Multilingual Plagiarism Detection

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1 Problem Definition

According to Wikipedia, Plagiarism is:

- **Inserting** a text—copied word-for-word, or closely paraphrased with very few changes—from a source that is **not acknowledged** anywhere in the article.

- **Summarizing** a source in your own words, **without citing** the source in any way. [1]

2 Problem Definition

- In monolingual documents, plagiarism can be detected by means of document similarity, synonyms, …
- What about Multilingual Plagiarism?

The look of Yosemite, from the toolbars to window construction, has been adjusted. Windows and the dock are now translucent.

Yosemite的外观，从工具栏到窗口设计，都进行了调整。窗口和停靠栏都是半透明的。

3 Challenges

- Machine translation (MT)?
  - There is more than one way to translate a word.
  - Different languages have different syntax.
  - Current MT tools are inefficient. [2]

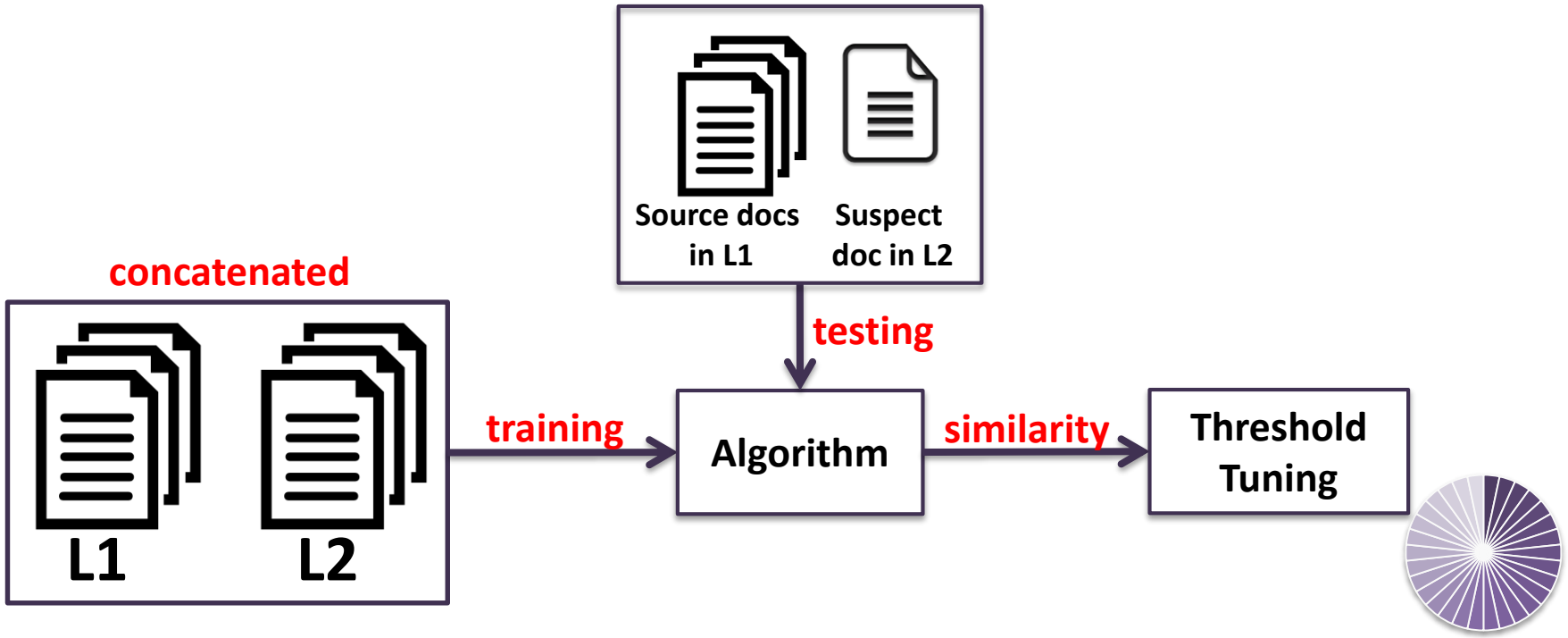
The look of Yosemite, from the toolbars to window construction, has been adjusted. Windows and the **dock** are now translucent.

优山美地的外观，从工具栏窗口建设，进行了调整。**Windows**和码头现在是半透明的。

Yosemite's appearance, from the toolbar window construction, have been adjusted. Windows and **Marina** is now translucent.

4 Approach

- Collection based Algorithms
  - Training with thousands of **parallel** or **comparable** documents about different topics.



5 Approach

- **L**atent **S**emantic **I**ndexing Algorithm(LSI):
  - Based on: words that are used in the **same contexts** tend to have **similar meanings**.[3]
  - Given a document d_{L1}, LSI retrieves documents in L2 that are **conceptually similar** in meaning to d_{L1} even if the results **don't share a specific word** or words with d_{L1}.[3]

6 Approach

- The disadvantages of using collection based approach are:
  - Collection (training) data coverage.
  - Computationally and memory intensive.

