Query Sentences as Semantic (Sub) Networks

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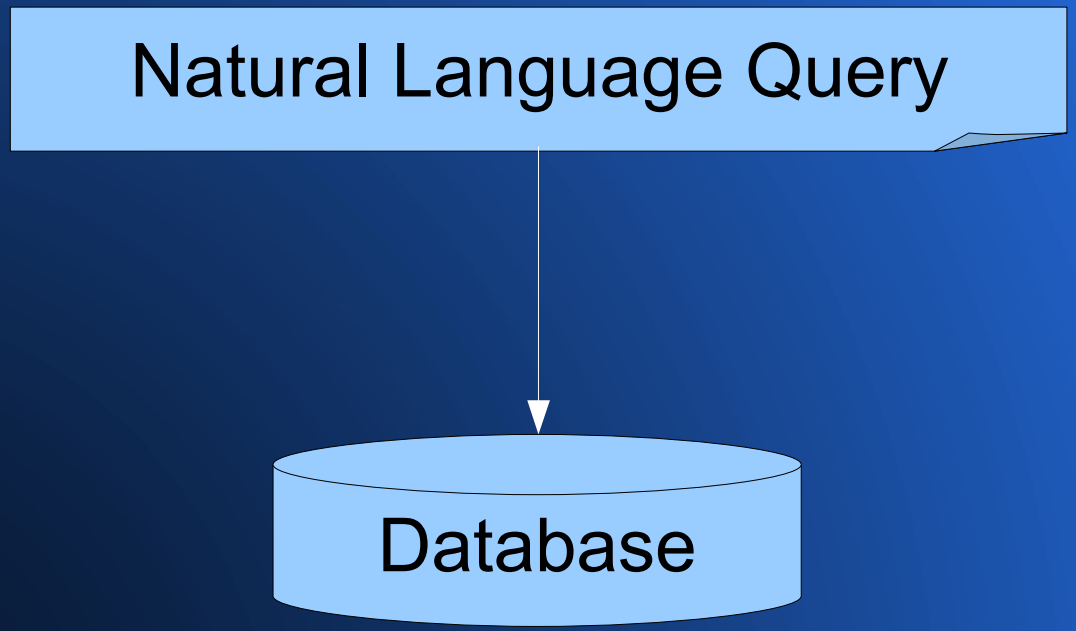
Outline

1. Motivation & Context
2. Data and Models
3. Algorithm
4. Preliminary Results and Evaluation
5. Future Work

Motivation



Research Context

- Transportation Information Systems
- Integration
  - Natural language processing
  - Ontologies
  - Transportation Query Language
  - HCI concerns

Key Point

- The is an intermediate representation
  - Not a complete QA or DB system

Motivating Example

Is there a cheap place on my way home?

- What counts as cheap?
- Where is home?
- How do I get there?
- What is “on the way”?

Objectives

- Represent natural language queries as semantic networks
- Extract implicit semantics from the NL query
- Minimal reliance on external resources and domain specific knowledge
- Shallow features only

Novelty

- Extensive integration
- Spatial and temporal concepts
  - Paired with explicit linguistic realizations
- Previously unused representation model

The Ontology

- A superset of the database model
  - Transportation
    - Space, time, spatio-temporal, graphs
  - User
    - Preferences, etc.
  - Linguistics
    - Deixis
- Annotated with WordNet entries

Algorithm Overview

1. Parse the input sentence
2. Generate candidate set
3. Candidate selection
4. Identify the target of the query
5. Build the resultant network

