UMassAmherst

UMASS MEDICAL SCHOOL

Collaborative Tagging of Phenotypic Data for Clinical and Translational Sciences

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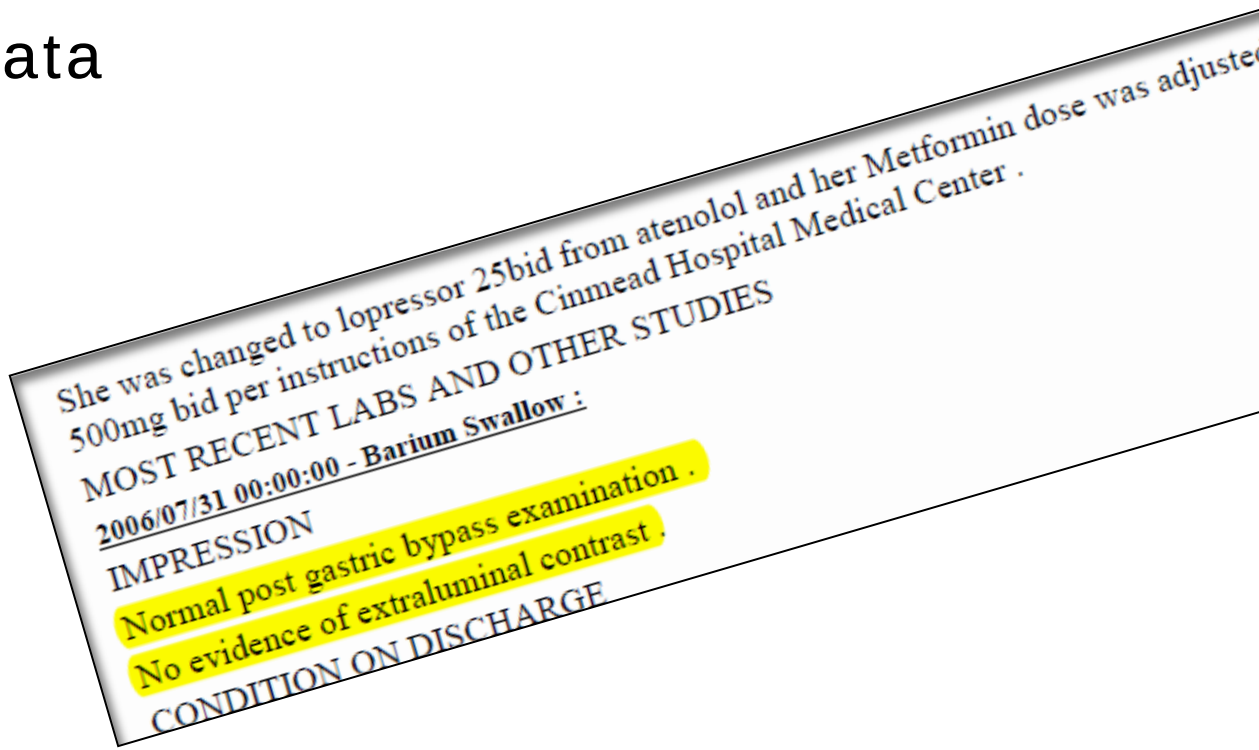
Clinical Information

- Structured Data (labs, meds, ICD-9)
- Unstructured Data
  - Trapped
  - Not Easily
    - computer-interpretable
    - Organized
    - Retrievable


She was changed to lopressor 25bid from atenolol and her Metformin dose was adjuste
500mg bid per instructions of the Cinmead Hospital Medical Center .
MOST RECENT LABS AND OTHER STUDIES
2006/07/31 00:00:00 - Barium Swallow :
IMPRESSION
Normal post gastric bypass examination .
No evidence of extraluminal contrast .
CONDITION ON DISCHARGE

Outside Medicine

- Collaborative Tagging
  - Labels users create to represent topics in documents
  - Other users (and information retrieval systems) use these tags to explore information
  - Often unstructured, open-ended and interpretive

Wikipedia

Collaborative tagging of clinical notes

- Motivation
  - Structured clinical data using standard taxonomies are accurate but limited, relatively static, and represent a single view
  - Unstructured text is a rich source of information but NLP techniques are fragile, training and review is expensive
- Middle ground: tagging
  - Groups of individuals add or mark phrases (“tags”)
  - Resulting *folksonomy* may be simpler to use and can evolve quickly
- This work explores that middle ground

