Agents and the Semantic Web

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Motivation

Purpose of this talk:

- Discuss some ideas for future research
- Brainstorming for possible grant application
- Looking for suitable theme (broad vs. concrete, visionary vs. realistic)
- Potential for cooperation with other CISA people?

Disclaimer

In this talk, I will...

- Lay out some very preliminary and exploratory ideas
- Make some strong claims about areas I don't know much about
- Express some very personal views about Them and, worse still,
- Some of you work in these areas or on Related research issues

Agents & The Semantic Web

- Semantic Web (SW) supposed to provide machine-processable meta-data
- Meta-data supposed to be used by agents
- SW should be ideal application area for agents:
  - Distributed sources of information
  - Web = open system comprising different (self-interested) parties

Agents & The Semantic Web

- If these agents are not intelligent, why bother?
  - Humans don’t need meta-data
    - Simple programs don’t need knowledge-level representations
- But maybe some kind of “web-based expert systems” is enough?
- Crucial issue: do we need collaboration on the SW?

Apparently, some SW people think that...

“the perception that the Semantic Web is concerned with AI is not helpful to its widespread adoption in the IT industry. [...] The Semantic Web is often presented as the technology that will achieve marvelous things [...] general problem solving, common sense reasoning and other features commonly associated with intelligence. These are not what the Semantic Web is about.”

(McBride, 2002)

The Semantic Web View

- Vision: to provide an infrastructure for information access and integration
- Research perspective: Knowledge representation & reasoning
- System view: Service-oriented, “expert systems with distributed knowledge base”

The Agent/MAS View

- Vision: to build (societies of) intelligent agents that solve complex tasks on behalf of humans
- Research perspective: Distributed problem-solving, autonomous systems
- System view: Autonomously operating, interacting entities, pro-/re-active

The Chasm

Three problems:

1. We don’t have good application scenarios for agent collaboration on the SW
2. People disregard the “autonomy” perspective
3. Agents are not built in an anthropocentric way

Example #1

- Composition of Web Services with support for service discovery
- Still considered something that human user will (mainly) do
- Workflow between services fairly fixed and services not really autonomous

Example #2

- Semantic Web Brokering
  - Finding, invoking and monitoring web services
    - What if services are autonomous?
      ⇒Importance of negotiation
    - How about ontology conflicts, misunderstandings?

Example #3

- Deploying interaction protocols on the Web
  - How can protocol adherence be guaranteed?
  - How much freedom/flexibility do protocols provide?

Four ideas for potential projects

- Increasing order of vision and breadth (decreasing order of realism and concrete goals)
- Some of them can be combined with others
- Attempt to focus on aspects I mentioned above

Idea #1: Ontology Conflict Resolution with Agents

- Idea: Complete ontology mappings not necessary to manage task-based interaction
- Why not try to resolve (smaller) ontology conflicts on the fly?
- Design negotiation protocols with specific Semantic Web flavour

Idea #1: Ontology Conflict Resolution with Agents

- Use instances, attributes, subsumption etc. for translation purposes
- Cooperative vs. competitive case
- Some previous work we could use, but still an open and important area
- Benefits: automated alignment of ontologies, reduces standardisation needs

Idea #2: Communication Learning

- In open systems perhaps most important aspect of learning
- Simple idea: base notion of meaning on observed behaviour (empirical/ evolutionary semantics)
- Macro-level: model communicating systems, provide respective information in SW-style

Idea #2: Communication Learning

- Micro-level: improve algorithms for communication strategy learning
- Particularly interesting: modelling of commmunication, state and action abstractions
- Problem: not much interesting “agent communication corpora” around
- Practical benefit questionable

Idea #3: Hybrid Semantic Web Agents

- How does a compound, hybrid entity consisting of human and a rtificial agent interact with others on the Web?
- Interesting: notions of autonomy, workflow, mixed-initiative reasoning and action
- Focus: bring agent action to human attention and vice versa (join communication channels and knowledge)

Idea #3: Hybrid Semantic Web Agents

- Theoretically appealing, novel view of web-based collaboration
- Related to NLP, user modelling, context-aware computing, rule extraction
- However, rather vague and potentially too complex

Idea #4: AI Methods for openness and autonomy (short: Social AI)

- Autonomy/openness contradictory to control paradigm
- System boundary questions (e.g. Autonomic Computing)
- Nobody knows how to deal with autonomy (except by restricting it)

Idea #4: AI Methods for openness and autonomy (short: Social AI)

- Example: Where does the semantics go in protocol specification?
- How to reason without closed world assumptions?
- Look at methods inspired by sociology, political theory and law

Idea #4: AI Methods for openness and autonomy (short: Social AI)

- Topics of interest:
  - Formal autonomy specification
  - Trust and reputation mechanisms
  - Organisational approaches
- Very broad, could be overly abstract and unfocused

Conclusion

- Many interesting things to do
- Criteria should be:
  1. Is the idea broad enough to justify a project?
  2. Is it still realistic?
  3. Will the result solve someone's problem?
- Tradeoff between vision and realism

Answers?