**Lecture 12 – Discriminative Parsing**

1. Grammars
   1. Dependency Grammars
2. Discriminative Parsers
   1. Graph based parsing
      1. Parameterization
      2. Inference
      3. Learning
3. Two extensions
   1. Neural representation (Kipperwassser and Goldberg)
   2. Randomized greedy parsing

**Regular Languages**



1. and are regular , , is regular

* Not all languages are regular

**Context Free Languages**

* (recursive construction/center embedding), cannot be represented by regular languages
  + i.e. The dog that snores sleeps.
* It was though that context free was sufficient…
  + But it was found that it was not; in fact we need context sensitive

**Dependency Grammars**

* Only one type of relationship between words
  + Parent child or governs or depends…
* Easier to train
* Problems
  + No constituents
  + Can be hard to annotate

**Tree Adjoining Grammar**

* More powerful than PCFG (can be context sensitive)

**Generative vs Discriminative**

* Discriminative
  + Slower to get good performance
  + Easily add more features
* Generative
  + This distribution can be sampled
  + Can very quickly get good performance
  + Difficult to add more features
  + NLP is mostly generative models

**Dependency Parsing**

* Words represented as
* Arcs represented as (pairs )
* all the direct rooted trees over (universe of possibilities)
* Scoring
  + Arc-factored scoring
    - Sum of arc scores
    - Can have many features …is this a problem?
      * No, can rely on other features…unlike language model where its possible no features exist.
* Inference
  + Find the maximum weight spanning tree for a directed graph
* Estimation of
  + For each
    - Compute
    - If