

Semi-automatic Generation of Active Ontologies from Web Forms

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"Create an appointment with Peter on Friday."



2018 MAY						
SUN	MON	TUE	WED	THU	FRI	SAT
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

www.free-printable-calendar.com

How can we

automatically

add new features to

intelligent assistants ?

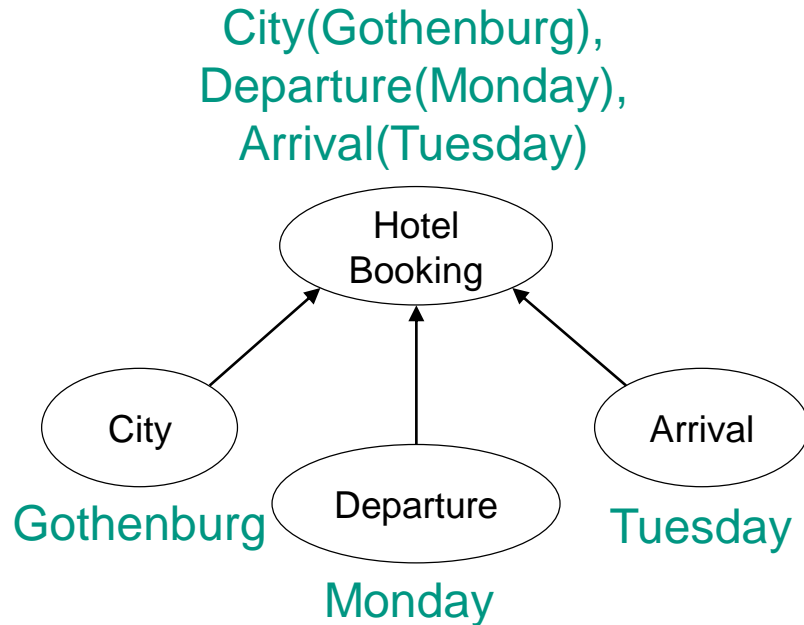


EASIER: A Framework to Connect Intelligent Assistants with Arbitrary Web Forms



- Generates 65% of the software automatically
- Correctly answers 70% of the queries with the generated software

