COMP348 — Document Processing and the Semantic Web

Week 13 Lecture 1: Natural Language Processing for Evidence Based Medicine

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COMP348 2018H1

Abstract

This lecture will go over some of the technology behind a practical system designed to help the medical doctor to search, extract, and appraise the quality of clinical evidence available in published reports. This system is being developed at Macquarie University. If you are interested in participate, contact us!

Update June 4, 2018

Contents

Some Useful Extra Reading

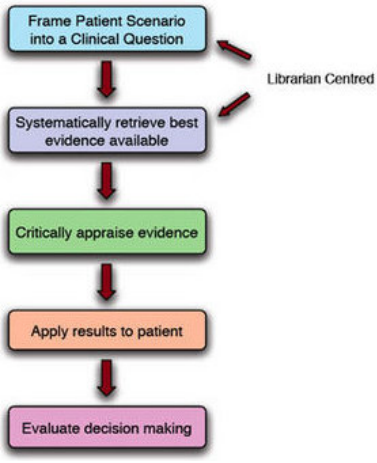
- NLP of Medical Texts: project page *http://comp.mq.edu.au/~diego/medicalnlp/*
- EBMSummariser demo: *http://130.56.244.116:8000/*

1 What is Evidence Based Medicine?

Evidence Based Medicine

http://laikaspoetnik.wordpress.com/2009/04/04/evidence-based-medicine-the-facebook-of-medicine/

Steps in EBM

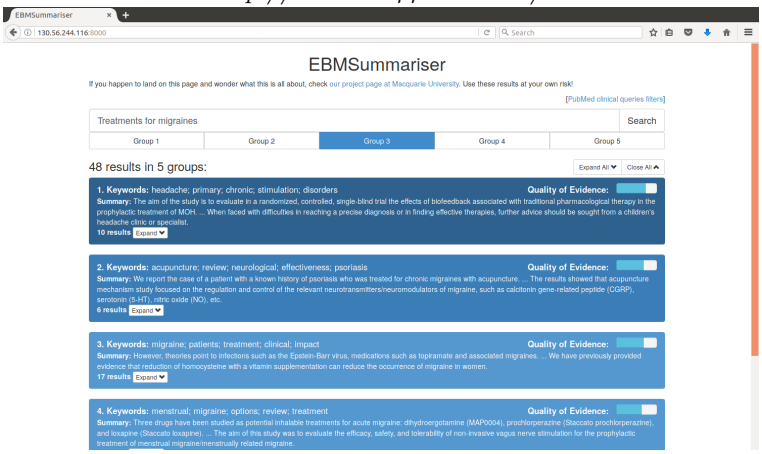


http://hlwiki.slais.ubc.ca/index.php?title=Five_steps_of_EBM

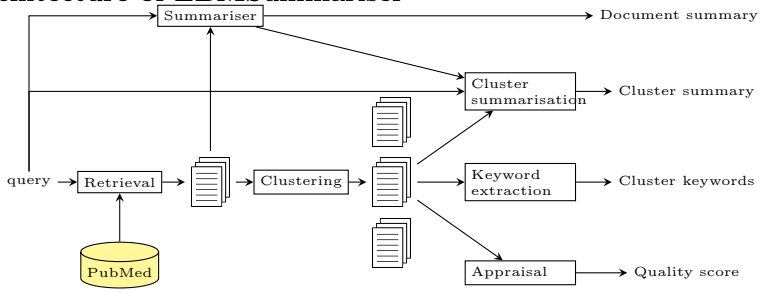
2 EBMSummariser

The System

http://130.56.244.116:8000/



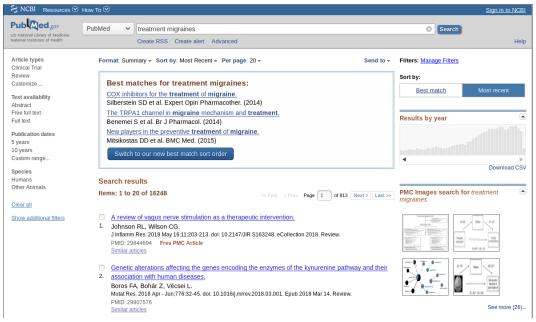
Architecture of EBMSummariser



Retrieval of Relevant Documents

PubMed

- *https://www.ncbi.nlm.nih.gov/pubmed/*
- More than 28 million citations from biomedical literature.
- API via the Entrez Programming Utilities (E-utilities).



Single-document Summarisation

Regression-based Summarisation

- On a training set, all sentences are annotated with a score of importance.
- We train a regression system (Support Vector Regression) to learn to score the sentences.
- We choose the top n sentences.

