A comparative study of I2B2 Shared Task 2011 Co-reference resolution in clinical text

David Hinote, Carlos Ramirez, Ping Chen

Introduction

Co-reference occurs when multiple concepts in a sentence or document refer to the same thing. The purpose of this study is to find an automated process to mark this kind of relation in medical documents, and participate in the I2B2 Shared

Rules of Co-reference

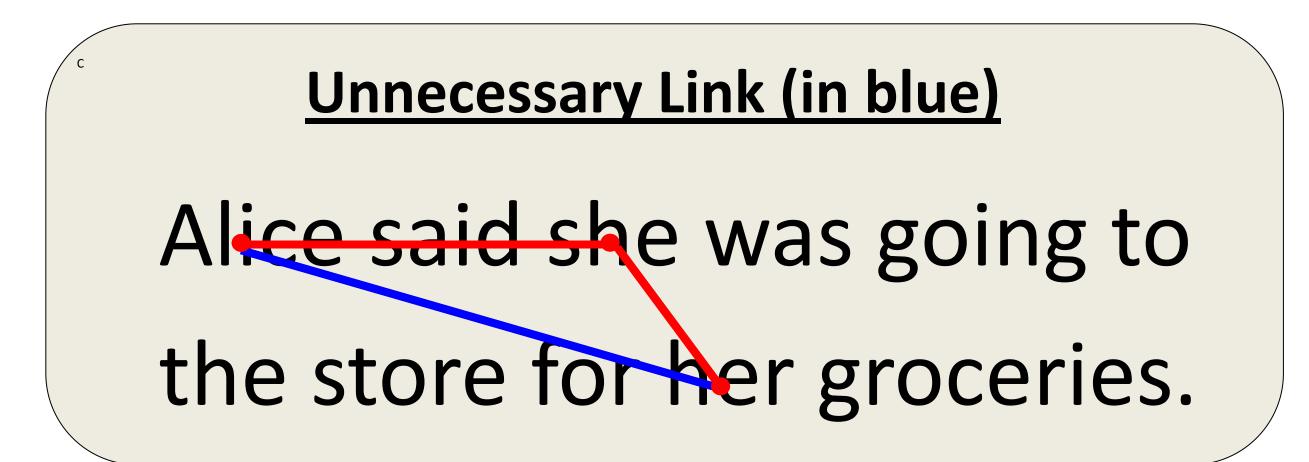
Using the visual tool, we coded rules that utilize simple string matching, the UMLS, and WordNet databases to give meaning to the concepts and match the meanings. All pronouns use linking rules specifically coded for each case.

University of Houston-Downtown

Building Chains

Concepts are first linked in pairs, then, after filtering, unnecessary links are removed to make he chains.