Active Ontologies / Active Semantic Network

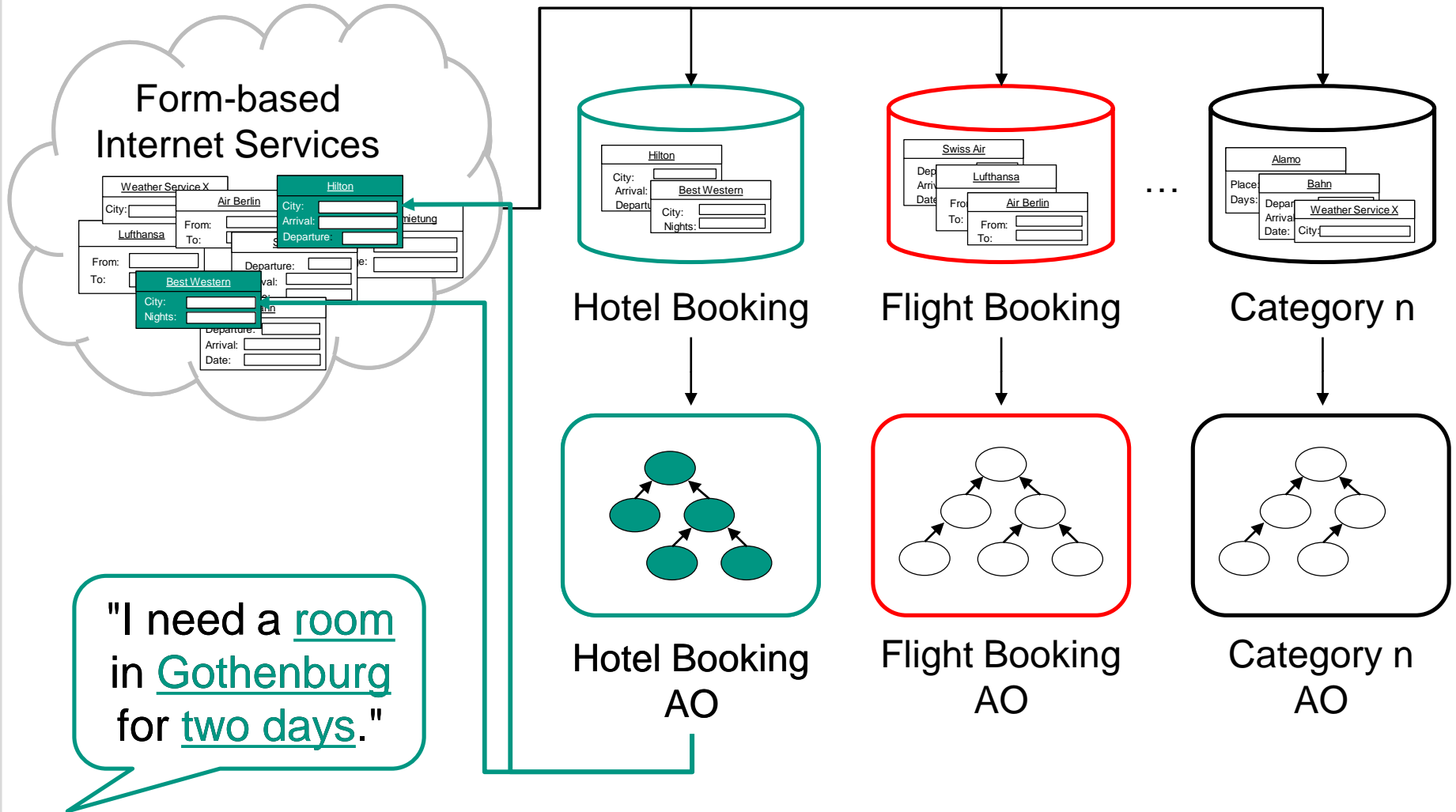


"I need a hotel room
In Gothenburg from
Monday to Tuesday."

- Combine the modelling of domain knowledge with an execution environment
 - Different node types
 - Leaf nodes
 - Non-terminal nodes
 - Bottom-up processing of utterances

 - Supporting new features requires extending the ontologies or even building new ones
- Manual & labor-intensive steps

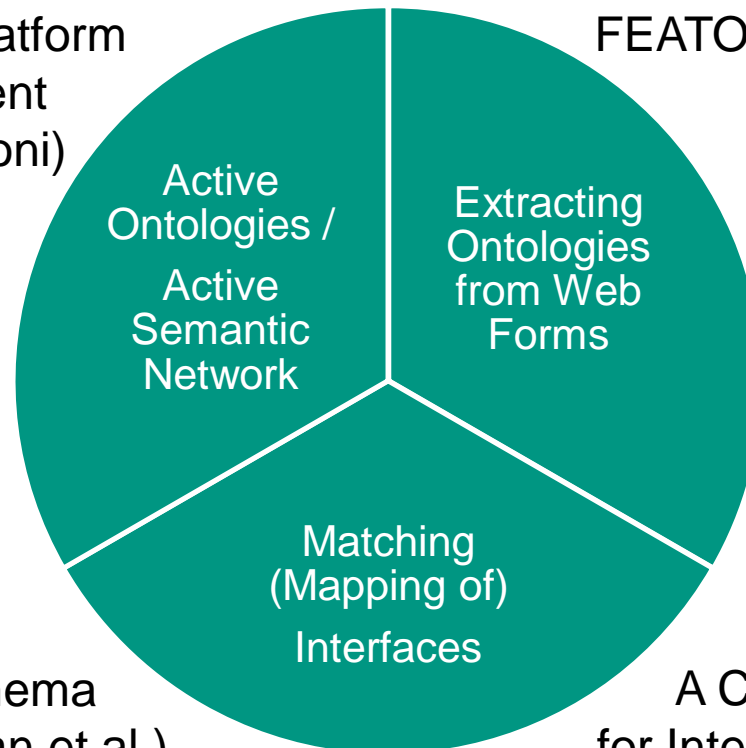
EASIER – Big Picture



Related Work

Active: A Unified Platform for Building Intelligent Applications (Guzzoni)

FEATON: Builds Ontologies from Forms semi-automatically (Berlanga et al.)