- We will attempt to overcome some of these disadvantages by looping humans in.

7 Implementation

- **Language Pair:**
  - English <-> Chinese
- **Training Datasets:**
  - United Nations manually translated sessions **[Parallel].** **(politics, economic, human rights topics)**
  - Wikipedia dataset using multilingual links and Wikipedia official dumps **[Comparable].** **(politics, science, sports, biographies, art, ...)**
  - Mix of both

8 Implementation

- **LSI implementation:**
  - Used gensim (Python library) implementation of LSI.
- **Test Documents:**
  - 28 English-Chinese pairs collected manually from various sources such are:
    - Wikipedia Chinese featured documents.[4]
    - Edinburg University plagiarism dataset (translated by MT tools and verified by Jerry!).[5]
    - Xinhuanet bilingual zone. [6]
    - Yeeyan manually translated articles.[7]

9 Implementation

- **Documents Preprocessing:**
  - English documents:
    - Lower case
    - Clear non-alpha characters
    - Remove stop words.[8]
    - Stemming.[9]
  - Chinese documents:
    - Cut words (segmentation).[10]
    - Remove stop words.[8]

- Removed documents shorter than **30** words.
- Removed words that appeared in less than **5** documents.
- Removed words that appeared in more than **half** the documents.
- Afterwards, retained only the top **150,000** words from both languages.

10 Implementation

- LSI infers some latent topics.
- Example:
  - Topic 1: -0.184*"委员会" + -0.170*"会议" + 0.162*"安全" + 0.148*"council" + 0.139*"我们" + 0.136*"secur" + -0.135*"committe" + -0.124*"a" + -0.123*"大会" + 0.115*"理事会"

committee

conference

security

general assembly

council

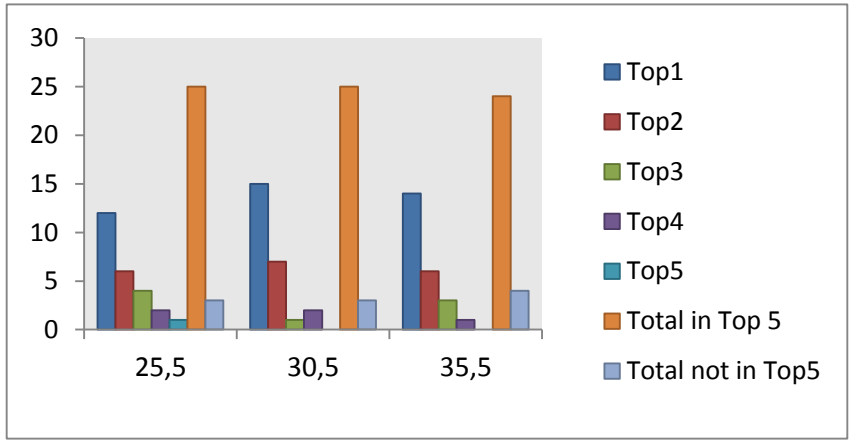
11 Implementation

- Topics in the parallel test dataset:
  - Politics
    - The 1996 United States campaign finance controversy was an alleged effort by the People's Republic of China to influence domestic American politics …..
  - Economics
    - Bank of China (Hong Kong) Limited is the second-largest commercial banking group ….
  - Technology
    - Many people blame Microsoft’s predicament on Steve Ballmer, the big, bald, manic, fist-pumping sales …..
  - Sports
    - Top seed Novak Djokovic is one match win away from becoming year-end world No. 1

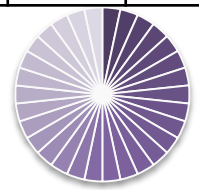
12 Results

Tested the system using the manually collected dataset:

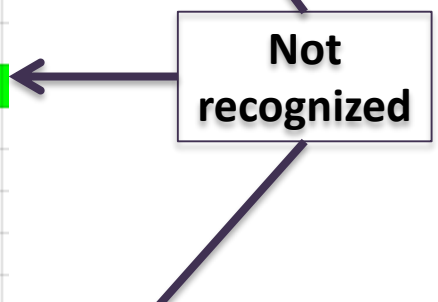
- **28 Chinese** documents versus a collection of around **10000 English** documents (including corresponding pairs of the 28 docs).
- Some documents were not retrieved at all.
  - Top seed **Novak Djokovic** is one match win away from becoming year-end world No. 1…..
  - UN Secretary-General Ban Ki-moon said Friday that there is hope that the **ebola** outbreak could be contained by mid-2015