University of Houston-Downtown



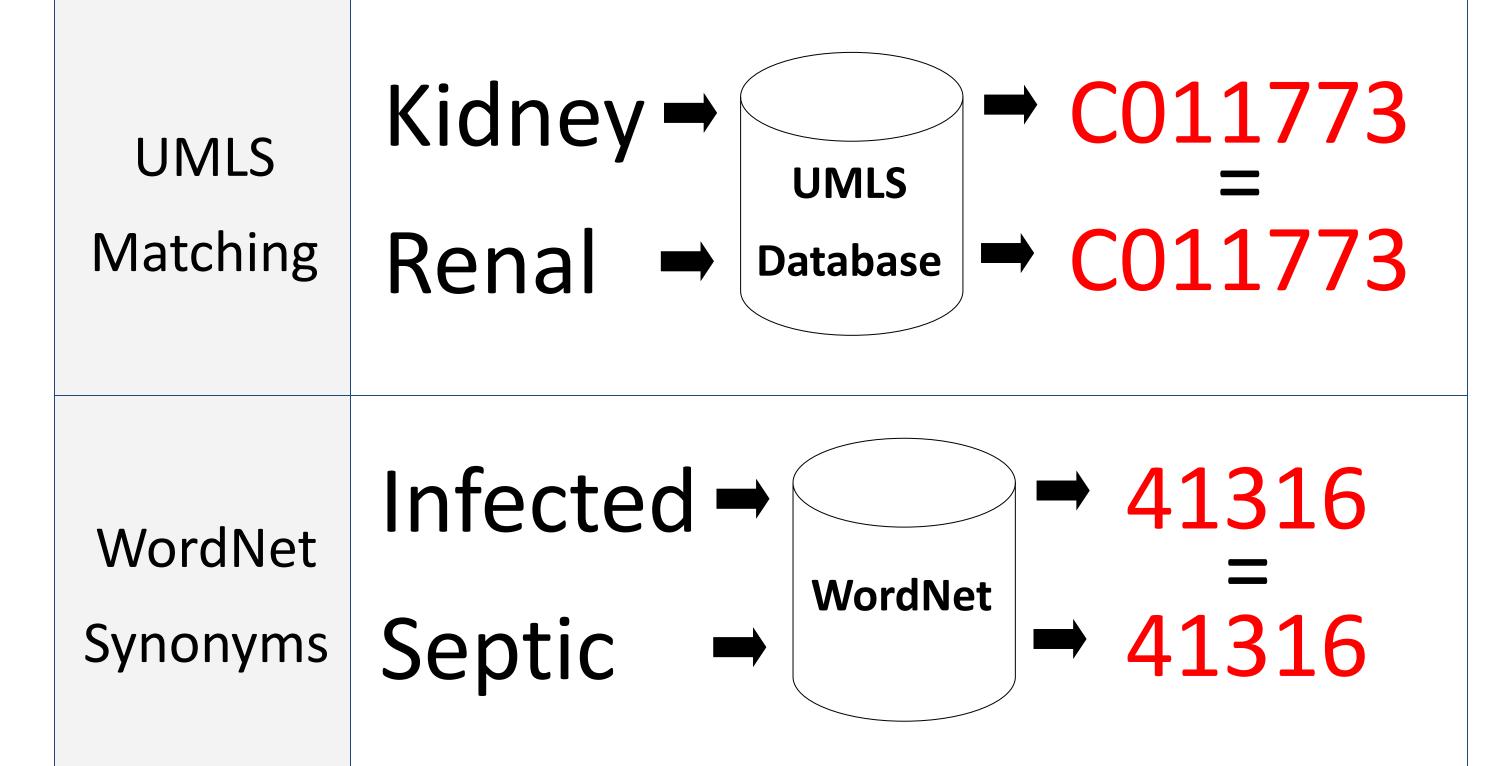


<u>Example Co-reference Chains</u> My boss told me I must give him my final Report.

Approach

Since there are co-reference resolution systems that already exist, we searched for and obtained publicly available tools which mark co-reference. In addition to these tools, we constructed our own rule-based algorithm for marking co-reference which we could specialize for the clinical records. The rest of the study would involve comparing the results of the systems and find which system, or combination of the systems, produces the greatest amount of correct co-referent links.

StringSyncope → SyncopalMatchingPulmonary embolus → PE



Other Systems & Results

The other systems tested in addition to the rule based system we created are the Stanford NLP System, BART, and LingPipe. The overall scores for all four were obtained using an evaluation script provided by I2B2, the hosts of the 2011 shared task. The following scores are the overall F1 scores of performance on the I2B2 data. The F1 score is the harmonic average of precision (total correct links/total generated links) and re-

Building an Algorithm

The first step in building our own algorithm was to construct an environment in which we can easily view the input documents & concepts, and the output co-referent links being discovered by the rules we create. Once finished, we used this tool to write rules for our algorithm, and view the results.

Link Filtering

After linking concepts that have the same meaning, links between concepts which do not actually refer to the same entity must be filtered out.

The patient had knee surgery on 7-10-99. Knee surgery also occurred on (total correct links/total generated links) and re-

call (total correct links/number of actual links).

| UHD | BART | Stanford | LingPipe |
|-------|-------|----------|----------|
| 0.900 | 0.775 | 0.633 | 0.633 |

Combining results

The only publicly available co-reference system which found correct links that our algorithm did not was the BART system. We took the output from BART and put it in a union with our output and ran the combination in the script. The result of that was about a 1% increase in recall, but a decrease of about 15% in precision. Because of this, only the results of the algorithm we constructed were sent in for our participation in the 2011 I2B2 Shared Task.

| *INSTITUTION | ^ | 🔽 I2B2 |
|--|----------|------------|
| Discharge Summary | | VHD |
| Name : | | Stanfo |
| *NAME[AAA, BBB] | | Bart |
| Acct # : | | LingPi |
| *ID-NUM | | Lingri |
| MRN : | | |
| *ID-NUM | | |
| Admitted : | | |
| *DATE[Mar 12 2007] | | |
| Discharged : | | |
| *DATE[Mar 30 2007] | | |
| Dict : | | |
| *NAME[XXX, WWW] | | |
| Attend : | | |
| *NAME[ZZZ , YYY] | | |
| DEATH SUMMARY | | |
| DATE OF DEATH : | | |
| *DATE[Mar 31 2007] . | | |
| CAUSE OF DEATH : | | |
| thronic obstructive pulmonary disease , end stage . | = | |
| | - | |
| Ns. **NAME[AAA] was an **ACEfin 80s]- year- old female who was admitted on **DATE[Mar 12 2007] , and found to have pheumonia as well as doncurrent end - stage chronic obstruct | <u>i</u> | |
| the patient was started on Pseudomonas for Insetment of Mer right lower lobe pneumonia. | | |
| lowever, ther hospital course was complicated by a GI bleed , requiring 12 units of PRBCs transfusion . | | |
| the patient continued to deteriorate throughout the hospital course and became weaker, and it was clear that the COPD was end stage . | | |
| herefore , hospice was recommended , and the patient was transferred to hospice on **DATE[Mar 30 2007] , after full discussion with the patient 's family and medical staff and care prov | <u>i</u> | |
| Dnce transferred to hospice , the patient was managed on the principles of comfort measures only . | | |
| fer respiratory status continued to worsen , and <mark>lifer</mark> overall condition continued to deteriorate . | | |
| he patient was eventually <u>placed on continuous IV infusion</u> of morphine for comfort . | | |
| On **DATE[Mar 31 2007] , the nurse notified the <u>**NAME[VVV] MD regarding</u> the patient 's clinical condition . | | |
| Dr. **NAME[UUU] examined the patient at bedside , and findings were significant for no respiration , no pulse , and negative and the patient at bedside , and findings were significant for no respiration , no pulse , and negative and the patient of the open in the the patient ceased to breathe at 12.30 pm on **DATE(Mar. 31.2007) and the death certificate was signed and dated at the article of the open in the | | |
| The traffient ceased to breathe at 12.30 p.m. on **DATE(Mar.31.2007) and the death certificate was signed and dated at the GALIIPIC INC UPCIIIII CIIC | | |

2-23-02.

The sentences surrounding the linked concepts are

examined for information that indicates if they are

actually different entities. If any relevant informa-

tion is found and it differs, the link is discarded.

Acknowledgements

This work is funded by the United States National Sci-

ence Foundation (Grant: CNS 0851984) and The

United States Department of

Homeland Security (Grant:

2009-ST-061-C10001)

