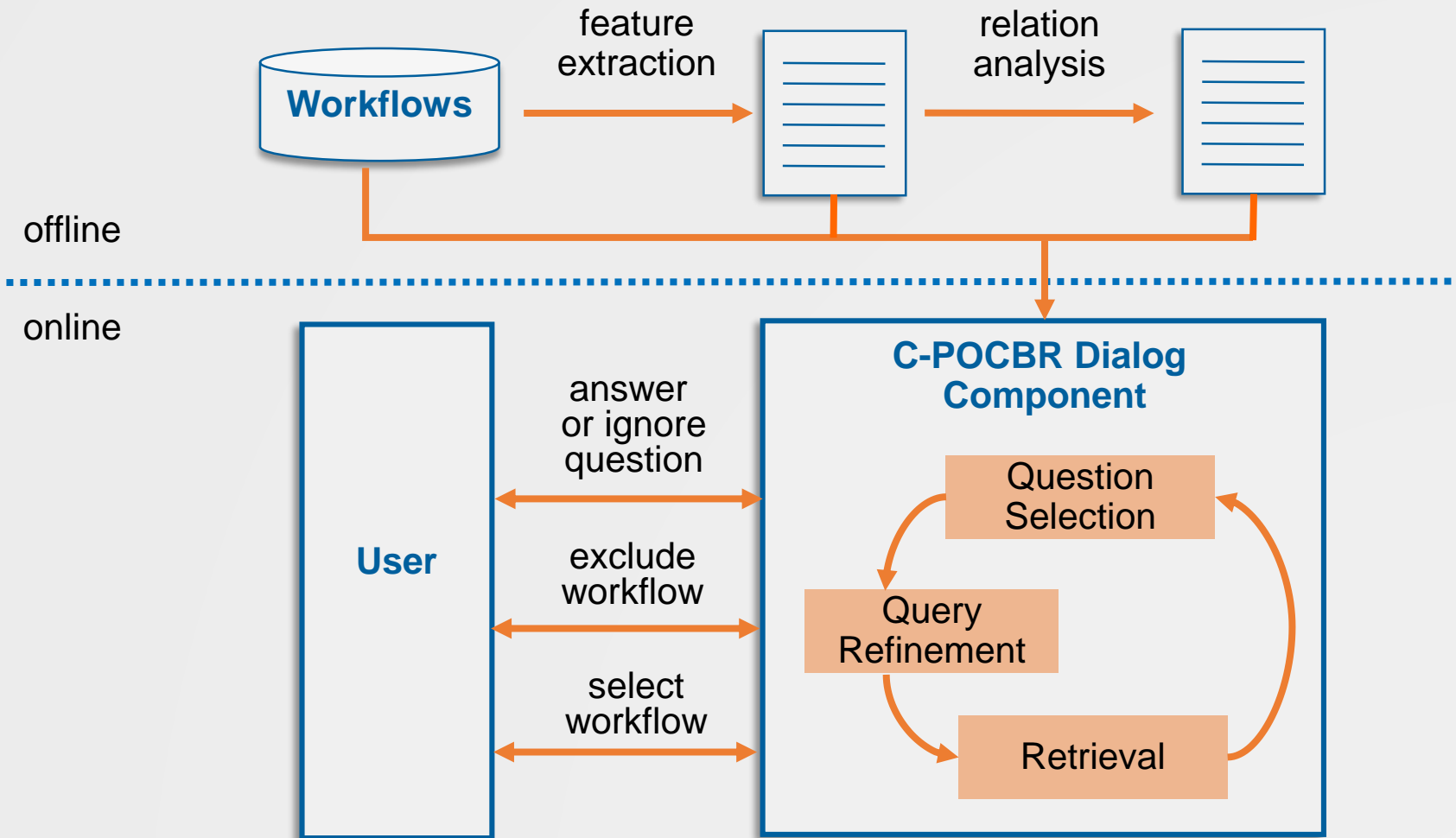
Query Q consists of a desired workflow q^+ and several restriction workflows $q^- \in Q^-$:





