



# Information Retrieval

## Assignment 5:

## Finding Frequent Word Co-Occurrences

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# Collocation

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- two terms **co-occur** if they appear together in a sentence
- a **collocation** is a sequence of tokens that correspond to some conventional way of saying things [MS99]
  - examples: excruciating pain, crystal clear, whisper softly, cosmetic surgery
- one way to find collocations is to search for co-occurrences that appear **more often than would be expected by chance**
- assignment 5: find all over-represented co-occurrences among a reduced set of words in the IMDB corpus

# Assignment 5: Finding Frequent Co-Occurrences

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- only parse the **titles** and **plot** descriptions from the plot.list
- **tokenization** (at spaces, line breaks, dots, commas, colons, question marks and exclamation marks) and **lower-case-conversion** as in assignment 2
- since we don't detect sentence borders, we only consider as co-occurrence **subsequent occurrences of the two tokens**
- **disregard** tokens that are **stop words** based on the "Default English stopwords list" from [www.ranks.nl/stopwords](http://www.ranks.nl/stopwords)
  - don't remove stop words from the corpus, only disregard co-occurrences containing them
- **disregard** infrequent **tokens** with **less than 1000** total occurrences in the corpus
  - **again, both tokens have to be subsequent to one another (in the corpus) and neither may be a stop word or appear less than 1000 times**
- sort co-occurrences by descending **score**  $s(t, t') = \frac{2 \cdot F(t, t')}{F(t) + F(t')}$ 
  - $F(t)$  is the frequency of token  $t$  in the corpus
  - $F(t, t')$  is the frequency of bigram  $t, t'$  in the corpus (a **bigram** is a sequence of two adjacent tokens)
- report the top 1000 co-occurrences along with their score

# Example

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- sentences (“about”, “against”, “and”, “be”, “me”, “the”, “this”, “was”, and “with” are stop words):
  - *the crystal clear water rose against the coast, merging with the sky*
  - *let me be crystal clear about this, Rose*
  - *the red sun rose and the sky turned clear*
- token and bigram frequencies:
  - $F(\text{crystal}) = 2, F(\text{clear}) = 3, F(\text{water}) = 1, F(\text{rose}) = 3, F(\text{sky}) = 2, \dots$
  - $F(\text{crystal, clear}) = 2, F(\text{water, rose}) = 1, F(\text{rose, sky}) = 0, \dots$
- scores:
  - $s(\text{crystal, clear}) = \frac{2 \cdot F(\text{crystal, clear})}{F(\text{crystal}) + F(\text{clear})} = \frac{2 \cdot 2}{2 + 3} = \frac{4}{5}$
  - $s(\text{water, rose}) = \frac{2 \cdot F(\text{water, rose})}{F(\text{water}) + F(\text{rose})} = \frac{2 \cdot 1}{1 + 3} = \frac{1}{2}$
  - $s(\text{rose, sky}) = \frac{2 \cdot F(\text{rose, sky})}{F(\text{rose}) + F(\text{sky})} = \frac{2 \cdot 0}{3 + 2} = 0$
  - ...

# Top-10 Output (plot.list changes, your output may differ!)

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los angeles 0.8932607215793057

hong kong 0.7493632195618951

las vegas 0.7398075240594926

u s 0.70640263377721

united states 0.6942972495584153

hip hop 0.6292054402290623

san francisco 0.6093043290975663

martial arts 0.4953350296861747

beverly hills 0.48834080717488787

award winning 0.3101041554815849

# Deliverables

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- by Thursday, 9.2., 23:59 (midnight)
- submission: archive (zip, tar.gz)
  - contains Java source files, any used libraries, and your executable (and ready-to-be-executed) Jar
  - file name (of submitted archive): **your group name**
- upload to [https://hu.berlin/ue\\_ir\\_5](https://hu.berlin/ue_ir_5)
  - **if this doesn't work, send via mail to [buxmarcn@informatik.hu-berlin.de](mailto:buxmarcn@informatik.hu-berlin.de)**

