A Multi-Agent System for Building Dynamic Ontologies

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Plan

Plan

Introduction

Current situation

- Text analysis makes ontology building easier
- NLP analysis examination is a difficult and slow process
- Emerging technics based on machine learning

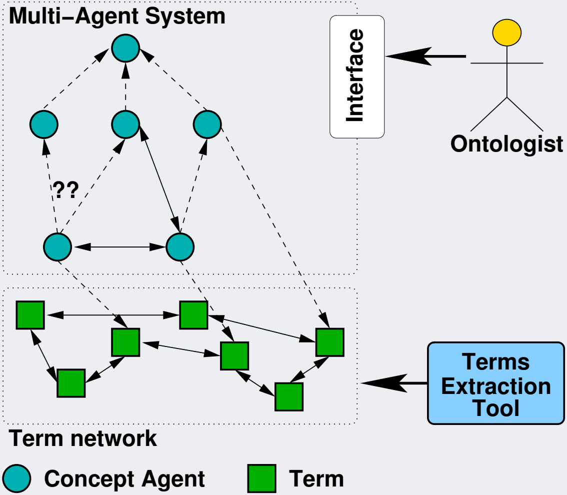
Our proposal

- Keep the user in the production loop
- Allow the "Living Design" of ontologies
- Reorganization following user modifications

Plan

Overview

Architecture



Overview

Term Network

- Produced by *Syntex*
- "Head-Expansion" graph
  - knowledge engineering from text
  - knowledge engineering
- Term contexts used to compute similarity

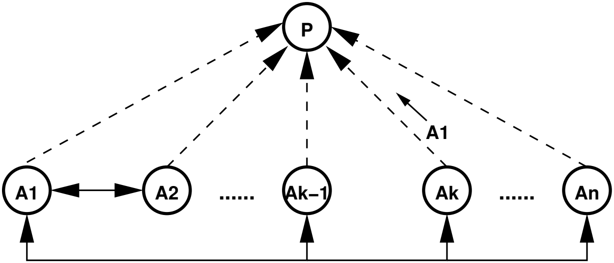
Multi-Agent System

- Each agent represents a concept of the taxonomy
- Each agent tries to position itself
- Based on a condition/action rule set

Plan

Distributed Clustering Algorithm

Local view

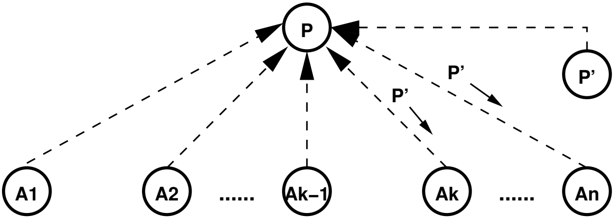


Steps

1. Evaluating similarity and "votes"
2. Partitioning and intermediate layer creation
3. Parent change

Distributed Clustering Algorithm

Local view



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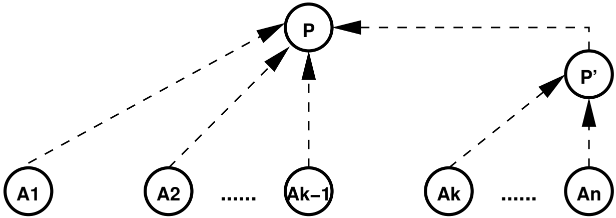

Steps

1. Evaluating similarity and "votes"
2. Partitioning and intermediate layer creation
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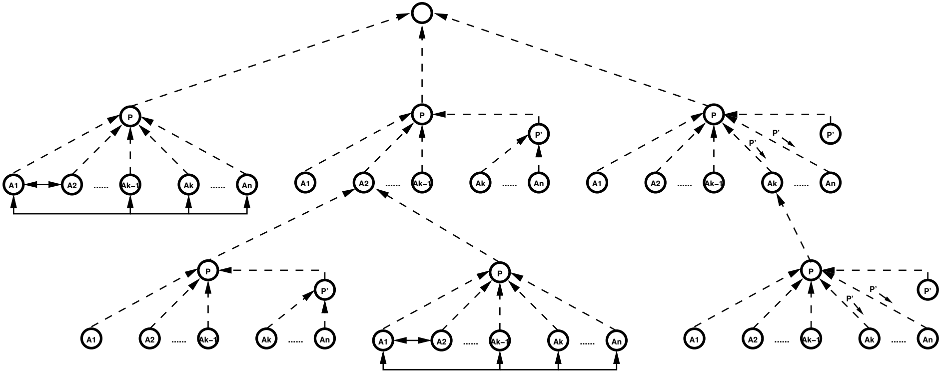
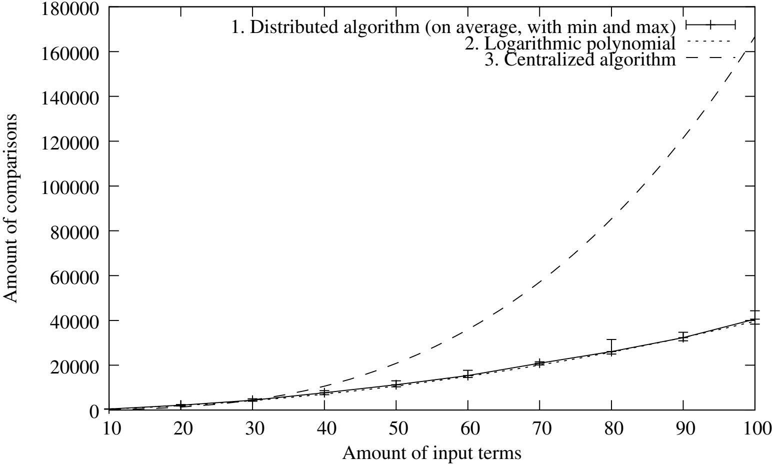
Distributed Clustering Algorithm
Global View