CONVERSATIONAL POCBR

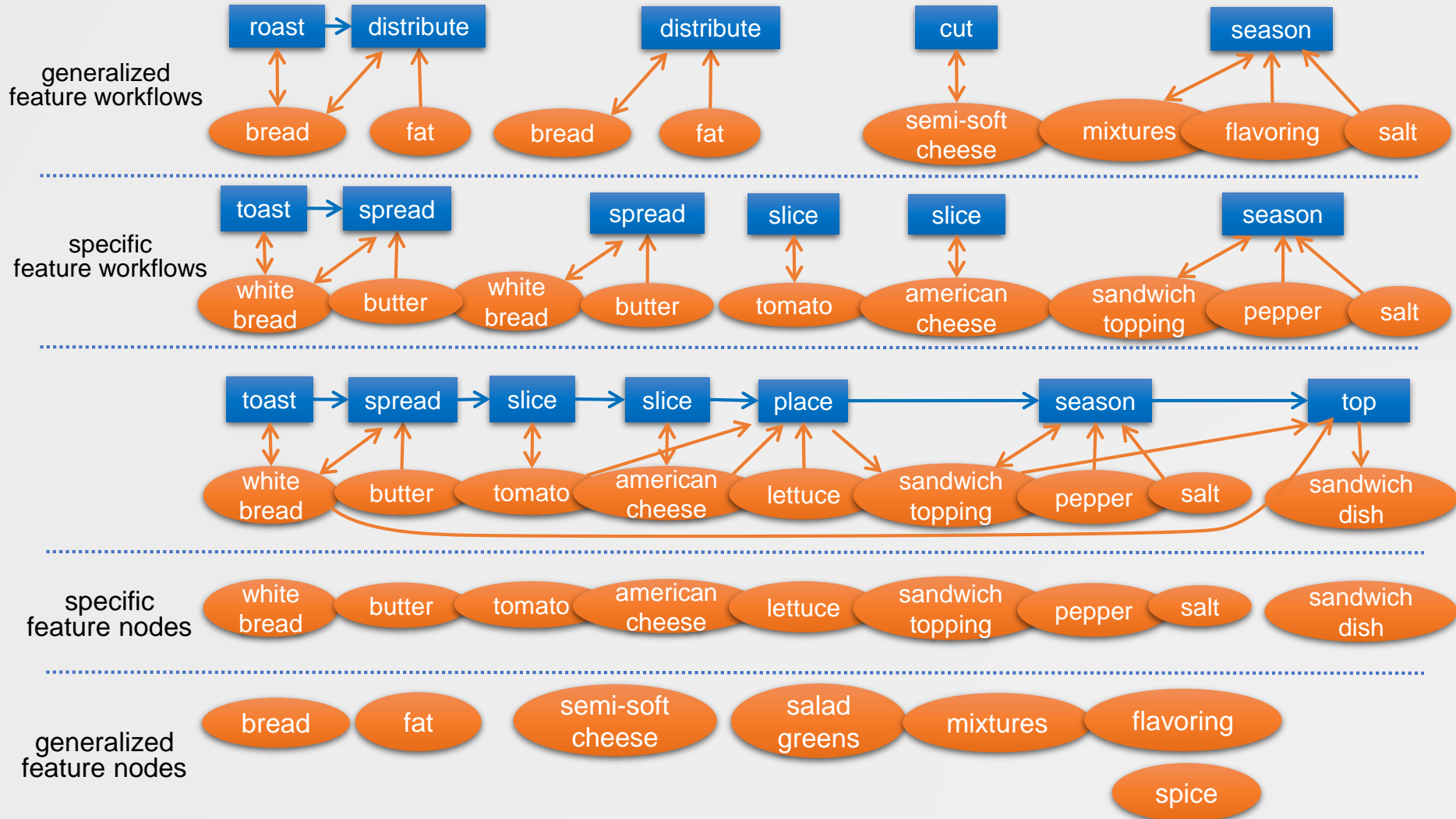
Conversational POCBR



Feature Extraction

- Apply generalization algorithm to generalize each workflow W
(Müller, Bergmann, FLAIRS 2015)
- Extract features from workflows W and generalized workflows W^*
 - feature nodes
 - single nodes from W
 - single nodes for all generalizations within the taxonomy up to the respective node in W^*
 - feature workflows
 - partial workflows from W and W^*

