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Report: Recognizing Textual Entailment in Java

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For part 3 we implemented a learning algorithm provided by the Mahout[1] library. Mahout is a powerful and scalable machine learning library, providing algorithms for recommendations, clustering, and classification.

We implemented the *BasicMahoutMatcher* by using the *OnlineLogisticRegression* algorithm. The results were not very promising at first and it is fairly easy to get really bad results from the machine learner if the parameters are not correctly set or the wrong features are selected. The following features are used for the *BasicMahoutMatcher*:

- Lemma Matching
- IDF Lemma Matching
- Lemma+POS Matching
- BleuScore
- 2-Gram Overlap

The resulting score is not very good, as no semantic information and almost no structural information is used. The *BasicMahoutMatcher* scores 56.4%.

[1] Mahout website: `http://mahout.apache.org/`

Evaluating the Machine Learner

We implemented a 10-fold cross-validation to verify if our changes to the features improved the matcher or made the results worse. The code for this can be found in the *Main* class under the function name *crossValidate(ArrayList<THPair> pairs, IMachineLearnerRecognizer mlearner)*.

2 Building our own RTE system

In this section we describe our best RTE system.

2.1 Considerations from the prior systems

All prior systems turned out to be worse than the normal lemma matching, Which to this point was still our best system with a score of 63.25%. We did not see any big potential in improving the basic lemma matching further, so we decided to try to tune our machine learning matcher *BasicMahoutMatcher* in the form of *MahoutMatcher*. Our basic idea was to use the best non-machine-learner systems as features for the machine learner, hoping this would give the machine learner a good basis to work with.

2.2 Implementation

We already had the basic *BasicMahoutMatcher* from part three, which we decided to tune. The base of this matcher was the *OnlineLogisticRegression* learning algorithm distributed with the Mahout machine-learning library. We played around with all our basic matchers as features, but ended up only using a quite small subset in the final version. Only 6 features were used:

- Lemma Matching
- IDF Lemma Matching
- Lemma+POS Matching
- BleuScore
- Polarity
- WordNet Synonym Matching

For all features for which we had matchers (all except Polarity) we used the matchers estimate whether a text/hypothesis pair was entailing or not as value, as this is already a convinient value between 0 and 1. All matchers except for BleuScore already contain the Polarity measurement already as a sort of "deatch" criteria, where we set the estimate to 0 if the polarity doesn't match. We still use it as seperate feature, by setting the value to 1 if it matches and 0 if it doesn't, this proved helpful (without polarity feature, the result was 62.6%).

3 Results

- TreeDistMatcher combined with cost function

technique	parameters	threshold	correct
MahoutMatcher	10 fold cross-validation	avg. 0.5225 [0.475-0.55]	65.625% [57.5%-75%]
SynonymMatching		0.675	63.375%
LemmaMatching		0.675	63.25%
LemmaAndPosMatching		0.625	62.875%
LexicalMatching		0.575	62%
BleuScoreMatching	depth=2	0.425	61.875%
IDFLexicalMatching		0.325	61.625%
IDFLemmaMatching		0.5	61.375%
BleuScoreMatching	depth=4	0.5	61.25%
BleuScoreMatching	depth=3	0.425	61.125%
BleuScoreMatching	arithm. mean, depth=2	0.075	60.875%
LinSimilarityMatching		0.35	60.5%
WordNetDistanceMatching		0.775	60.25%
TreeDistMatcher	costs: WeightedLemma	0.725	57.125%
TreeDistMatcher	costs: WeightedIDF	0.4	55.75%
BleuScoreMatching	arithm. mean, depth=3	0.05	55.375%
BleuScoreMatching	arithm. mean, depth=4	0.05	51.875%
TreeDistMatcher	costs: FreeDeletion	0.05	51.7%

- very low threshold on some - consider seperately because of cross validation

4 Future plans and why we like to kiss erwins butt