### I. The Problem

Some orderings sound clearly wrong

1. Cambridge is a beautiful academic city
2. Oxford is an academic beautiful city

Modifier order affects meaning

3. dirty French book ➔ covered in dirt
4. French dirty book ➔ adults only
5. wild office party ➔ wild
6. wild bird enthusiast ➔ almost certainly not wild

This poses multiple NLP challenges

- Room for improvement in AO systems for English language generation
- No cross-linguistic systems
- Extracting semantic representations of complex NPs is hard

### II. The Subjectivity Hypothesis

- Subjectivity: the degree to which an utterance can or cannot be interpreted independently of speaker perspective (Langacker 1991)
- Hypothesis: More subjective adjectives appear further from the noun

### III. System Overview

**Figure 2:** Schematic design of subjectivity-based AO system

- Feature profiles extracted for each from 24m words of BNC data
- Logistic regression classifier trained on 'correct' orderings taken from 1tn word Google N-gram Corpus – then tested on unseen pairs

### IV. Features of Adjective Subjectivity

Features potentially indicative of subjectivity – derived from:

- linguistic analysis
- automatic subjectivity quantification e.g. (Wiebe 2000)

**MODIFIABILITY:** Likelihood that adjective takes a ‘degree modifier’ (very hot, really tired)

**COMPARABILITY:** Likelihood that adjective takes (morphological or composite) comparative or superlative form (Wiebe 2000) (colder, the most expensive)

**PREDICATIVITY:** Occurrence in predicative (I am confused) vs. attributive (a confusing poster) constructions

**POLARITY:** Positive/negative sentiment (wonderful, terrible) vs. neutral (quiet, yellow) (Wiebe 2000)

**ADVERBIABILITY:** Prevalence of derived adverbial forms (slow → slowly, yellow → yellowly)

**NOMINALITY:** Prevalence of nominal senses (expected to indicate objectivity) (the British are intolerable)

### V. Outcomes

- Features combined are highly significant predictors of AO \( \chi^2 = 2257, p < 0.001^* \)
- Ordering accuracy of unseen combinations 73.0%
- Accuracy rises to 86.3% if testing on the 3000 pairs with highest ordering preference in N-gram Corpus (70.1% lowest 3000)

**Figure 3:** Performance of each feature in isolation

- All features apart from COMPARABILITY are statistically significant in combined model \( p < 0.001^* \)
- NOMINALITY correlates inversely with distance from head noun as predicted
- All features statistically significant predictors in isolation \( p < 0.001^* \)
- Introduction of ‘direct’ feature LEFTTENDENCY increases accuracy to 76.3%

### VI. Conclusions

Implications:

- Semantic features can be usefully incorporated into AO systems
- Potential to apply distributional subjectivity features to other tasks e.g. phrase-level semantic interpretation and inference, and cognitive modelling
- Strong empirical evidence for the subjectivity hypothesis for AO previously supported only by discussion and examples

Future work:

- More Training Data: Analysis shows rising accuracy when more data used for feature extraction (73.0% for 24m words vs. 71.1% for 7m words)
- Combine semantic (subjectivity) and direct (n-gram) features
- Direct comparison with existing benchmarks: Current testing framework does not correspond to other published work

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References


Felix Hill
Computer Laboratory, University of Cambridge, UK
fh295@cam.ac.uk