Clinician tagging of clinical notes

- Used existing, de-identified i2b2 collection

- Recruited clinicians to highlight and tag notes
- Approximate breakdown of resulting group
  - 50% family medicine doctor
  - 42% internal medicine doctor
  - 3% each nurse practitioner, physician assistant, senior resident

Their instructions

- Highlighting
  - Please use a highlighter to precisely select (highlight) tags, as many as you want, as few as you think you would need to best represent the **most important** aspects of the note you would like to share with others (could be two tags, could be ten tags, could be more).
- Tag generation
  - These tags are things you as a clinician might infer from the note, but are not explicitly stated (e.g., “missed diagnosis”, “good preventive care”, “depression prolonged hospital stay”).

Sample highlighted note

HISTORY OF PRESENT ILLNESS : Mr. Little is a 53 year old male who is under the care of Dr. Royendchaelmares , at Hend Geadcoastcar Hospital , with the diagnosis of coronary artery disease . He has a history of an old inferior myocardial infarction . He was well until three days prior to admission , when he developed an episode of shoulder and arm pain , with minimal exertion . The night prior to admission , he slept well , but the following day , he had a prolonged episode of chest pain .

He went to the Emergency Ward of Hend Geadcoastcar Hospital , where was found , on electrocardiogram , to have a right bundle branch block , and ST-segment elevations in the inferior and apical leads . He was treated with intravenous Streptokinase , intravenous heparin , intravenous nitroglycerin . He had a brief episode of bradycardia and hypotension , which responded to atropine and dopamine . He had some ventricular ectopy that responded to Xylocaine . He did well , without recurrent chest pain , congestive heart failure , or further arrhythmias . He ruled in for myocardial infarction , with a peak CPK of 660 units , 16% mB . An echocardiogram revealed an ejection fraction of 52% . He had cardiomegaly . He underwent an exercise tolerance test with Thallium , where he exercised for 2 minutes . The test was positive . Coronary angiography was performed on Sep 8 , which demonstrated a mean pulmonary capillary wedge pressure of 7 millimeters of mercury .

There was a 30% stenosis of the main left coronary artery . There was a 50% stenosis of the left anterior descending . The circumflex artery had a total occlusion . His right coronary artery had a severe 95% stenosis . The left ventricle has normal size , and an ejection fraction of 65% .

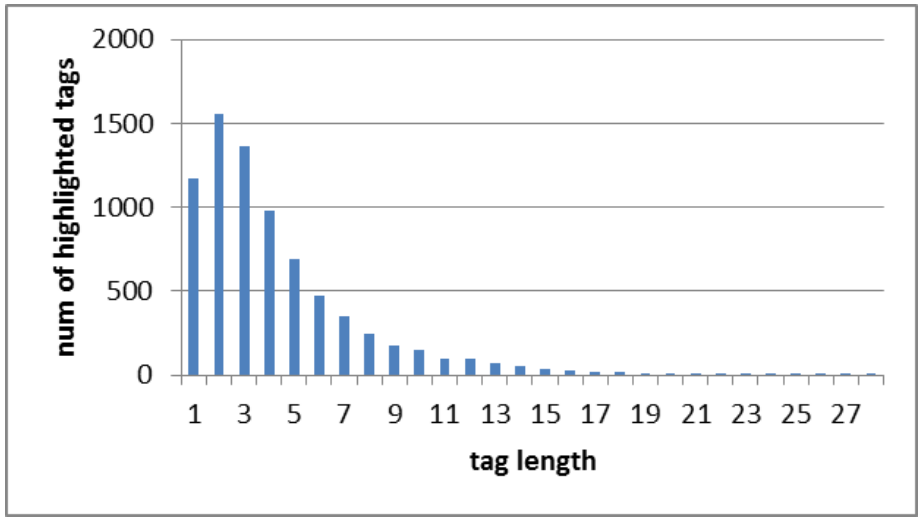
His PAST MEDICAL HISTORY is remarkable for an old Q-wave myocardial infarction .

He has a hiatus hernia .

He had prior surgery for hernia .

