

Automated Acquisition of Anaphora Resolution Strategies

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Abstract

We describe one approach to build an automatically trainable anaphora resolution system. In this approach, we used Japanese newspaper articles tagged with discourse information as training examples for a machine learning algorithm which employs the C4.5 decision tree algorithm by Quinlan (Quinlan 1993). Then, we evaluate and compare the results of several variants of the machine learning-based approach with those of our existing anaphora resolution system which uses manually-designed knowledge sources. Finally, we will compare our algorithms with existing theories of anaphora, in particular, Japanese zero pronouns.

Introduction

Anaphora resolution is an important but still difficult problem for various large-scale natural language processing (NLP) applications, such as information extraction and machine translation. Thus far, no discourse theories have been tested on an empirical basis, and therefore there is no answer to the "best" anaphora resolution algorithm.¹ Moreover, an anaphora resolution system within an NLP system for real applications must handle:

- degraded or missing input (no NLP system has complete lexicons, grammars or semantic knowledge and outputs perfect results), and
- different anaphoric phenomena in different domains, languages, and applications.

These requirements have motivated us to develop robust, extensible and trainable anaphora resolution systems. Previously (Aone & McKee 1993), we reported our data-driven multilingual anaphora resolution system, which is robust, extensible and manually trainable. It uses discourse knowledge sources (KS's) which are manually selected and ordered. (Henceforth,

we call the system the Manually-Designed Resolver, or MDR.) We wanted to develop, however, truly automatically trainable systems, hoping to improve resolution performance and reduce the overhead of manually constructing and arranging such discourse data.

In this paper, we first describe one approach we are taking to build an automatically trainable anaphora resolution system. In this approach, we tag corpora with discourse information, and use them as training examples for a machine learning algorithm. (Henceforth, we call the system the Machine Learning-based Resolver, or MLR.) Specifically, we have tagged Japanese newspaper articles about joint ventures, and used the C4.5 decision tree algorithm by Quinlan (Quinlan 1993). Then, we evaluate and compare the results of the MLR with those produced by the MDR. Finally, we compare our algorithms with existing theories of anaphora, in particular, Japanese zero pronouns.

Applying a Machine Learning Technique to Anaphora Resolution

In this section, we first discuss a corpus used for training, then describe features used for training, and discuss training methods we employed for our current experiments.

Discourse-Tagged Corpora

In order to both train and evaluate an anaphora resolution system, we have been developing corpora which are tagged with discourse information. The tagging has been done using a GUI-based tool called the Discourse Tagging Tool (DTTool).² The tool allows a user to link an anaphor with its antecedent, and specify the type of the anaphor (e.g. pronouns, definite NP's, etc.). The tagged result can be written out to an SGML-marked file, as shown in Figure 1.

For our experiments, we have used a discourse-tagged corpus which consists of Japanese newspaper articles about joint ventures. The tool can let a user

¹Walker (Walker 1989) compares Brennan, Friedman and Pollard's centering approach (Brennan, Friedman, & Pollard 1987) with Hobbs' algorithm (Hobbs 1976) on a theoretical basis.

²Our work on the DTTool and tagged corpora was reported in a recent paper (Aone & Bennett 1994).

Errors In Anaphora Acquisition

Shasha Hu



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