Implicit Negative Feedback in Clinical IR

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Medical Literature: Scale & Growth

- 25 Million articles indexed in MedLine
- Recently growing by ~1 Million new articles per year
- Manual search and processing become infeasible
- Search technology is needed
- Goal: Processing the collection in < 20 mS
Patient-centric Search Scenarios
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A 58-year-old African-American woman presents to the ER with episodic pressing/burning chest pain that began two days earlier for the first time in her life. The pain started while she was walking, radiates to the back, and is accompanied by nausea, diaphoresis and mild dyspnea, but is not increased on inspiration. The latest episode of pain ended half an hour prior to her arrival. She is known to have hypertension and obesity. She denies smoking, diabetes, hypercholesterolemia, or a family history of heart disease. She currently takes no medications. Physical examination is normal. The EKG shows nonspecific changes.
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Detrimental Effects on Search Performance
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- Negated phrases contain valuable information
- Using them as query terms can be problematic
- Naive approach: Remove all negated phrases
- Alternative: Use them as negative feedback
Formal Patient-centric Retrieval

Standard Retrieval Model

\[ S(Q, D) = S(Q_{\text{full}}, D) \]

Negation Filtering

\[ S(Q, D) = S(Q_{\text{pos}}, D) \]

Negative Feedback

\[ S_{\text{combined}}(Q, D) = S(Q_{\text{full}}, D) - \beta \times S(Q_{\text{neg}}, D) \]
Experimental Setup

- TREC Clinical Decision Support Track
- 30 anonymized clinical notes
- 733,000 PubMed articles
- Find relevant literature for each patient
- Evaluated by NLM experts
Results

Retrieval Performance

- Negations
- No negations
- Negation Filtering
- Negative Feedback
Conclusion

- Clinical data science becomes crucial as collections scale
- Accounting for phrase compositionality is important
- E.g., negated phrases
- Negations detriment state-of-the-art retrieval methods
- Explicitly modelling and using this type of information helps
- Future (ongoing) work: Deep neural networks for modelling phrase compositionality
Thank You!