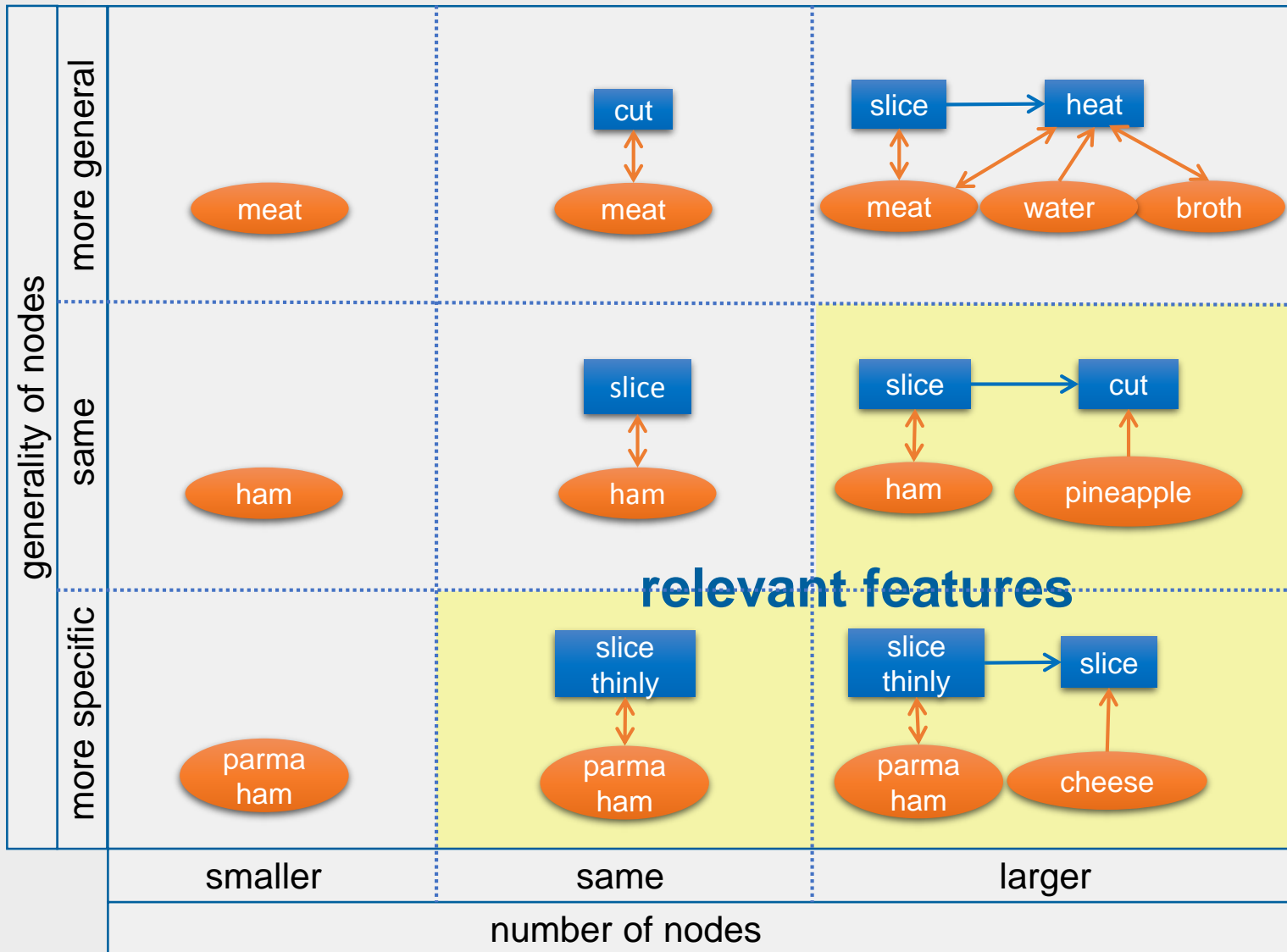
Example: Extracted Features from a Cooking Workflow



Relation Analysis

- Determine related features for each extracted feature
 - both features share a common partial workflow
 - partial workflow of a feature is a generalization of another feature
- Differentiate related features
 - number of nodes (smaller, same, larger)
 - generality of nodes (more specific, same, more general)

