# Summary Report (11/13/2014)

## Overview

In this week, I have done the following things:

* Mead + LexRank + MMR

## MMR for PhraseMead

In the implementation of MMR, I used the cosine as the similarity function, and the scores given by Mead or Mead+LexRank as the original ranking scores.

MMR will select documents one by one greedily with the following rule.

It is a linear combination of two scores: the original ranking score and the penalty score of duplication.

However, the implementation of MMR in Mead has a bug: it doesn’t consider the situation that there are multiple duplicate sentences in the input document. It is not an issue at a sentence level because the chance that two sentences are same is very low. However, at a phrase level, it happens a lot. By using the implementation of MMR in Mead, it will output multiple phrases that are same. The reason is even though two phrases are same, they might have different scores because of the position. Thus, even if the second phrase loses some penalty point because it is same as the existing one, the final score is still bigger than others.

This issue is fixed by filtering out phrases that have already picked.

## Clustering

A detail about how to perform the clustering:

* Since the initial seeds of the clusters are picked randomly, to minimize the random effect, the clusters are performed 100 times (it is very fast) and the results with the smallest within-cluster sum of distances are outputted.

## Available models

* Unigram: Most frequent Unigram
* Bigram: Most frequent Bigram
* Keyphrase: a supervised keyphrase extraction method
* NPrase-\*-TFIDF: Most frequent NP (with TFIDF)
* Phrase-\*-lexrank: Just rank the phrases by Lexrank
* PhraseMead: feed the Mead with phrases
* PhraseMead + MMR: perform a MMR reranking after the PhraseMead (best performance is reported, with the parameter lambda)
* PhraseMead + LexRank
* PhraseMead + LexRank + Cluster: add a clustering method to perform redundancy reduction

### All Results



### Observations

* The clustering method performance better all scores except (R2 for POI, LP, and RSU4 for MP)
* MMR improves the PhraseMead a little bit, but not PhraseMead + LexRank
* Need significant testing

## Clustering example

This is the same example I showed last week in the presentation.

There are 66 candidate phrases, and the number of clusters are 8.

The centroid phrase (output in the cluster algorithm) in the cluster is highlighted.

|  |  |  |
| --- | --- | --- |
| cluster id | size | phrases |
| 1 | 23 | part iii on worksheet in class , comparing metals ., 5, hooke 's law, a laser pointer,15 % of the class, resilience, any trouble with anything, all information, the class, the answers to part iii, most of the lecture, the projector, that calculation, this class, a much faster rate, the lecture, the values, a group member, the text, the pictures, printout, specific detail, each metal, metal |
| 2 | 9 | the coefficient of thermal expansion relationship to bond strength, 4 : axes on coefficient of thermal expansion graph ., property related to bond strength, the concept of thermal expansion, a little confusing properties related to bond strength, the bond strength, equations with bond strength and hooke 's law, the coeff of thermal expansion, higher coefficient of thermal expansion |
| 3 | 8 | the graph, several slides with complicated graphs and undefined variables, graphs and equations, energy vs. distance between atoms graph and what it tells us, size of print and colors, the graphs, graphs, the different graphs that look the same |
| 4 | 7 | graphs of attractive + repulsive forces, stress + strain, atomic structure, graphs of attraction / repulsive & interatomic separation, the repulsive / attraction charts, the attractive and repulsive force graphs from the third slide, the graphs of attraction and repulsion |
| 5 | 5 | elastic modulus, the working definition of elasticity, elastic modulus, the elastic modulus, elastic modulus |
| 6 | 5 | not the least bit confusing, nothing confusing, van der waals, the white board, a little bit |
| 7 | 5 | the activity, the activity ( part iii ), more than activities, the activity, the activity |
| 8 | 4 | the terms and equations, the trends, equations with stress, the concepts |

* General speaking, it is pretty good.

## Compression Rate by number of phrases

The results shown above are based on the compression rate of words (30 words in total)

In these experiment, I changed the compression rate to number of phrases, with 4 (the median number of phrases for Muddiest point)



## Frequency Computing

The number in the end of each entry in the TA’s summary indicates how many students expressed the same point. Thus, for phrase summarization, I used the number of students who has similar phrases as the weight, and the similar phrases are the phrases in the cluster.

