CS 182 Spring 2004. Assignment 8 Solution.

javaKARMA exercises

The solutions here are model answers only. There are a number of equally good answers to these questions.

Problem 1. Metaphor alternatives

Briefly (~1-2 paragraphs) give the pros and cons of such a scheme. In particular, when will such a design be better than the system described in class? Be as specific as you can in your answer. Extra credit will be given for concrete examples to support your case (either way).

> The multiple lexicon approach will work when the metaphor is not productive, in that related concepts in the source domain does not get mapped to the target. For example, if it were the case that falling in the motion source domain got mapped to failing in the target domain of abstract actions but associated concepts like stumble or trip or slide etc. did not have systematic interpretations in the target.

> If the metaphor is productive (as in the embodied motion case), then the multiple lexicon approach will require separate entries for every concept and every associated concept (through various relations) in every target domain. So we would need entries for fall, stumble, trip in the domain of economics, another set of entries for these concepts in the domain of interpersonal relationships, another in the domain of politics etc. Of course the entire inferential structure stumble may lead to fall will have to be replicated across domains as well. Representing the metaphor map explicitly as in the KARMA system allows for all the target domains to tap into the inferential structure of the source domain.

Problem 2. Aspectual inferences

a. What is the (linguistic) difference between Germany is on the verge of stumbling into recession and Germany is starting to stumble into recession? How does the KARMA program capture this difference?

> The first sentence implies that the German Economy is likely to be in future recession. In the KARMA system this means that the normal economic state is about to be interrupted and the next state is likely to be recession. The second sentence implies that the interruption has already started occurring and that the German economy is going into recession. The second sentence relies on an embedding where it is the ongoing part of the start transition that is being referred to.

b. What is the (linguistic) difference between France is about to fall into recession and France is on the verge of falling back into recession? How does the KARMA program capture this difference?

> The first is aspectually prospective, the second is retrospective.
> In the first case France is not in recession but is likely to be in future.
> In the second, France was in recession in the past, is not now, but is likely to be in the future.

Problem 3: X-schema parameters

The following sentences differ only in the manner of motion expressed:

       The U.S. economy is crawling.
       The U.S. economy is at a standstill.
       The U.S. economy is sprinting along.

a.   What feature in the target domain is most affected by the specific manner of motion involved? How do the metaphoric inferences differ for these sentences?

       The rate of progress of the economy and the corresponding economic state is affected most. The first has a continuing low growth economic state, the second suggests no growth and the third rapid progress and correspondingly high growth.

b.   What is the (linguistic) difference between France fell into recession and France walked into recession? How does the KARMA program capture this difference?

       Falling is unintentional, since the agent loses control of their location/orientation, while walking is an intentional act. Falling into recession suggests a lack of control over events which is the metaphoric projection of the semantics of falling. Walking into recession on the other hand suggests that the country had control and could have avoided recession if with better monitoring and care. The in_control relation in KARMA is true for the walk case and false for the fall case.

Problem 4: Multiple events

For each sentence, briefly describe the metaphoric inferences made by the system.

a.   US Economy was at a standstill, but it is now sprinting along.

       The best A posteriori value for the EC_STATE variable changes from NO GROWTH prediction after processing the first sentence to HIGH GROWTH after processing the second sentence

b.   France was on the verge of stumbling into recession, but recovered.

       The best A posteriori value for the EC_STATE variable changes from RECESSION prediction after processing the first sentence to NO GROWTH or LOW GROWTH after processing the second sentence.

Problem 6: New metaphors

Consider the following :

        The U.S. economic ills are cured.
        The Economy is healthy again.
        Free trade is the best therapy.

These sentences all include a metaphor that is not part of the current KARMA system.

a. Identify this metaphor, and give a systematic list of the mappings in terms of frame semantics.

    They all use metaphors that map concepts from the domain of health and well being onto concepts from the domain of economic policies. Part of this is already in the KARMA demo system, such as the state of health is mapped to the state of the economy, the evaluation of the treatment (good, bad) is mapped to an evaluation of the policy (free trade protectionist). The source frame (health care) has frame elements Patient, Doctor, Prescription, etc. and the Target frame (economic policy) has frame elements for the economy, its economic state etc.

    Some elements of the source and target frame are shown along with associated mappings.

Patient	MAPSTO	Economy
Patient.HealthState	MAPSTO	Economy.EconomicState
Patient.HealthState.Healthy	MAPSTO	Economy.EconomicState.HighGrowth
Patient.HealthState.Ill	MAPSTO	Economy.EconomicState.Recession
Patient.HealthState.Illness.severity	MAPSTO	Economy.EconomicState.Recession.severity
Doctor	MAPSTO	PolicyAuthority(could be Economist, PolicyMaker, Government etc.)
Prescription(Doctor, Patient)	MAPSTO	PolicyProposal(PolicyAuthority, Economy)

b. Suppose you wanted to modify the KARMA system to handle these sentences and make inferences about them. What X-Schema's would have to be added?

    We would have to add schemas for treating and curing illnesses.

c. Give an example of a Bayes net that could be used to reason about this domain.

    The target domain Bayes net would be the same as the one in KARMA. The source domain Bayes net would have nodes for the various frame elements of the health domain. The KARMA system already has nodes for TREATMENT and PATIENT STATE. The additional nodes would be added for the source domain frame elements that are mapped onto the target. For example, additional nodes would be added for the TYPE and SEVERITY of ILLNESS which get mapped to the EC_State variable in the target.

d. What would be the mappings between the X-Schema's from part 2) and the Bayes net from part 3)?

    The treat schema would map to two time steps in the source, one in which the patient state had value "ill" and another which had the treatment node ongoing. This would map to the target variable EC_STATE with initial value RECESSION. The policy node would has aspectual state ONGOING.

    The cure schema would map to two time steps in the source, one in which the patient state had value "ill" and the next in which it had value "healthy". The metaphor maps would connect to the EC_STATE target variable with initial state RECESSION and the next state where it was most likely LOW_GROWTH.