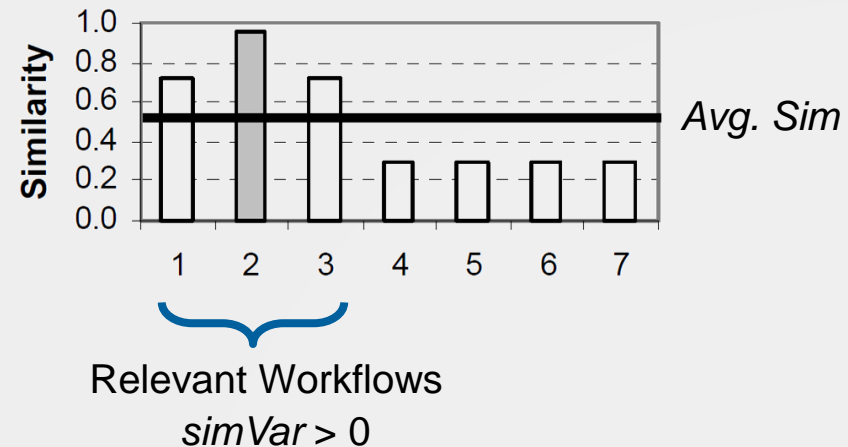
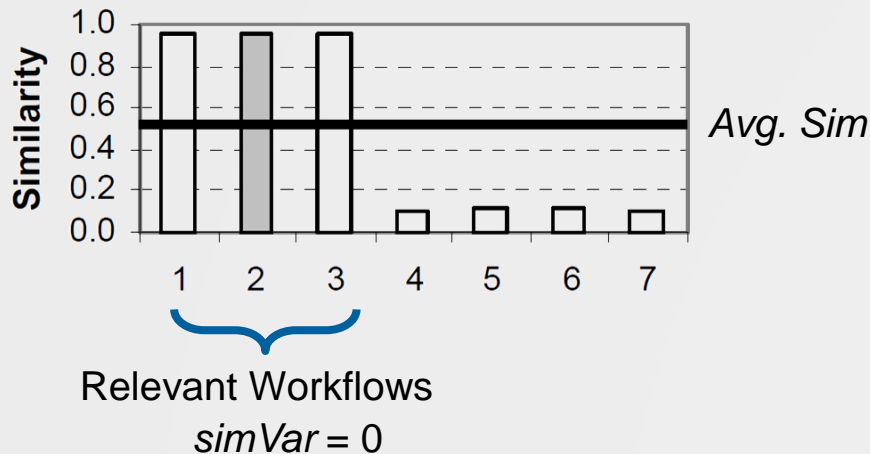
Example: Related and Relevant Features



Which is the best feature to ask?



- Which feature allows to better differentiate among the workflows?
- Application of the *simVar*-Measure
(Kohlmaier, Schmitt, Bergmann, ICCBR 2001)