Dataset Size Wikipedia (in k),UN (in k)	Top1	Top2	Top3	Top4	Top5	Total in Top 5	Total not in Top5
25,5	12	6	4	2	1	25	3
30,5	15	7	1	2	0	25	3
35,5	14	6	3	1	0	24	4



doc ID	top1	top2	top3	top4	top5	Not in top 5
9995	10002:0.244318	**9995:0.241621**	9521:0.227007	2971:0.225436	5565:0.218973	
9996	**9996:0.42459**	7380:0.318104	8017:0.286381	3834:0.2861	700:0.285542	
9997	7428:0.272027	9323:0.199209	4203:0.160149	8016:0.159793	7453:0.159406	
9998	**9998:0.15379**	3060:0.149815	5057:0.134144	4561:0.133826	2947:0.123357	
9999	**9999:0.326629**	6010:0.178842	7426:0.176884	10001:0.166236	3241:0.1656	
10000	**10000:0.286095**	195:0.160096	10009:0.156029	6702:0.148463	6615:0.142424	
10001	**10001:0.232291**	5298:0.156159	5252:0.154189	6127:0.133772	7312:0.129184	
10002	**10002:0.244318**	9995:0.241621	9521:0.227007	2971:0.225436	5565:0.218973	
10003	7831:0.150514	**10003:0.150514**	7847:0.145938	2832:0.135866	6727:0.132127	
10004	9251:0.26151	2635:0.206752	**10004:0.203041**	7967:0.203041	2905:0.202943	
10005	5871:0.202647	**10005:0.202647**	621:0.157082	8366:0.155484	6882:0.145546	
10006	**10006:0.431898**	7071:0.431898	9287:0.431766	1995:0.365436	7031:0.354422	
10007	3297:0.215907	**10007:0.215907**	8762:0.188679	7755:0.180947	5017:0.172974	
10008	9426:0.281064	1109:0.264178	9038:0.222037	8900:0.185158	9986:0.173137	
10009	**10009:0.40259**	761:0.325885	3515:0.251154	10015:0.244404	577:0.206303	
10010	**10010:0.506566**	8424:0.345125	3237:0.274772	5283:0.253996	8325:0.252478	
10011	1905:0.250049	**10011:0.237531**	5854:0.235739	5343:0.225055	9930:0.2231	
10012	**10012:0.283682**	8508:0.241707	1574:0.219177	7230:0.20921	6952:0.198783	
10013	**10013:0.28181**	8278:0.275479	1853:0.264668	4580:0.248308	7434:0.244814	
10014	6074:0.459326	**10014:0.433736**	6245:0.358228	8361:0.353778	1425:0.346055	
10015	5821:0.370207	1947:0.338291	6841:0.331168	**10015:0.300781**	3182:0.291361	
10016	**10016:0.221447**	1420:0.202973	4323:0.202973	851:0.190042	3421:0.188941	
10017	9038:0.275893	1109:0.248936	9426:0.248851	2794:0.238646	2867:0.229935	
7831	**7831:0.150514**	10003:0.150514	7847:0.145938	2832:0.135866	6727:0.132127	
7967	9251:0.26151	2635:0.206752	10004:0.203041	**7967:0.203041**	2905:0.202943	
5871	**5871:0.192901**	10005:0.192901	2060:0.128025	1698:0.124953	275:0.120014	
7071	10006:0.431898	**7071:0.431898**	9287:0.431766	1995:0.365436	7031:0.354422	
3297	**3297:0.215907**	10007:0.215907	8762:0.188679	7755:0.180947	5017:0.172974	
Tops:	15	7	1	2	0	3



13 Results

- Some topics were **not included (or not well covered)**in the training documents, and in result they are unrecognized by the algorithm.

