Information Extraction from Dirty Notes for Clinical Decision Support

Clare T Grasso, UMBC
Anupam Joshi, PhD (Advisor)
Eliot Siegel, MD

Requirements

- **Information Retrieval & Extraction**
  - High precision
    - Top 1-2 Ranking
  - High recall
- **Clinical Decision Support**
  - Near real-time performance constraints
    - 3 seconds or less
    - Over thousands of pages of text

Semantic Search

Use Case: Pain

Attributes:

- Location
- Severity
- Quality/Type
- Onset
- Duration

Patient came in complaining of abdominal pain. Symptoms started 2 weeks ago, sudden, usually lasts intermittently. He rates the pain as 8/10 with zero being no pain and 10 being worst possible pain. Pain is described as aching, shooting, squeezing and throbbing.

John, Tony (March 15, 2012). "What is Semantic Search?". *Techulator*. Retrieved July 13, 2012.

Dirty Notes

Characterized by nonstandard use of:

Abbreviations

Punctuation

Capitalization

White space

Etc.

1. CHIEF COMPLAINT:

ABD PAIN @ OLD SURGICAL SITE, ONSET THIS AM, DENIES SOB, DENIES C/P, PT. THOUGHT PROCESS OFF/CONFUSING THIS THOUGHTS, DR. XXXXXX MADE AWARE PT IN ACUTE AREA BED #5

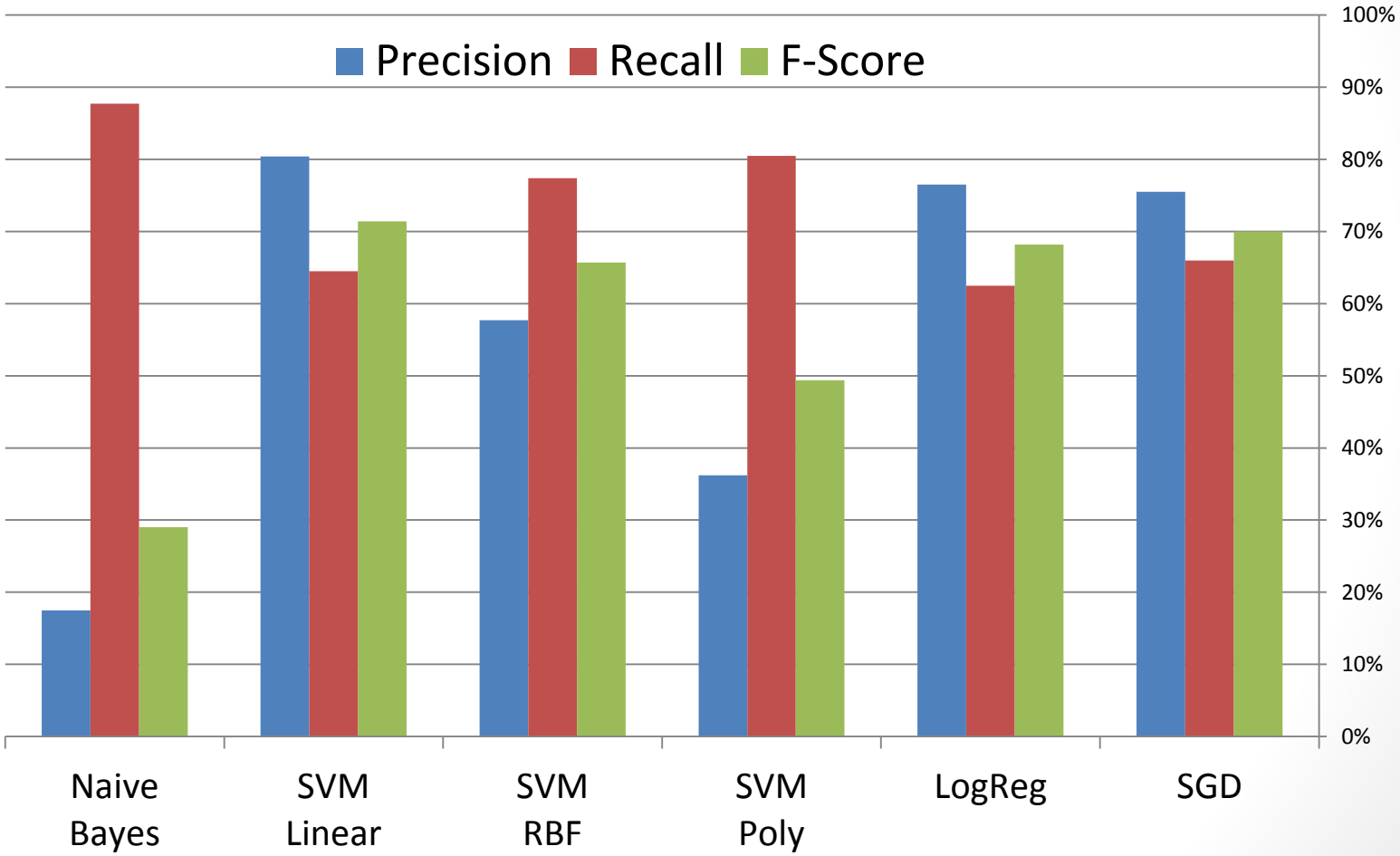
Data Properties

- Training Data
  - 1500 pages @ 10 point font
  - 1-2% of the lines contain data relating to patient pain

