Named Entity Recognition in Bio Medical Text

CSE 5539: Natural Language Question Answering

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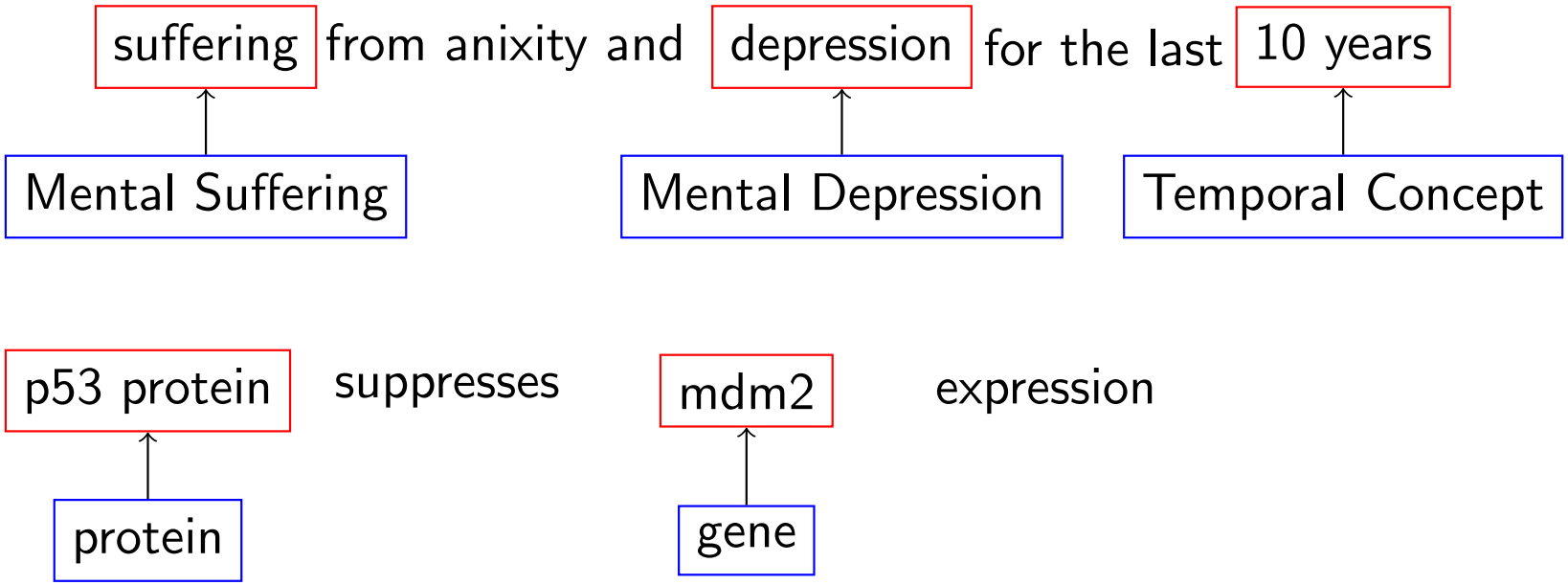
Outline

Problem Definition & Motivation

- **What do we want?**



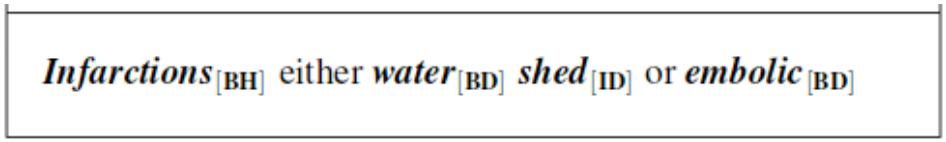
- **Motivation** -
  - Biomedical literature is increasing in volume.
  - Online Discussion Forums specific to Medical domain are being formed.
  - Thus automated information extraction and Knowledge Base Construction has become essential.
  - Named Entity Recognition forms one of the fundamental steps in most of the above procedures.