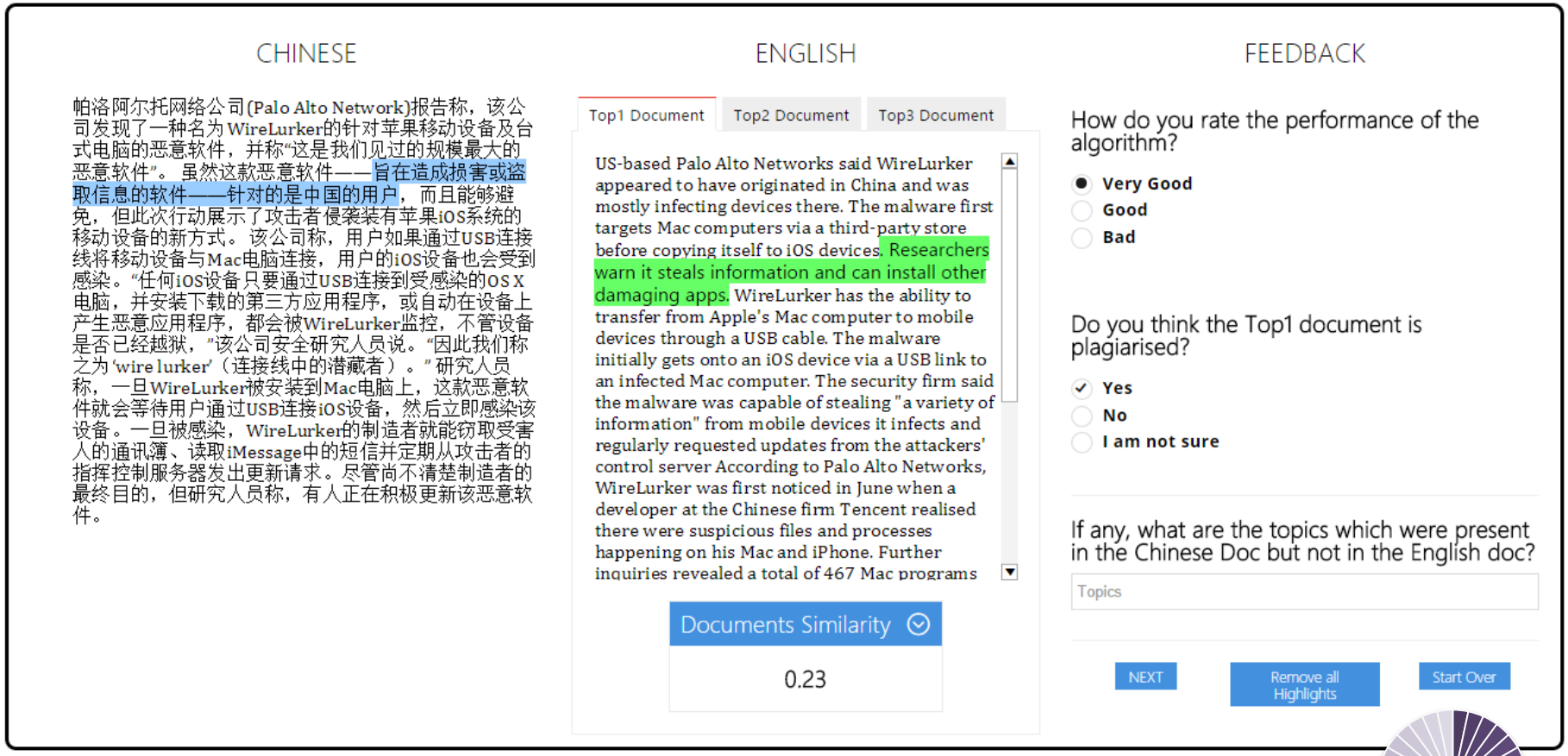
- Therefore, we ran **two experiments** with humans:
  1. Evaluate how users perceived plagiarism by displaying 4 articles, 2 plagiarized and 2 similar, and asking users for their opinions.
  2. Evaluate the algorithm similarity index and missing topics. (no one offered to help ☹)

15 Results

- Feedback received from users on Exp1 :
  - Reduce documents length.
  - Split documents to sentences.
  - Results were somewhat inconsistent.
- Each user took around 2-3 mins per document pair.

Users	Document:1 ISIS Same Author	Document:2 Ebola Same Author	Document:3 Online Privacy Diff Authors	Document:4 IPhone Security Diff Authors	Document:5 Exactly Translated Document
User1	Partially Plagiarized	Plagiarized	Partially Plagiarized	Not Plagiarized	Plagiarized
User2	Partially Plagiarized	Plagiarized	Not Plagiarized	Not Plagiarized	Not Plagiarized
User3	Partially Plagiarized	Plagiarized	Partially Plagiarized	Not Plagiarized	Partially Plagiarized
User4	Plagiarized	Plagiarized	Not Plagiarized	Partially Plagiarized	Not Plagiarized

14 Results (UI from Exp2)



16 Future Work

- Use the collected data from users to:
  - Tune the threshold for deciding if a document pair is plagiarized or not.
  - Add missing topics to the training data.

- Sample documents from Wikipedia that gives good and equal coverage over the general topics.

17 References

- [1] http://en.wikipedia.org/wiki/Wikipedia:Plagiarism
- [2] https://www.plagiarismtoday.com/2011/02/24/the-problem-with-detecting-translated-plagiarism/
- [3] http://en.wikipedia.org/wiki/Latent_semantic_indexing
- [4]http://en.wikipedia.org/wiki/Wikipedia:WikiProject_China/Featured_and_good_content
- [5]http://www.inf.ed.ac.uk/teaching/courses/tts/assessed/assessment3.html
- [6] http://www.xinhuanet.com/english/bilingual/news.htm
- [7] http://www.yeeyan.org/
- [8] https://code.google.com/p/stop-words/
- [9] http://www.nltk.org/_modules/nltk/stem/porter.html
- [10] http://code.google.com/p/smallseg/

Question 1

Question 2

Thank You!