Query_i Include feature f into the query → Query_{i+1}

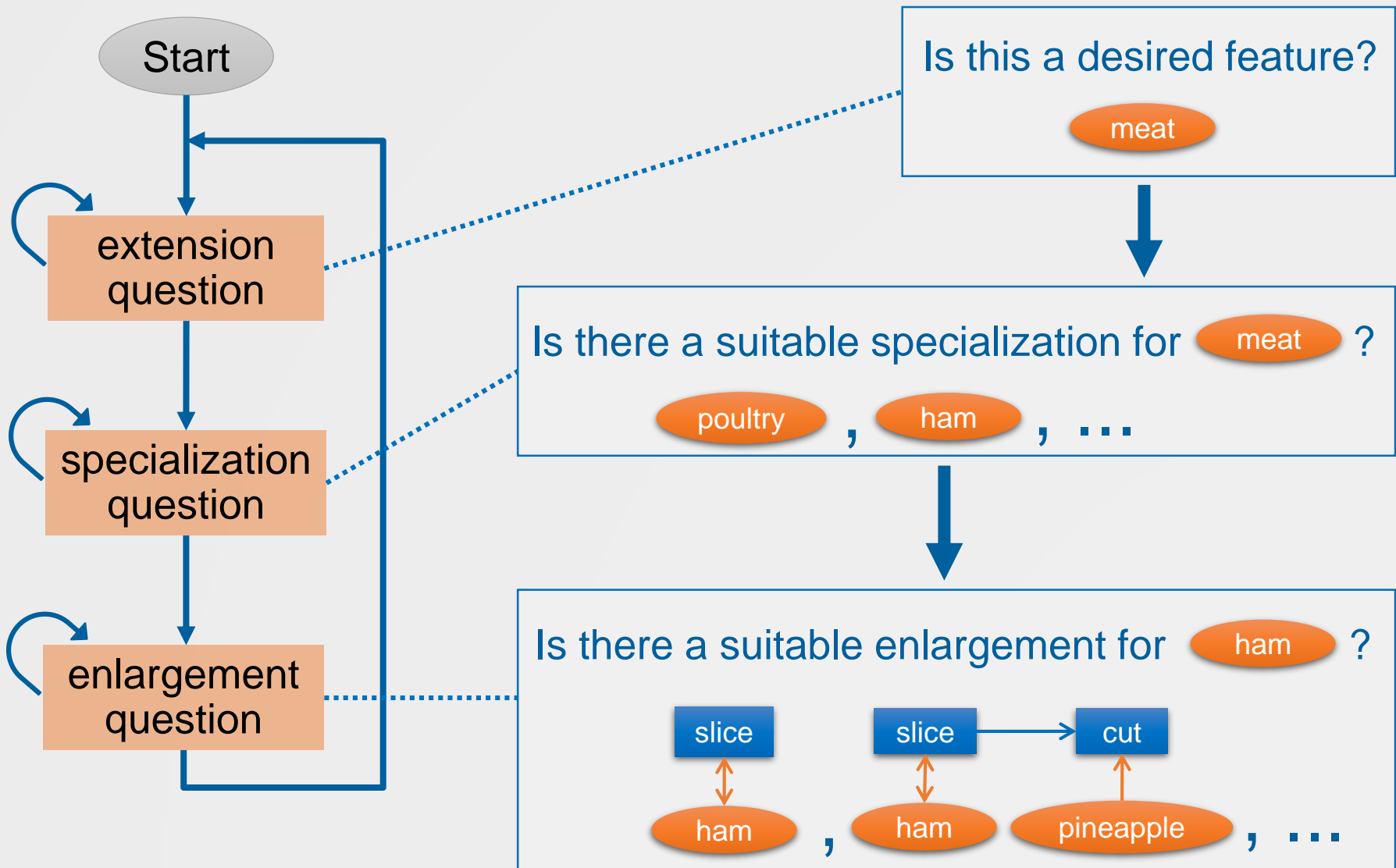


- Selection of feature with highest *simVar* value.

Types of Questions

- Extension Question:
 - Select the *best feature* to ask
 - Ask whether a certain feature is desired or undesired
 - If answered: Feature becomes part of the desired workflow or a restriction workflow
- Specialization Question
 - If possible: ask for a feature that is *more specific* than the one asked in the previous question
- Enlargement Question
 - If possible: ask for a feature that is *larger* than the one asked in the previous question

