Artificial Intelligence & Natural Language Understanding

Boris Hollas

HTW Dresden, Germany

February 28, 2012

1 Course overview

This lecture presents basic methods for knowledge representation and natural language processing and their implementation in the logic programming language Prolog. The following topics will be covered:

- Regular grammars

- Context-free grammars

- Syntax trees and ambiguous grammars

- Relations and predicates

- Knowledge representation and logical inference in Prolog

- Definite clause grammars and genus-casus-congruence in Prolog

In the project, we want to combine results of the speech & handwriting recognition project with natural language processing. The goal is to implement a simple dialogue system that receives input as speech or handwriting, processes both the audio signal and the resultant text, and provides an answer that is fed into a speech synthesizer to produce an output. We will present specific project ideas that you may choose from. Within this course, the focus is on the text processing and answer generation part.

2 Topics to prepare

Please review the following topics:

- Regular and context-free grammars

- Relations

- Logical connectives $\wedge$, $\vee$, $\rightarrow$

Suitable literature is listed below.

We will use the logic programming language Prolog for knowledge representation, inference and language processing. Please install SWI-Prolog (`http://www.swi-prolog.org/download/stable`) and try the examples below. You can use SWI-Prolog with the editor contained in the SWI-Prolog distribution or use `prolog-mode` in Emacs. Enter this Prolog-program

```
studies(tim, engineering).
studies(anne, medicine).
studies(peter, engineering).
```

and enter this query in the interactive environment:

```
?- studies(anne, medicine).
```

Prolog will answer **true**. Now let's see who studies engineering:

```
?- studies(X, engineering).
X = tim;
X = peter;
false.
```

You get the answers by typing ";" and return. The `false` indicates that there are no further answers.

3   Literature

- Michael Sipser: *Introduction to the Theory of Computation.*

- John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman: *Introduction to Automata Theory, Languages and Computation.*

- Stuart J. Russell and Peter Norvig: *Artificial Intelligence: A Modern Approach.*

- Ivan Bratko: *PROLOG Programming for Artificial Intelligence.*

- William F. Clocksin and Christopher S. Mellish: *Programming in Prolog.*