Case-Agents: a novel architecture for case-based agents

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Motivation
- This research started from a thought exercise
  - what if.....?
- The paper doesn't present an implementation or results
  - I will present some initial findings
- Intended to stimulate people to ask what if....?

CBR & agents
- “intelligent agents are both a distant and unnecessary goal”


CBR & agents
- Given the popularity of CBR & agents from the mid 1990’s onwards it’s surprising there hasn’t been more CBR-agent work
- One reviewer said “there are roughly only ~20-25 publications relevant to this topic…”
  - Enric Plaza’ group
  - Katia Sycara’s group
  - Robin Burke
CBR agent architectures

- Internal-case agents
  - Each agent has its own case-base

- External-case agents
  - Agents share external case-base(s)

- Intra-case agents
  - Both inter- & extra-cases in one system

What if……..

- Each case was an agent?
  - What would this architecture look like?
  - How would it work?
  - Would there be any benefits?
  - Would there be any drawbacks?
  - What sort of problems would be suited?

Case-agents

- Case-representation
  - Basic division of a case into problem description:solution description
  - Structural representations could also be supported
  - But cases with different internal representations could co-exist in the same system
  - Providing each case-agent has a similar interface
  - No real change here then
Case-agents

- Case Retrieval
  - Each case is responsible for assessing its similarity to Target/Query cases
  - Cases can use different similarity metrics
  - Truly local similarity
  - This is different
    - Perhaps "better" retrieval
    - Greater complexity, inefficient, danger of over-fitting

Case-agents - retrieval

Case-agent similarity neighborhood

Target problem

Case-agent similarity neighborhood

Case-agents - retrieval

Case-agents

- Reuse
  - Once cases have determined they are similar to a target
  - They present their solutions to a broker-agent
  - The broker agent could determine the best/cheapest/easiest to adapt solution from those on offer
  - Cases could adapt their own solutions or there may be adaptation-agents (not necessarily case-based)

Case-agents

- Retention
  - Once a new case was created a new agent would be created
  - Need to decide on similarity metrics
    - Perhaps same as agent that created the new case
  - Once a new case-agent was created it would interact with the existing case agents
  - Triggering a maintenance cycle

Case-agents

- Maintenance
Case-agents

- **Maintenance**
  - Interesting dynamic self-organizing behavior possible
- **The lonely case-agent**
  - Never sees any other cases or target problems
  - Programmed to kill or archive itself

Case-agents

- **Maintenance**
  - overcrowded case-agents
    - Negotiate to prune themselves
    - Use competence models (Smyth et al)
- **Case-agent tuning**
  - Agents could tune their similarity metrics and adaptation methods with respect to their neighbours
  - and their success in having brokers choose their solutions
  - Case-agents are competitive
  - Populations of case-agents
  - Evolutionary case-agents

Case-agents

- **Maintenance**
  - sparse case-agents
    - Negotiate fill competence holes (Smyth et al)

Case-agents

- **travel case-base**
  - Different similarity metrics across ~1100 agents
  - The case-agents are aware of time
    - As their holiday’s commencement date approaches they:
      - reduce their similarity threshold
      - discount their price
    - If their date expires they expire
Thank You

Questions?