Question Sequence





EXPERIMENTAL EVALUATION

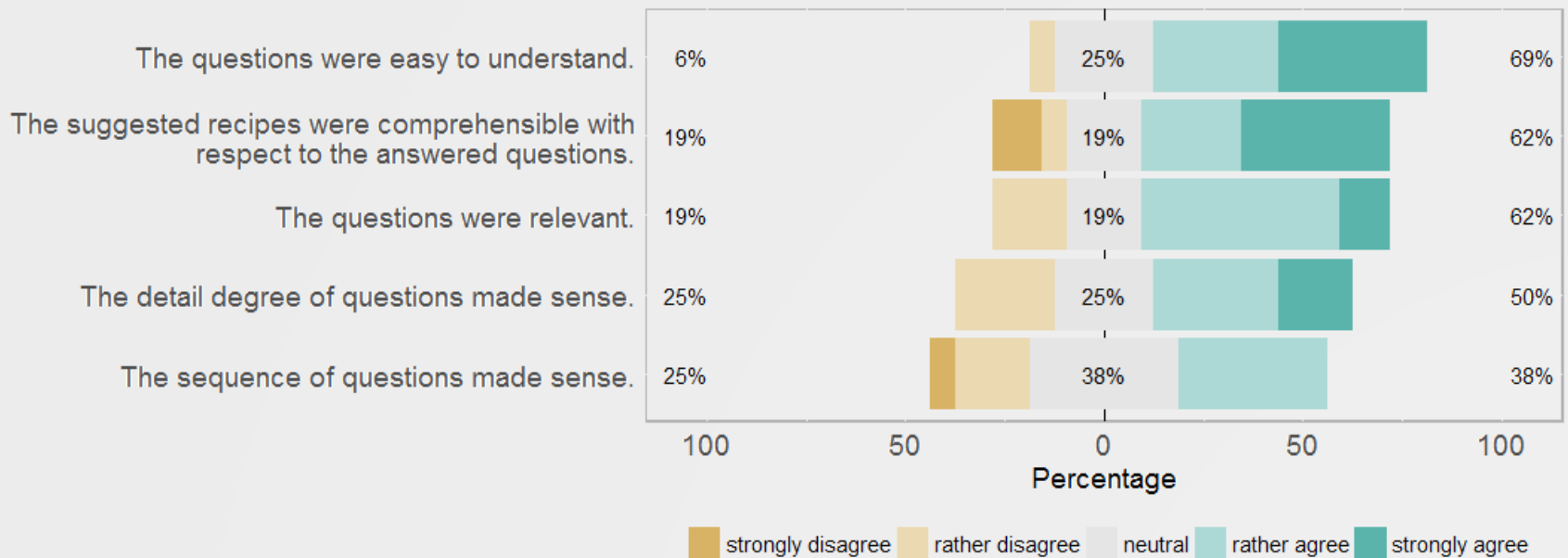
Evaluation I

- Repository of 61 cooking workflows
- Textual search scenarios are constructed from the workflows
- Experiment with eight users: compare dialog with queries formulated by hand (POCBR) vs. conversation-based (C-POCBR)

	POCBR	C-POCBR
Number of Successful Retrievals	15/16	14/16
Total Retrieval Time	5:34 min.	5:40 min.
Required Retrieval Time	4:46 min.	2:16 min.

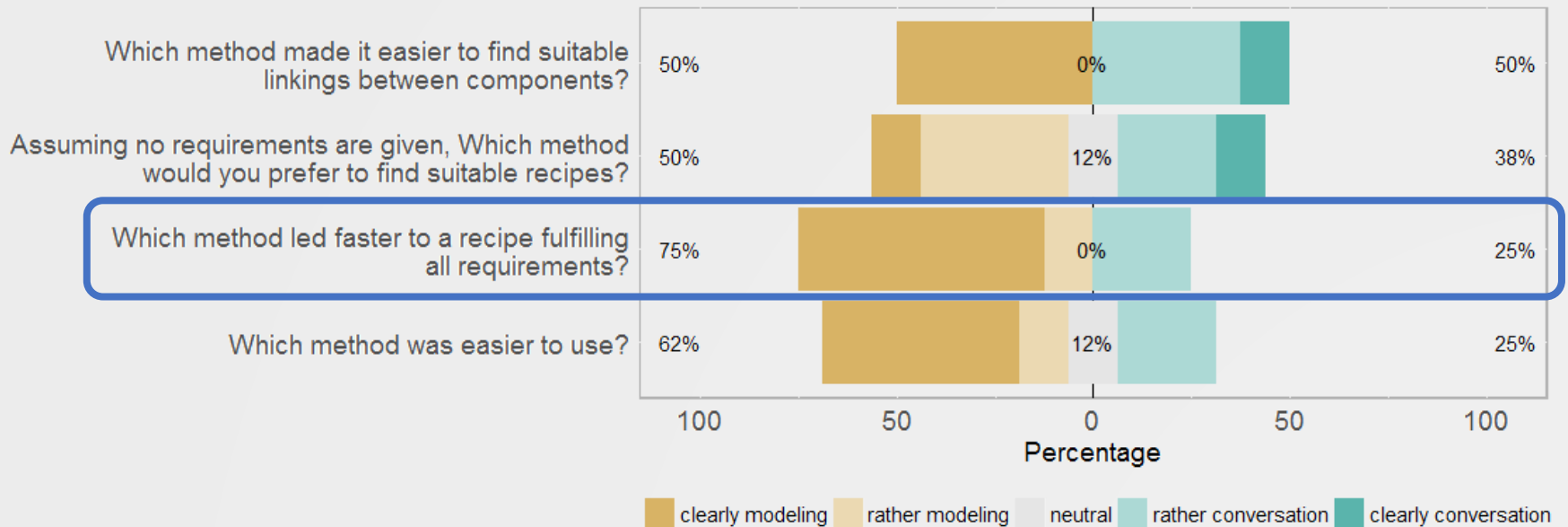
Evaluation II

Participants rate quality of C-POCBR conversations in a questionnaire on a five-point Likert scale



Evaluation III

Participants compare POCBR (modeling) and C-POCBR (conversation) in a questionnaire on a five-point likert scale



Conclusions

- Research Results
 - Conversational approach for workflow retrieval
 - Automatic extraction of features from workflows
- Discussion
 - Approach can reduce retrieval time
 - Generic approach for POCBR
- Future Work
 - Further studies w.r.t. other domains, more complex workflows, and more diverse features
 - Consider adaptability of workflows during conversation



THANK YOU!
