GiveMeExample: Learning Confusing Words by Example Sentences

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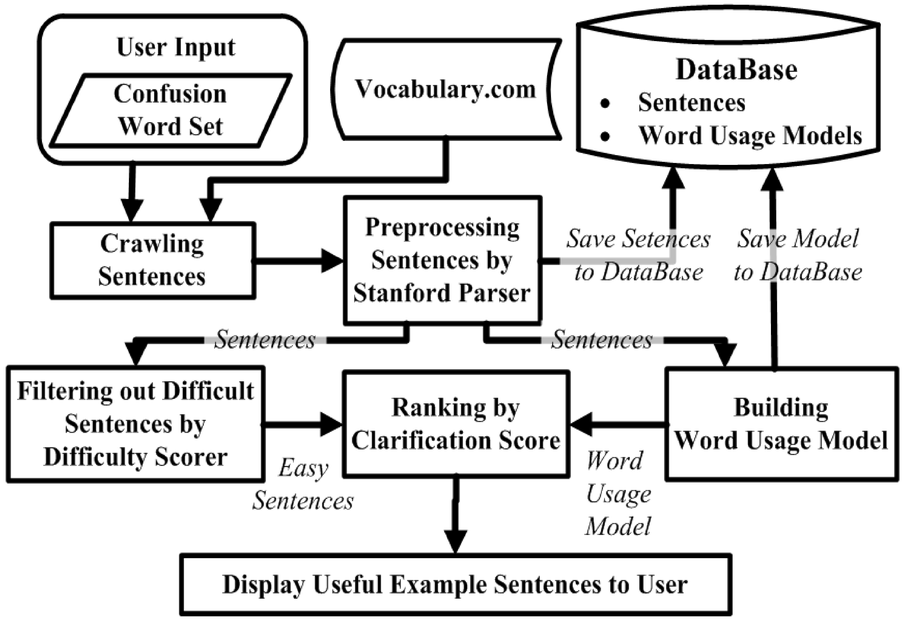
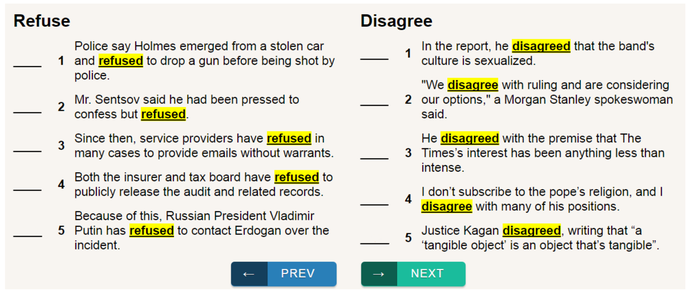
SYSTEM FRAMEWORK



GiveMeExample Framework

EXPERIMENT

- Learners labeled dataset.



An Example Question We Provide To Learner

- A total of 6 learners of 2 high, 2 medium, 2 low language proficiency help us label the most useful example sentence pair.
- 10 verb confusion sets and 200 questions are proposed for evaluation.
- For each question, we use the best rank among the 6 gold pairs to calculate the Mean Reciprocal Rank (MRR).

$$MRR = \frac{1}{\|Q\|}\sum_{q\in Q}\frac{1}{\min(rank_q)}$$

DIFFICULTY SCORER

- The automatic difficulty scorer is built based on the work of Pilan et al. but with several modifications.
  - In order to give a score to a sentence instead of a category, we apply linear regression instead of SVM.
  - Some features only for the Swedish language in Pilan's work are removed.
  - Training data is manually labeled by a native speaker, who considers the degree of difficulty of composite lexicons and the syntactic structure of the sentences.
- We set hard constrain for the difficulty score using a upper bound threshold.
  - "I accept it." is simple but not a good example sentence because it only provides limited information.

WORD USAGE MODEL

- We build word usage model to estimate $P(s|w)$ for each word w with the observed sentence s.
- Contexture Feature
  - Given an observed sentence $s = w_1 \dots w_{i-k} \dots w_i \dots w_{i+k} \dots w_n$, where w_i is target word and k is window size.
  - Contexture Feature will be $\{e_{w_{i-k}}P_{w_{i-k}} \dots e_{w_{i-1}}P_{w_{i-1}} \; e_{w_{i+1}}P_{w_{i+1}} \dots e_{w_{i+k}}P_{w_{i+k}}\}$, where e_w is word embedding of w, P_w is Part-Of-Speech of w.
- We apply Gaussian Mixture Model (GMM) to learn data's distribution.
- For each word, we use 5000 sentences to train its word usage model. Besides, the number of Gaussian mixture model is set to 50.

LEARNING DIFFERENCE

- When searching for the useful example sentences of the target word w_i in word set W. The clarification ability relates to two factors.
  - **Fitness Score**: $P(s|w_i)$, whether w_i is appropriate for the sentence s.
  - **Relative Closeness**: $\prod_{w_j \in W - w_i} P(s|w_i)/P(s|w_j)$, multiplication of probability ratios. The idea comes from that s should fit the target word w_i but be inappropriate for the rest of words in W.
- We define the clarification scoring function as the multiplication of these two scores:

$$score(s|w_i) = P(s|w_i) * \prod_{w_j \in W - w_i} \frac{P(s|w_i)}{P(s|w_j)}$$

RESULT

	accept / agree	delay / postpone	refuse / disagree	excuse / forgive	invent / discover
GiveMeExample	0.547	0.549	0.560	0.508	0.376
Random	0.434	0.428	0.413	0.402	0.411

	manage / arrange	prevent / deter	realize / understand	destroy / spoil	occur / happen
GiveMeExample	0.456	0.420	0.511	0.447	0.450
Random	0.428	0.433	0.438	0.419	0.424

- Average MRR of GiveMeExample is 0.486.
- Average MRR of Random Baseline is 0.423.

http://givemeexample.com/GiveMeExample