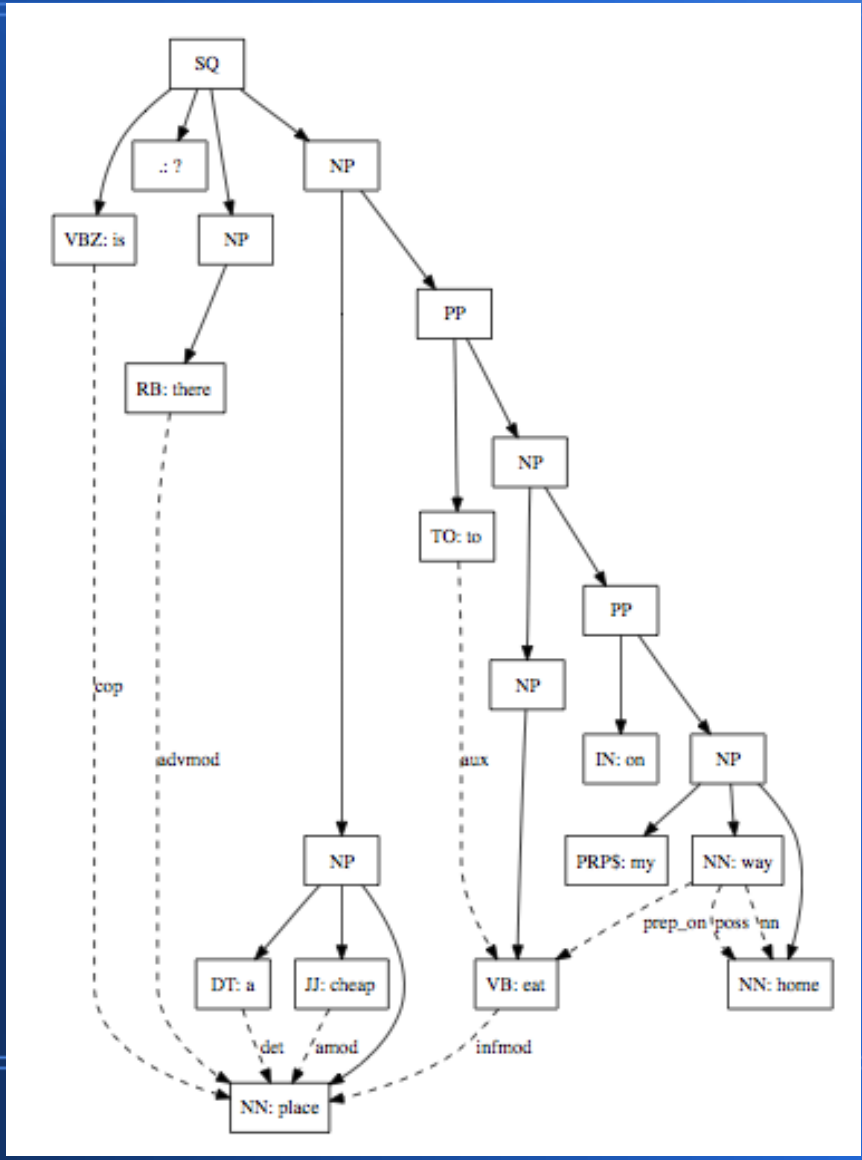
User Input

- A natural language query

  Is there a cheap place to eat on my way home?

Syntactic Parse

- Structural and Dependency
- Stanford Parser



Candidate Set Generation

- Pairwise comparison between parse nodes & ontological concepts
  - Match metrics
    - WordNet
    - String
  - Match = candidate
  - Each node may have multiple candidates
    - Candidates are not always unique

Candidate Selection

- Each match type is weighted
  - Edit distance
  - Distance in WordNet
  - …
- Generate a cumulative score for each candidate concept
- Select the highest ranked concept
  - Minimum threshold required

Query Target Identification

- Query target = what the user is looking for
- Based on the syntactic dependency parse
  - 5 patterns
  - Just follow edges in the graph