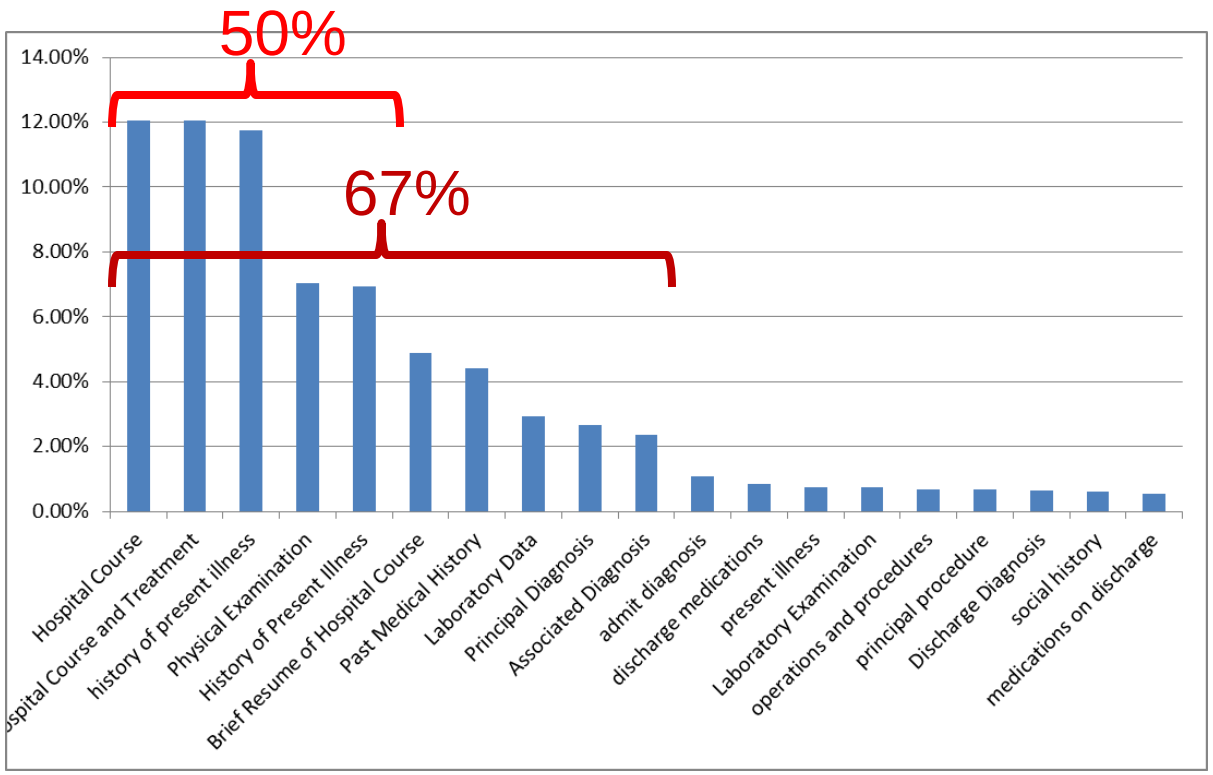
Summary of collected data

- 366 notes highlighted
  - Average of 2.1 annotators per note (766 notes)
  - Average of 5.8 notes per annotator (132 annotators)
  - From 16 to 496,506 words long
- 7,642 highlighted tags
  - Average of 20.9 highlighted tags per note
  - Average length is 4.36 words



Where do highlighted tags occur?

- Heavily skewed to a few sections of note



25% of tags in tail that is not shown

Use highlights to train *automatic* highlighting?

- cTakes, named entity tagger (small sample)
  - Identifies average of 232 tags
  - Here, 24 tags per notes, 17 of which overlapped
  - 70% recall, 7% precision

- SVM classifier
  - 21 features: length of tag, frequency, frequency in medical domain, which section, where in section, etc.
  - Pilot evaluation (27 train, 26 test)
    - 37% of top 5 words match
    - 16% of top 50 words match

Retrieving related medical records

- Query: medical record
- Goal: past medical records including related diseases, conditions, or treatments/interventions

- Pilot evaluation
  - 9 medical record “queries”
  - Average of 5.7 related past medical records

	Prec @ 20	Recall@20	MAP
Original	12%	43%	32%
Tags	13%	47%	37%
Expansion	17%	61%	44%

Example Applications

- Similarity
  - Identify a record with a medical error THEN
    - Find OTHER records with similar errors
  - Identify a specific hospital course THEN
    - Find OTHER records with similar

- Prioritize
  - Information within a note
  - OR within a patient record