Qualitative Communication about Object Scenes

H. Joe Steinhauer[1]

1 Introduction and motivation

The work presented here is strongly motivated by the WITAS project [1] and its follow up's. The aim of the project was to develop an autonomous helicopter that should be able to fulfil several tasks on demand and communicate with a human operator or mission leader via natural language.

Imagine a contaminated disaster area where civil people are trapped and need urgent medical and food supply. Rescue teams that enter the area would take tremendous health risks. It would be of great advantage if the area could be explored by unmanned vehicles (helicopters, all-terrain vehicles). From what they learn from the autonomous observers rescue experts plan the operation and aid can be provided fast and precise where it is needed.

2 Research question and approach

I use qualitative reasoning techniques to improve the natural language communication about a scene of objects between a person and an autonomous system.

The communication includes that an observer watching the scene describes what objects there are and what position relations these objects have to each other. In the case of moving objects the description has to be updated whenever an *important* change has occurred. Such an important change takes place whenever an object changes its *qualitative* position relation to another object.

A listener that does not see the scene takes the natural language description as input and therefrom reconstructs and updates the scene of objects. Whenever necessary the listener can ask clarifying questions the observer will immediately answer.

The model used is very simple and intuitive. To describe an object's position the observer uses a reference object the listener already knows about and describes the new object's position in relation to that reference object. The reference object is meant to have an orientation and I use a left/right and a front/back dichotomy to divide the space around the reference object into eight areas. A ninth region is the region where the reference object itself is situated.

My thesis statement is that this intuitive and simple qualitative approach is sufficient for natural language communication about a scene of objects. The objects' relative positions can be described by this approach and the scene can be reconstructed and updated from the description so that all qualitative relative positions of the objects in the reconstructed picture are the same as in the original.

[1] Department of Computer Science, Linköping University, Sweden, email: joest@ida.liu.se

3 Research method, results and future work

In the beginning of the project I decided by common sense and introspection that the simple and intuitive model should be sufficient to capture the important aspects of the communication about a scene of objects. Experimenting with different scenarios and scenes and even different mental abstraction levels showed that the model used is very promising.

In [2] I show how the model can be used to qualitatively describe vehicle traffic maneuvers by using the conceptual neighborhood between the qualitative states.

[3] uses the same approach for a diagrammatic abstraction of vehicle traffic that mirrors the different possible interpretations of it and with this the different mental abstractions that humans might make.

In [4] the technique for reconstructing an object constellation from verbally expressed relations between the constituent objects is described.

In [5] the observer process and the listener process for a scene of objects without orientation and for a scene of objects with different orientations are illustrated . Furthermore the updating process of a scene of moving objects is captured.

The process of observing a scene of objects without orientation, calculating the qualitative relations and formulating them in short natural language expressions together with the intake of the natural language expressions and the reconstruction of the scene is already implemented. Adding orientation information will not be difficult.

The process for a scene of moving objets and the recognition process of object maneuvers as well as different interpretation level descriptions is left to implement.

The approach so far already contains some implicit size and distance information. For the future I plan to develop processes that make this information usable in reasoning tasks.

REFERENCES

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