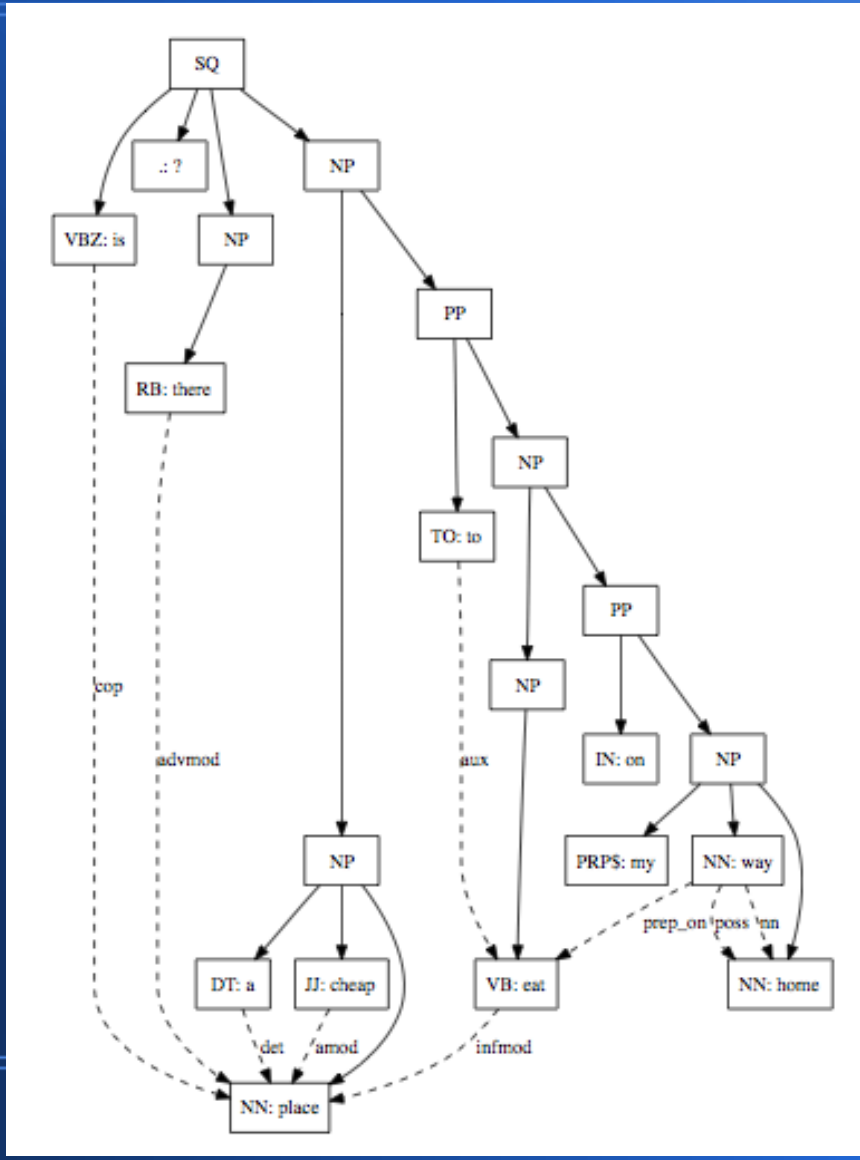
Query Target Example

- Where is/are … ?
- Is/are there … ?

"To be"

copula

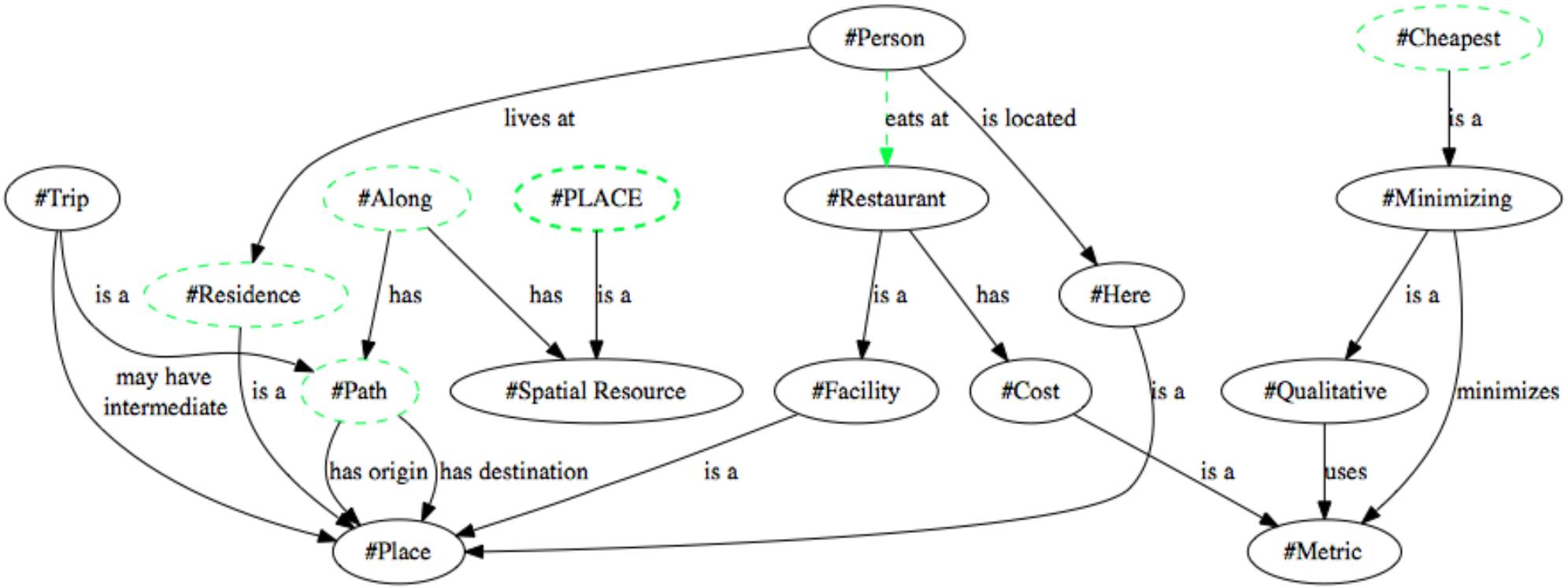
<u>noun</u>



Graph Generation

- Start with a “bag of concepts”
- Perform an all pairs shortest path to connect within the ontology

Output



Is there a **cheap place** to **eat on** my **way home**?

Tuning

- Weights and thresholds
- Done by hand
- Training set of 12 sentences

Matching Evaluation

- Preliminary testing
- 12 test sentences
- Promising results
  - 43 relevant nodes in the parse graph
    - 39 correctly resolved
    - 3 semi-correctly resolved
    - 1 correctly unresolved
    - No explicit errors

Conclusions

- A semantic representation of queries
- Algorithm based on shallow features
- Promising early results

Future Work

- Extensive testing
- Expanded ontology
- Improved matching metrics

- Complete the “big picture”

Questions?