Features

- tf.idf of the words in the sentence.
- Cosine similarity with the tf.idf of the words in the question.

Clustering

K-means Clustering

- We haven't covered clustering in this unit ...
- Clustering attempts to find groups of similar documents.
- We used k-means clustering.
- Each document is represented as a vector.
  - tf.idf of the words in the document.
- K-means uses Euclidean distance between vectors.
- The number of clusters K is simply the square root of the total number of documents retrieved:

$$K = \sqrt{N}$$

Cluster Appraisal

Regression

- The training data uses the Strength of Recommendation Taxonomy (SORT) with three levels.
- We map the levels to a number from 0 to 1.
  - A $\rightarrow$ 1, B $\rightarrow$ 0.5, C $\rightarrow$ 0
- The resulting numbers are the target score.
- We use Support Vector Regression to learn to score the clusters.

Features

- tf.idf of the document (title and abstract).

Cluster Summarisation

Steps

1. Score each sentence in the cluster.
2. Select the top 2 sentences.

Sentence Scoring

- Obtain the individual summary of each document.
- Concatenate all summaries into one document.
- Perform regression-based summarisation of the resulting document.
  - Same features as for single-document summarisation.

Keyword Extraction from Clusters

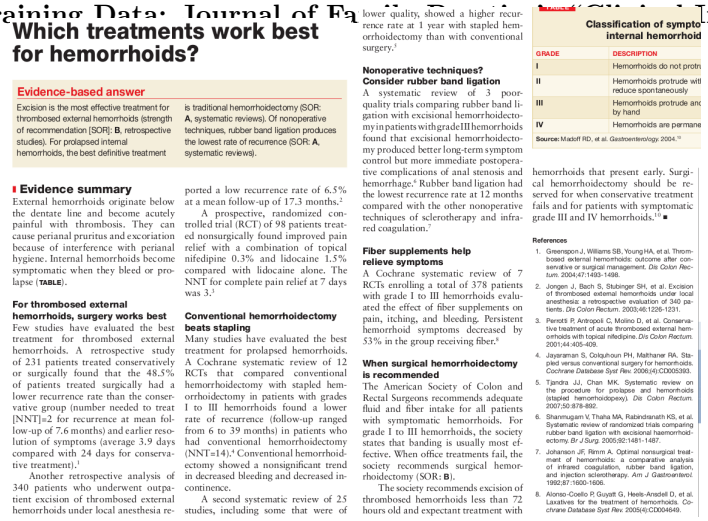
Cluster centroid

- Each document in the cluster is represented as a vector.
  - This is the same vector that is used by K-means to find the clusters.
- The centroid of a cluster is the average of all document vectors.

Extraction of Keywords

1. Find the cluster centroid, each element in the centroid represents one word.
2. Select the n elements in the centroid with highest value.
   - Ignore words that appear in the query.
   - Ignore words with low tf.idf score.

Training Data: Journal of Family Practice "Clinical Inquiries"



Which treatments work best for hemorrhoids?

Evidence-based answer

Excision is the most effective treatment for thrombosed external hemorrhoids (strength of recommendation [SOR]: **B**, retrospective studies). For prolapsed internal hemorrhoids, the best definitive treatment is traditional hemorrhoidectomy (SOR: **A**, systematic reviews). Of nonoperative techniques, rubber band ligation produces the lowest rate of recurrence (SOR: **A**, systematic reviews).

Evidence summary

External hemorrhoids originate below the dentate line and become acutely painful with thrombosis. They can cause perianal pruritus and excoriation because of interference with perianal hygiene. Internal hemorrhoids become symptomatic when they bleed or prolapse (**TABLE**).

For thrombosed external hemorrhoids, surgery works best

Few studies have evaluated the best treatment for thrombosed external hemorrhoids. A retrospective study of 231 patients treated conservatively or surgically found that the 48.5% of patients treated surgically had a lower recurrence rate than the conservative group (number needed to treat [NNT]=2 for recurrence at mean follow-up of 7.6 months) and earlier resolution of symptoms (average 3.9 days compared with 24 days for conservative treatment).[1]

Another retrospective analysis of 340 patients who underwent outpatient excision of thrombosed external hemorrhoids under local anesthesia reported a low recurrence rate of 6.5% at a mean follow-up of 17.3 months.[2]

A prospective, randomized controlled trial (RCT) of 98 patients treated nonsurgically found improved pain relief with a combination of topical nifedipine 0.3% and lidocaine 1.5% compared with lidocaine alone. The NNT for complete pain relief at 7 days was 3.[3]

Conventional hemorrhoidectomy beats stapling

Many studies have evaluated the best treatment for prolapsed hemorrhoids. A Cochrane systematic review of 12 RCTs that compared conventional hemorrhoidectomy with stapled hemorrhoidectomy in patients with grades I to III hemorrhoids found a lower rate of recurrence (follow-up ranged from 6 to 39 months) in patients who had conventional hemorrhoidectomy (NNT=14).[4] Conventional hemorrhoidectomy showed a nonsignificant trend in decreased bleeding and decreased incontinence.