Experimental Complexity Results



- Average complexity: $O(n^2 log(n))$
- Maximum variance: around 5%

Qualitative Point of View

Automated run

- Permanent view on the built hierarchy
- Allow to obtain a "first draft"

User modification

- No algorithm adjustment required
- Dynamicity, revision of the structure

Plan

Head Coverage Rules

Intended Behavior

Observations

- Similarity can't be always computed for term pairs
- Humans have specific heuristics for low-level structuring

Goal

- Take care of those terms
- Implement a similar heuristic

Parent Adequacy Function

- The best parent for C is the P agent that maximizes $a(P, C)$.
- *When an agent C is unsatisfied by its parent P, it evaluates $a(B_i, C)$ with all its brothers (noted B_i) the one maximizing $a(B_i, C)$ is then chosen as the new parent.*

Managing Several Criteria
Guidelines

How?

- Keeping it simple
  - Local criteria
  - Nominal values for those criteria
- Use cooperation heuristic

Cooperation

- Minimizing non-cooperation
- Priority system
  - Determine the current problems
  - Find the most urgent one
  - Try to fix it

Managing Several Criteria

Actual Implementation

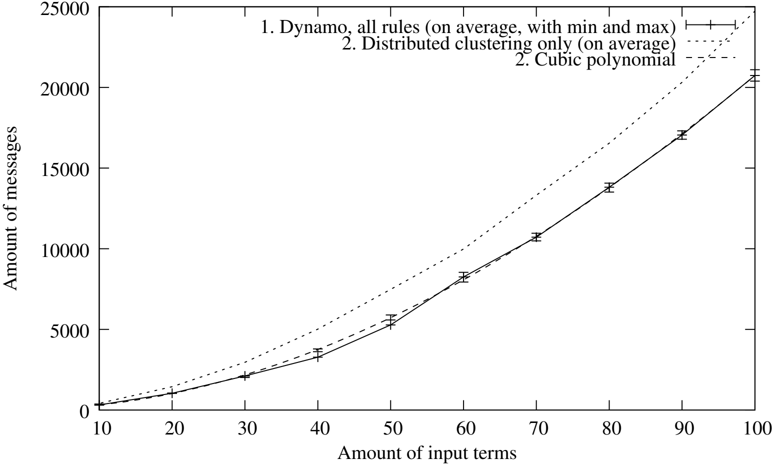
Minimize non cooperation

- $\mu_H(A)$: "head coverage" non cooperation degree of A
- $\mu_B(A)$: "brotherhood" non cooperation degree of A
- $\mu_M(A)$: "message" non cooperation degree of A
- $\mu(A) = max(\mu_H(A), \mu_B(A), \mu_M(A))$

Take care of the worst problem first

- $\mu(A) = \mu_H(A) \rightarrow$ Try to find a better parent
- $\mu(A) = \mu_B(A) \rightarrow$ Improve structuring through clustering
- $\mu(A) = \mu_M(A) \rightarrow$ Process other agent message

Experimental Complexity Revisited



- Average complexity: $O(n^3)$
- Maximum variance: around 0.6%

Plan

Discussion

Advantages of our approach

- Easier system/ontologist coupling
- Possible distribution on a network

Current limitations

- Results tend to depend on the add order
- Tend to produce binary trees only (except on leaves)

Perspectives

Concerning knowledge engineering

- Get closer to a taxonomy tree
- Find non taxonomic relations

Concerning multi-agent systems

- Improve the clustering algorithm
  - Remove the dependency on add order
  - Optimize
- Test this algorithm in other domains

Works in Progress, Conclusion

In progress...

- Taxonomy production
  - Tree pruning
  - Not only binary tree
- Evaluate the system on more corpora

Conclusion

- Evolving structure is possible in this field
- Performances are acceptable
- More efforts needed...

Questions ?

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