# Your Program

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- no Java code frame given this time
  - you may reuse code from assignment 2 (parser?, positional index?)
- output of your Jar: **top 1000 co-occurrences sorted** (from high to low) by score, which is also printed
  - format / syntax: <token> <token> <score of bigram as double>  
(see slide 5)
- your Jar must be
  - named **CoOccurrences.jar**
  - executable from the command line by running  
**java -jar CoOccurrences.jar plot.list**
  - tried and **tested on gruenau2** before submission

# Presentation of Solutions

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- presentations will be given on 13./14. 2.
- no dudle this time
- via [Agnes](#), we will announce who will (yet have to) present
- remember, having presented at least once is a **prerequisite for the exam admission**
- one team will present their [word filter](#) (stop words, infrequent words)
- one team will present their [bigram counter and odds scorer](#)



# Competition

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- parse corpus and compute co-occurrences as **fast** as possible
- use memory abundantly (you have up to 50 GB)
  
- buffering / pre-computation of results is not allowed
  - we will delete files created by your Jar prior to the next run

# Checklist

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before submitting your results, make sure that you

1. named your jar **CoOccurrences.jar**
2. named your submitted archive according to your **group name**
3. included your source code in the submitted archive
4. **tested your Jar on gruenau2** by running  
**java -jar CoOccurrences.jar plot.list**  
(you might have to increase Java heap space, e.g. -Xmx6g)
5. made sure the output is similar in content and identical in syntax to the output on slide 5

# FAQ

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1. Should our program detect potential collocations containing stop words at all? For instance, if the sentence “Elvis is dead” appears very frequently, should our program detect “Elvis” and “dead” as being co-occurring?
  - No. The word sequence “elvis is dead” contains the bigrams “elvis is” and “is dead”. Both of these bigrams are disregarded as potential co-occurrences, since they contain a stop word. The bigram “elvis dead” is not considered as a potential co-occurrence, since the tokens “elvis” and “dead” are not subsequent to one another in the corpus.
2. Wouldn't it also make sense to parse the episode title and evaluate it for potential co-occurrences.
  - While it might seem intuitive to contain the episode title in our analysis of co-occurrences, it usually contains the episode number, which would mess up our co-occurrence counts. For instance, many episode titles will contain the string “(#1.1)”, leading to the tokens (#1 and 1) to be considered highly co-occurring. We don't want that and, hence, excluded the episode title from the text fields to be investigated for co-occurrences.

# FAQ (2)

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3. Should our program consider co-occurrences of words across the title and the plot description or across multiple plot descriptions?

- No, we consider pairs of tokens, in which one token belongs of a plot description and the other token belongs to the title or another plot description, to not be co-occurring. Consider the following entry:

*MV: "Bestest Series Everest" (????) {Quite a good episode}*

*PL: The best*

*PL: episode.*

*PL: A rather dull episode.*

Your program should only consider the following bigrams as potential co-occurrences:

*bestest series*

*series everest*

*the best*

*best episode*

*a rather*

*rather dull*

*dull episode*

Some of these bigrams will later be discarded due to containing a stop word or infrequent word.

# FAQ (3)

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4. Ist es erlaubt die Stop-Word-Liste als Programmparameter zu übergeben oder sollen wir die von der Webseite parsen?

- Die Stop-Word-Liste ist recht überschaubar. Ihr könnt sie entweder  
(a) als Text-File mit in euer Jar packen (siehe z.B. <https://www.mkyong.com/java/java-read-a-file-from-resources-folder/>) und dann bei Aufruf des Jars auslesen oder  
(b) direkt in den Code übernehmen, z.B. so:

```
private static Set<String> stopWords =  
    new HashSet<>(Arrays.asList("stop word 1", "stop word 2", ...));
```

Da die Liste an Stop-Word-Liste konstant ist und bleibt, haben wir uns dagegen entschieden, sie als Parameter übergeben zu lassen.

# Next (Final) Steps

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- 30./31. Jan (next week):
  - evaluation of assignment 4
  - presentation of solutions for assignment 4
  - Q/A session for assignment 5
- 6./7. Feb
  - Q/A session for assignment 5
  - attendance is optional
- 9. Feb:
  - submit assignment 5
- 13./14. Feb
  - evaluation of assignment 5
  - presentation of solutions for assignment 5
  - award & farewell ceremony