Testing a Series of NLP Systems

- **Key Goal:** supporting clinical decision support systems.

 Key word/phrase-based NLP conditioned by a probabilistic diagnostic system

 Semantics used Bayesian networks to identify and relate clinical concepts.

 Extended model improved syntactic/semantic integration

 A new effort to integrate probabilistic semantic models with disease ontologies. 

 Key Goal: supporting clinical decision support systems.
Syntactic Parse Tree

(A hazy opacity is seen in the right upper lobe.)

Using augmented transition networks, chart parsers.
Bayesian Networks Represent Semantic Knowledge

Overall Concept

State

Presence Marker

Topic

Topic Unit

Finding Modifier

Severity Unit

Severity

Link Unit

Anatomic Unit

Change Unit

Change With Time

Change Degree

Change Quality

Anatomic Location

Anatomic Location Link

Anatomic Location Modifier

Inferior/Superior Modifier

Sidedness Modifier

= Word

= Concept
Output of Semantic Parse
(an object representing the most probable meaning)

PARSE: A hazy opacity is seen in the right upper lobe.

- **Instantiated Event:**
  - **Overall Concept:** localized infiltrate (0.998669)
  - **State Concept:** present (0.780993)
  - Presence Term: null (0.779583)
  - **Topic Concept:** poorly-marginated opacity (infiltrate) (1.0)
    - Topic Term: opacity~n (1.0)
    - Topic Modifier Term: hazy~adj. (1.0)
    - Topographic Location Term: null (0.588844)
  - **Severity Concept:** null (0.969009)
  - Severity Term: null (0.962739)
  - **Link Concept:** involving (0.686011)
    - Topic Location Link Term: in (1.0)
  - **Anatomic Concept:** right upper lobe (1.0)
    - Anatomic Location Mod: null (0.9375)
    - Anatomic Location: lobe~n (1.0)
    - Anatomic Location Mod1: right (1.0)
    - Anatomic Location Mod2: upper (1.0)
    - Anatomic Location Mod3: null (1.0)
    - Anatomic Location Mod4: null (1.0)
    - Anatomic Location Mod5: null (1.0)
“I see hazy opacity in both upper lobes”

*Chest X-Ray*
A new infiltrate consistent with pneumonia is noted in the right upper lobe. Suggest clinical confirmation.
Parsing Using Computable Ontologies

- Build production system
- Support CDS and research
- Configure around a collection of NLP tools
- Provided as a service in an EHR
A hazy opacity is seen in the right upper lobe.
Simple Sentence Interpreter

- Information extraction for simple sentences
- (sentence that maps to a single meaning)
Medical Finding Taxonomy

- Relating findings to each other
- Deriving implied observations
Disease Ontology

- Integrates findings from NLP with disease semantics.
### Relevant Activities

- **Prototypes**
  - Sentence segmentation
  - Section header identification
  - POS Tagging (annotation)
  - Chart parsing
  - Co-reference resolution
  - Terminology development
  - Semantic models (annotation)
  - Other tools (random forest classifiers)
  - Data models

- **Projects: NLP for Case Identification**
  - Community Acquired Pneumonia
  - Lung Cancer
  - Pancreatic Cancer