Research Report: Learning to Search Better than Your Teacher

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Natural Language Processing (NLP) is the study of making computers understand how humans naturally speak, write, and communicate. Solving NLP problems is of the utmost importance to building a system that can function in the real-world. In NLP, POS (parts-of-speech) tagging is the process of marking up a word in a text as corresponding to a particular part of speech, based on both its definition and its context (See figure below). The significance of POS for language processing is the large amount of information they give about a word and its neighbors. This is clearly true for major categories (verb & noun), and is also true for the many finer distinctions. Knowing whether a word is a possessive pronoun or a personal pronoun can tell us that words are likely to occur in its vicinity. This can be very useful in a language model for speech recognition. POS tagging can also be used in stemming for informational retrieval (IR), since knowing a word’s part-of-speech can enhance an IR application by selecting out nouns or other important words from a document. Automatic assignment of POS plays a role in parsing, in word-sense disambiguation algorithms, and in shallow parsing of texts to quickly find names, times, dates, or other named entities for the information extraction applications.

In June 2015, Hal Daumé III, Associate Professor of Computer Science and director of the Computational Linguistics and Information Processing lab, pub-

![Figure 1: An example of POS tagging from the Penn Treebank Dataset [1].](image)


lished “Learning to Search Better than Your Teacher” in the International Conference on Machine Learning (ICML) [2, 3]. He collaborated on this work with researchers from University of Illinois at Urbana Champaign, Carnegie Mellon University, and Microsoft Research.

The collaborators’ work provides a new learning algorithm for structured prediction, applicable for a wide variety of problems in natural language processing. Methods for learning to search for structured prediction typically imitate a reference policy, with existing theoretical guarantees demonstrating low regret compared to that reference. This is unsatisfactory in many applications where the reference policy is suboptimal and the goal of learning is to improve upon it.

The paper in ICML provides a new learning to search algorithm, Locally Optimal Learning to Search (LOLS), which does well relative to the reference policy, but additionally guarantees low regret compared to deviations from the learned policy: a local-optimality guarantee. Consequently, LOLS can improve upon the reference policy, unlike previous algorithms.

LOLS performs well in the POS problem but can be used in many applications. Anyone can use it in their own applications. All programmers need to do is provide their own reference policies and LOLS does the rest of the learning automatically. It does well even when the reference policy is sub-optimal and is fast. Integration of Machine Learning into everyday software is becoming more realistic everyday.

References