OntoBuilder: Extracts Ontologies from Web Forms (Gal & Roitman et al.)

Cupid: Generic Schema Matching (Madhavan et al.)

A Clustering based Approach for Interface Matching (Wu et al.)

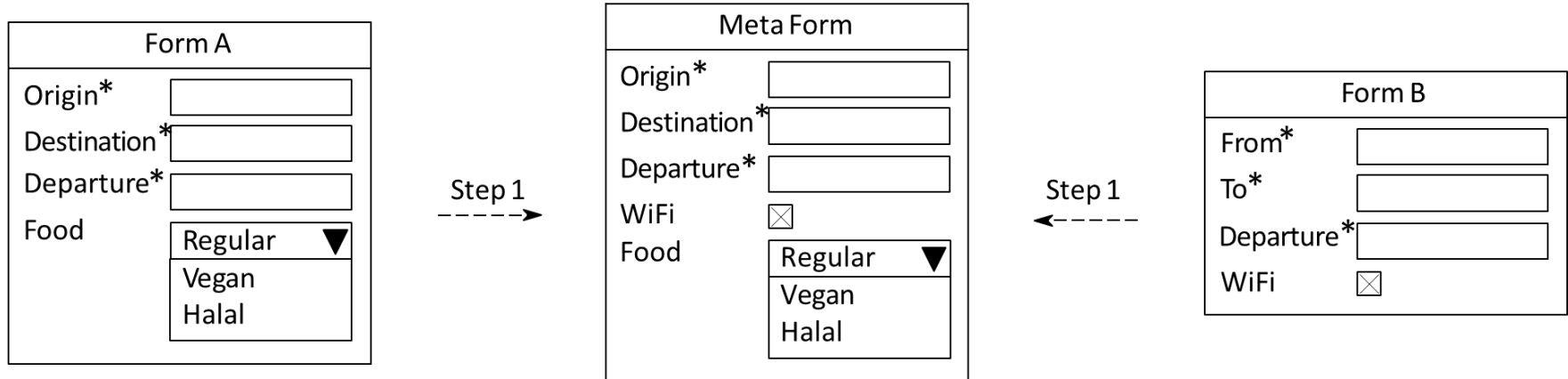
WISE: Automatic Integrator for Web Search Interfaces (He et al.)

Automatically Creating Active Ontologies: Overview

Form A							
Origin*	<input type="text"/>						
Destination*	<input type="text"/>						
Departure*	<input type="text"/>						
Food	<table border="1"><tr><td>Regular</td><td>▼</td></tr><tr><td>Vegan</td><td></td></tr><tr><td>Halal</td><td></td></tr></table>	Regular	▼	Vegan		Halal	
Regular	▼						
Vegan							
Halal							