Using IR with Machine Learning

- Vectorization
  - TF.IDF
  - Cosine normalization
- Query Terms
  - “learned” by ML Algorithms
- Performance Efficiency
  - 0.6 seconds

Machine Learning Results



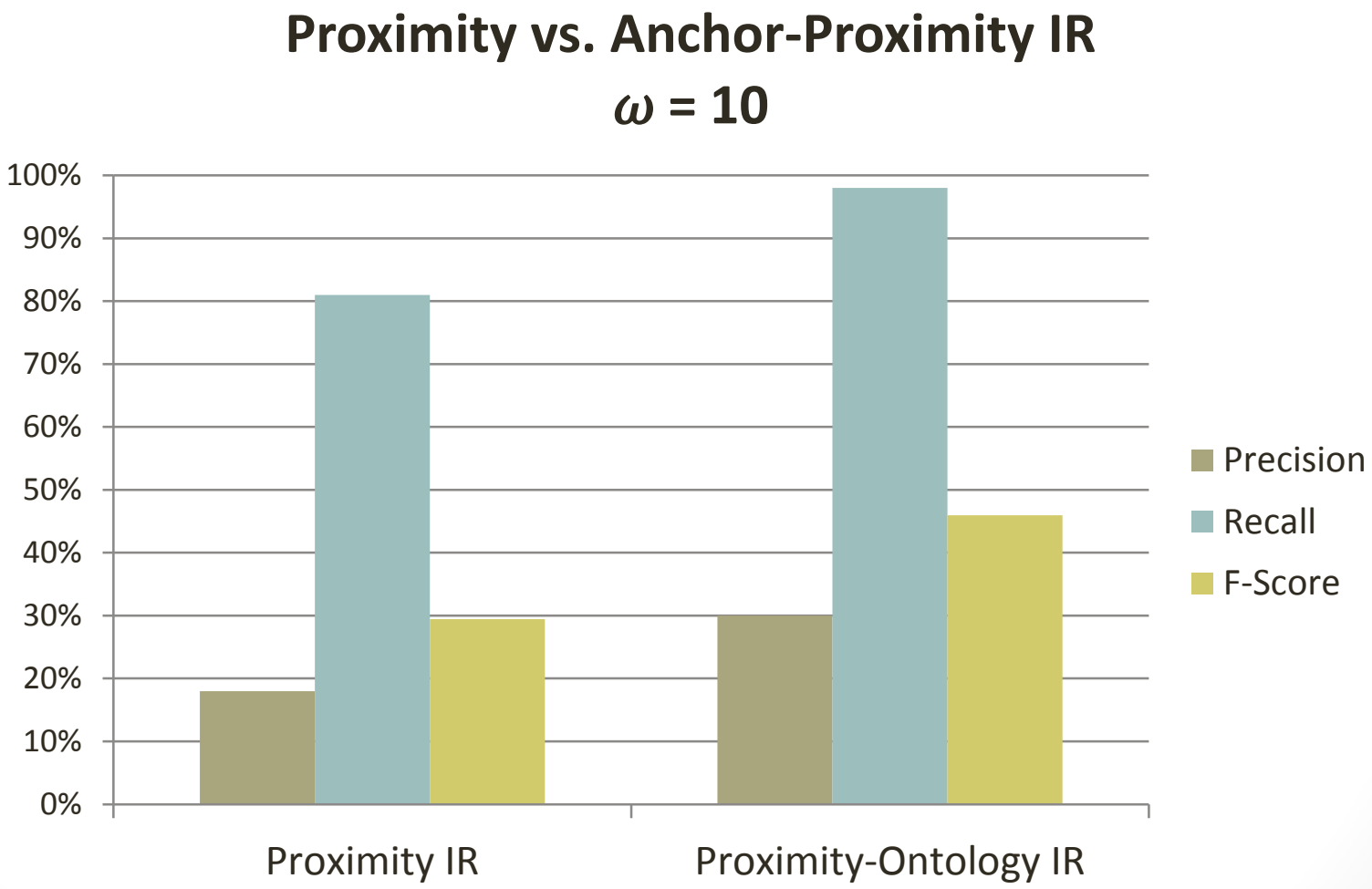
Current Research Approach

- Proximity-Weighted Scoring
  - Score relevancy of each document by how many query terms appear within a set window size of ω.
- Ontology Driven Retrieval
  - Ontology specifies concepts and how they relate to each other (eg, ***is-a, has-a***).
  - Concepts are expressed in words and can be used as query terms
  - Relationships can be used to generalize / specialize the query terms and results

Anchor-Proximity IR

- Develop ontology for pain
- Define anchor terms = [‘pain’, ’painful’]
- Retrieval Algorithm
  - Use a sliding window ω = 10 terms
  - Relevance Score is:
    - number of ontology terms in the document
    - that are within ω terms of an anchor term

Anchor-Proximity Results



Questions ?

THE LD_{50} OF TOXICITY DATA IS
2 KILOGRAMS PER KILOGRAM.