A second systematic review of 25 studies, including some that were of lower quality, showed a higher recurrence rate at 1 year with stapled hemorrhoidectomy than with conventional surgery.[5]

Nonoperative techniques? Consider rubber band ligation

A systematic review of 3 poor-quality trials comparing rubber band ligation with excisional hemorrhoidectomy in patients with grade III hemorrhoids found that excisional hemorrhoidectomy produced better long-term symptom control but more immediate postoperative complications of anal stenosis and hemorrhage.[6] Rubber band ligation had the lowest recurrence rate at 12 months compared with the other nonoperative techniques of sclerotherapy and infrared coagulation.[7]

Fiber supplements help relieve symptoms

A Cochrane systematic review of 7 RCTs enrolling a total of 378 patients with grade I to III hemorrhoids evaluated the effect of fiber supplements on pain, itching, and bleeding. Persistent hemorrhoid symptoms decreased by 53% in the group receiving fiber.[8]

When surgical hemorrhoidectomy is recommended

The American Society of Colon and Rectal Surgeons recommends adequate fluid and fiber intake for all patients with symptomatic hemorrhoids. For grade I to III hemorrhoids, the society states that banding is usually most effective. When office treatments fail, the society recommends surgical hemorrhoidectomy (SOR: **B**).

The society recommends excision of thrombosed hemorrhoids less than 72 hours old and expectant treatment with hemorrhoids that present early. Surgical hemorrhoidectomy should be reserved for when conservative treatment fails and for patients with symptomatic grade III and IV hemorrhoids.[10] ■

Classification of sympto internal hemorrhoid

GRADE	DESCRIPTION
I	Hemorrhoids do not protr
II	Hemorrhoids protrude wit reduce spontaneously
III	Hemorrhoids protrude an by hand
IV	Hemorrhoids are permane

Source: Madoff RD, et al. *Gastroenterology.* 2004.[10]

References

1. Greenspon J, Williams SB, Young HA, et al. Thrombosed external hemorrhoids: outcome after conservative or surgical management. *Dis Colon Rectum.* 2004;47:1493-1498.
2. Jongen J, Bach S, Stubinger SH, et al. Excision of thrombosed external hemorrhoids under local anesthesia: a retrospective evaluation of 340 patients. *Dis Colon Rectum.* 2003;46:1226-1231.
3. Perrotti P, Antropoli C, Molino D, et al. Conservative treatment of acute thrombosed external hemorrhoids with topical nifedipine. *Dis Colon Rectum.* 2001;44:405-409.
4. Jayaraman S, Colquhoun PH, Malthaner RA. Stapled versus conventional surgery for hemorrhoids. *Cochrane Database Syst Rev.* 2006;(4):CD005393.
5. Tjandra JJ, Chan MK. Systematic review on the procedure for prolapse and hemorrhoids (stapled hemorrhoidopexy). *Dis Colon Rectum.* 2007;50:878-892.
6. Shanmugam V, Thaha MA, Rabindranath KS, et al. Systematic review of randomized trials comparing rubber band ligation with excisional haemorrhoidectomy. *Br J Surg.* 2005;92:1481-1487.
7. Johanson JF, Rimm A. Optimal nonsurgical treatment of hemorrhoids: a comparative analysis of infrared coagulation, rubber band ligation, and injection sclerotherapy. *Am J Gastroenterol.* 1992;87:1600-1606.
8. Alonso-Coello P, Guyatt G, Heels-Ansdell D, et al. Laxatives for the treatment of hemorrhoids. *Cochrane Database Syst Rev.* 2005(4):CD004649.

The XML Contents

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      3.</longtext>
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      Antropoli C, Molino D ,et al. Conservative treatment of acute
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Take-home Messages

- Natural Language Processing technology to help the medical doctor find the best clinical evidence.
- The current system is a collection of simple approaches.
- For more details, see *http://comp.mq.edu.au/~diego/medicalnlp/*

What's Next

Interested to know more?

- Friends of COMP348 (Facebook group) *https://www.facebook.com/groups/187767448495983/*