## Example

S1: Graphs of attraction/repulsive & interatomic separation

S2: nothing

S3: Energy vs. distance between atoms graph and what it tells us

S4: Property related to bond strength

S5: The activity was difficult to comprehend as the text fuzzing and difficult to read. The pictures are impossible to understand It's too small

S6: Elastic modulus

S7: Equations with bond strength and Hooke's law

S8: I found a little confusing properties related to bond strength

S9: What is the coeff of thermal expansion?

S10: The graphs of attraction and repulsion were confusing to me

S11: Hooke's law

S12: I didn't fully understand the concept of thermal expansion

S13: How to determine the answers to part III, in the activity

S14: The activity ( Part III)

S15: Graphs are too small to look at specific detail

S16: The coefficient of thermal expansion relationship to bond strength

### Number of words (R=30)

|  |  |
| --- | --- |
| Human Summary | 1) Graphs of attraction/ repulsive & atomic separation [10]  2) Properties and equations with bond strength [7]  3) Coefficient of thermal expansion [6]  4) Activity part III [4] |
| Unigram | graphs, thermal, expansion, bond, understand, strength, class, repulsive, activity, confusing, coefficient, equations, elastic, modulus, graph, attraction, didn, hard, determine, part, iii, hooke, read, bit, small, related, understood, lecture, couldn, worksheet |
| bigram | thermal expansion, bond strength, elastic modulus, graphs of, hard to, understand the, didn 't, coefficient of, part iii, couldn 't, hooke 's, determine the, equations with, difficult to, graphs and, |
| Mead+LexRank | 4 : AXES on coefficient of thermal expansion graph .  graphs and equations  The coefficient of thermal expansion relationship to bond strength  a little confusing properties related to bond strength |
| Mead+LexRank+Clustering | the class [15]  The coefficient of thermal expansion relationship to bond strength [9]  graphs and equations [8]  graphs of attractive + repulsive forces [7]  elastic modulus [5]  nothing confusing [5]  the activity ( part iii ) [5] |

### Number of phrases (R=4)

|  |  |
| --- | --- |
| Human-generated Summary | 1) Graphs of attraction/ repulsive & atomic separation [10]  2) Properties and equations with bond strength [7]  3) Coefficient of thermal expansion [6]  4) Activity part III [4] |
| Unigram | graphs, thermal, expansion, bond |
| bigram | thermal expansion, bond strength, elastic modulus, graphs of |
| Mead+LexRank | 4 : AXES on coefficient of thermal expansion graph .  graphs and equations  The coefficient of thermal expansion relationship to bond strength  a little confusing properties related to bond strength |
| Mead+LexRank+MMR | 4 : AXES on coefficient of thermal expansion graph .  graphs and equations  a little confusing properties related to bond strength  Elastic modulus |
| LexRank+Clustering | the class [15]  The coefficient of thermal expansion relationship to bond strength [9]  graphs and equations [8]  graphs of attractive + repulsive forces [7] |

## Modified ROUGE-Score

The original ROUGE scores assume the ngrams are equally important, which might not be true. The ngram that included in more students should have higher weight.

Thus, the ROUGE scores are modified by adding a weighting to each ngram, which is given by the human.

The new ROUGE score are below:

However, I just modified the Recall of the ROUGE-N. The precision of ROUEG-N is not modified, because we cannot have the golden-standard of the weights in the model output.

TODO:

## Paper I read

Erkan, G., & Radev, D. R. (2004). LexRank: graph-based lexical centrality as salience in text summarization. *Journal of Artificial Intelligence Research*, *22*(1), 457–479. Retrieved from http://dl.acm.org/citation.cfm?id=1622487.1622501

<http://www.mendeley.com/share/document/invite/f28bcb14cf/?utm_medium=email&utm_source=transactional&utm_campaign=share%2Finvitation-document>