Datasets and Tools

- Datasets
  - Unified Medical Language System (UMLS) [1] Semantic Network
  - CHQA Named Entity Dataset [2]
- Existing Tools - Baselines
  - Metamap [3] - Maps biomedical text to UMLS entities
    - One of the largest medical KB.
    - Uses Locality sensitive hashing for recognizing entities.
  - BANNER [4] - Uses Conditional Random Fields with various Syntactic Features for tagging Named Entities.
  - Various other HMM based tools [5] [6]

Challenges

- Metamap uses simple string similarity and thus produces low scores.
- BANNER, a CRF based tool suffers from the implicit inability of sequence models to identify discontinuous entities.
- To enable CRF's to identify discontinous entities,an extended form of the **BIO** tagging which includes **B,I,O,BD,ID,BH,IH** is proposed in [7]
- Example

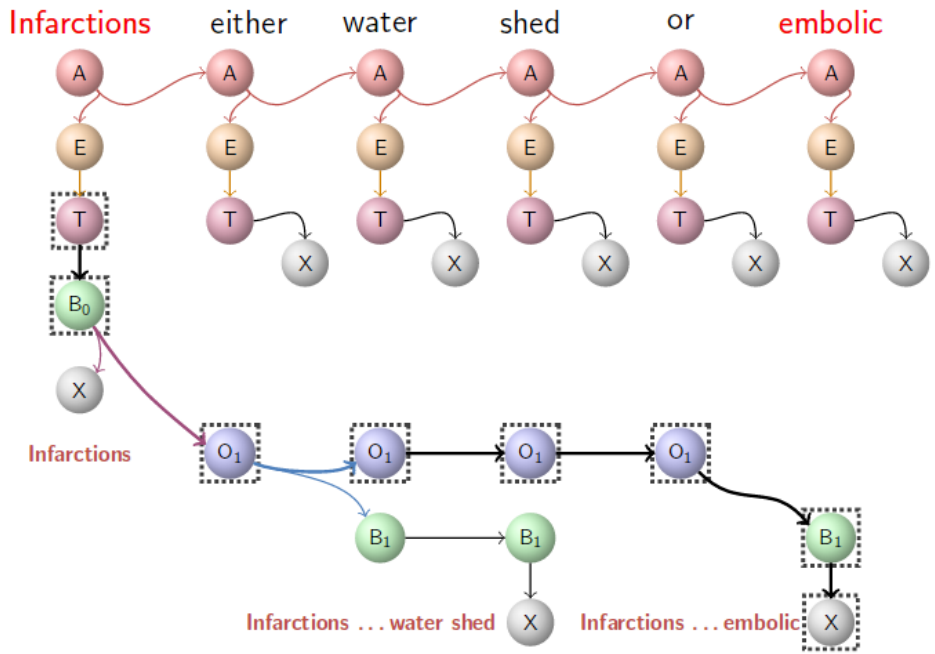


[8]

- Even if all tokens are correctly annotated, determining all the corresponding entities is difficult.
- The annotation scheme is not directly applicable to the CHQA dataset since entities in this dataset do not necessarily overlap at the beginning

Recognizing Discontinuous Entities

- We are currently trying to adopt the idea from [8] (referred onwards as statnlp tool) which models the task of Discontinuous and overlapping named entities as a hypergraph prediction problem where various nodes are :



A - All entities that begin with current or future word.

E - All entities that begin with the current word.

T - Entities of a specific type t that begin with the current word.

B - The word is part of the component of a given entity type.

O - Given word is between two components of a given entity

Recognizing Discontinuous Entities

- Each entity is represented by a unique subgraph.
- Given this hypergraph based model and training for maximizing the conditional log-likelihood of the data, the task now becomes determing the most likely sequence (MLS) or the Highest-Scoring subgraph using the Viterbi Algorithm.
- Challenges - The tool requires the knowledge of UMLS entity types. However, the CHQA dataset is annotated with newly created wrapper entities on top of UMLS entity types. e.g. UMLS Types -(Disease, Syndrome, Neoplastic process) have been combined into **PROBLEMS** in CHQA.

Current Progress

- Performed initial analysis of Metamap on the CHQA dataset.
- Performance of Metamap is low - 13%
- Tested Banner on non-overlapping and non-continuous entities from the CHQA dataset and on a 5-fold cross validation split achieved the following best scores -
  - **Precision** - 80.58%
  - **Recall** - 67%
  - **F1-Score** - 73.17%
- Currently working on empirical evaluation of statnlp tool on CHQA dataset.

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