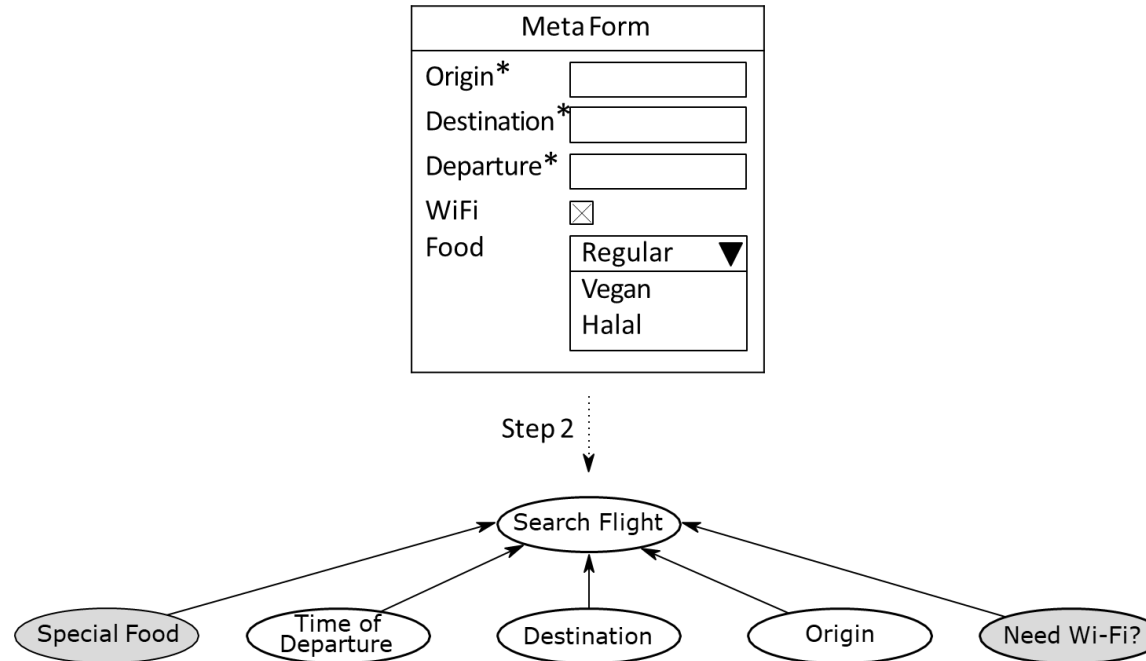
Form B	
From*	<input type="text"/>
To*	<input type="text"/>
Departure*	<input type="text"/>
WiFi	<input type="checkbox"/>

Automatically Creating Active Ontologies: Grouping Related Form Elements



- Grouping similar form elements
 - Uses linguistic and structural similarities
 - Hierarchical Clustering of similar form elements
- Generation of meta form elements (global objects)
 - Merge form elements

Automatically Creating Active Ontologies: Deriving the Ontology



- One Active Ontology for each meta form (i.e., one per category)
 - Value range unclear → ask developer
 - Select AO node type

Evaluation

- Three evaluation questions
 - How good is the field matching?
 - What is the degree of automation?
 - Are the generated AOs capable to answer user queries?

- Data Source
 - 58 web forms from the UIUC Web Integration Repository
 - Three categories: airfare, automobile, and book search

- Queries
 - 61 queries for the airfare domain
 - 40 subjects (20 of them are native English speaker)

Evaluation: Field Matching

Category	Precision	Recall	$F_{0,5}$ Measure
Airfare	90.6	21.0	54.4
Automobile	90.6	37.3	70.5
Book	98.4	46.4	80.4

- Highest precision for the book search domain
- Recall of clustering must be improved

Evaluation: Degree of Automation

Category	Nodes			
	Total	Manual	Autom.	Autom. [%]
Airfare	126	29	97	77%
Automobile	41	23	18	44%
Book	49	24	25	51%
Total	216	76	140	65%

- Automatically generated 77% of the elements needed for the airfare domain
- Needed the help of developers in only 35% of the cases

Evaluation: Query Answering

- How many query elements were correctly identified by the sensor nodes?
 - 61 queries from airfare domain
 - E.g. "Book a flight from Frankfurt to Paris."
 - Post-processing of given values
 - Expected: origin, destination, departure
 - Ask user for missing information
 - Results
 - Recall: 75%
 - Queries Completely recognized
 - Only mandatory information: 77.4%
 - Mandatory and optional information: 35.5%

Evaluation: Query Answering (2)

Field	Correct	Wrong	Missing
Origin	191	9	0
Destination	185	15	0
Departure	124	24	52
Total	500	48	52

- How many queries were correctly identified by the sensor nodes?
 - 26 complete queries (out of 61 queries)
 - 10 analyzed
 - 20 web forms (airfare domain)
- Results
 - 7 queries were recognized correctly
 - 2 were not recognized (EASIER asked the user)
 - 1 was recognized incorrectly

Conclusion and Future Work

- EASIER automates the process of building AOs
 - Automatically generates 65% of the AO's sensor nodes
 - High precision in field matching (90.6 - 98.4%)

- Queries
 - Correctly answers 70% of the queries
 - Asks for missing information

- Future Work
 - Improve field matching performance (HTML5, ARIA, ...)
 - Integrate complex field mappings
 - Better domain knowledge (Wikipedia, Cyc)

References

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