EECS 595: Natural Language Processing
Homework 4 Assignment

Due date: November 15

November 15, 2019

This assignment only contains a written portion.

1. For the following sentences, give FOL translations that capture the temporal relationships between the events.

   - When Mary's flight departed, I ate lunch.
     $\exists e_1, e_2, i_2, n$ Departing(e_1) $\wedge$ Departer(e_1, Mary) $\wedge$ WayOf(e_1, flight) $\wedge$ Eating (e_2) $\wedge$ Eater (e_2, Speaker) $\wedge$ Meal (e_2, Lunch) $\wedge$ IntervalOf (e_2, i_2) $\wedge$ Endpoint (e_1, n) $\wedge$ Endpoint (e_2, n) $\wedge$ Precedes(n, Now)
   - When Mary's flight departed, I had eaten lunch.
     $\exists e_1, e_2, i_2, n_1, n_2$ Departing(e_1) $\wedge$ Departer(e_1, Mary) $\wedge$ WayOf(e_1, flight) $\wedge$ Eating (e_2) $\wedge$ Eater (e_2, Speaker) $\wedge$ Meal (e_2, Lunch) $\wedge$ IntervalOf (e_2, i_2) $\wedge$ Endpoint (e_1, n_1) $\wedge$ Endpoint (e_2, n_2) $\wedge$ Precedes(n_1, Now) $\wedge$ Precedes(n_2, Now) $\wedge$ Precedes(n_2, n_1)

2. Given the following grammar, what is the FOL representation for the sentence "John bought a computer"? Show the steps to derive such a representation.

   S $\rightarrow$ NP VP {NP.sem(VP.sem)}

   NP $\rightarrow$ Det Nominal {Det.sem(Nominal.sem)}

   NP $\rightarrow$ ProperNoun {ProperNoun.sem}

   Nominal $\rightarrow$ Noun {Noun.sem}

   VP $\rightarrow$ Verb {Verb.sem}

   VP $\rightarrow$ Verb NP {Verb.sem(NP.sem)}

   Det $\rightarrow$ a {λP.λQ.$\exists$x P(x)$\wedge$Q(x)}

   Noun $\rightarrow$ computer { λc.Computer(c)}

   ProperNoun $\rightarrow$ John { λj.j(John)}

   Verb $\rightarrow$ bought { λw.λz.w(λx.$\exists$e Bought(e)$\wedge$ Buyer(e,z) $\wedge$ ThingBought(e,x))}

   a computer: λQ.$\exists$ x Computer(x) $\wedge$ Q(x)

   (λz.$\exists$ yFlight(y) $\wedge$ $\exists$e Booked(e) $\wedge$ Booker(e,z) $\wedge$ BookedThing(e,y))(John)

   $\exists$ **y Computer (y)** $\wedge$ $\exists$ **e Bought(e)** $\wedge$ **Buyer(e, John)** $\wedge$ **BoughtThing(e, y)**

3. Go to the Wordnet site (http://wordnet.princeton.edu) and answer the following questions:

   (a) Using the hypernymy hierarchy, find the lowest common ancestor of sense 1 and sense 2 of the verb "elect".
   S: (v) decide, make up one's mind, determine (reach, make, or come to a decision about something) "We finally decided after lengthy deliberations".

   (b) Find the meronyms of all senses of the word university.
   graduate school, grad school (a school in a university offering study leading to degrees beyond the bachelor's degree), college (an institution of higher education created to educate and grant degrees; often a part of a university).

   (c) Find the antonyms of all senses of the adjective late.
   early, middle, punctual, present, future, alive.

   (d) Find the lowest common ancestor using the hypernym dictionary across all noun senses of gate and fence. Does distance in the hierarchy tell you anything about semantic relatedness? Why or why not?

   - gate (a movable barrier in a fence or wall) and fence, fencing (a barrier that serves to enclose an area):
     barrier (a structure or object that impedes free movement)
     They have 8 common ancestors.
   - gate (a movable barrier in a fence or wall) and fence (a dealer in stolen property):
     whole, unit (an assemblage of parts that is regarded as a single entity) "how big is that part compared to the whole?"; "the team is a unit"
     They have 4 common ancestors.
   - gate, logic gate (a computer circuit with several inputs but only one output that can be activated by particular combinations of inputs) and fence, fencing (a barrier that serves to enclose an area):
     artifact, artefact (a man-made object taken as a whole)
     They have 5 common ancestors.
   - gate, logic gate (a computer circuit with several inputs but only one output that can be activated by particular combinations of inputs) and fence (a dealer in stolen property):
     whole, unit (an assemblage of parts that is regarded as a single entity) "how big is that part compared to the whole?"; "the team is a unit"
     They have 4 common ancestors.
   - gate (total admission receipts at a sports event) and fence, fencing (a barrier that serves to enclose an area):
     entity (that which is perceived or known or inferred to have its own distinct existence (living or nonliving))
   - gate (total admission receipts at a sports event) and fence (a dealer in stolen property):
     entity (that which is perceived or known or inferred to have its own distinct existence (living or nonliving))
   - gate (passageway (as in an air terminal) where passengers can embark or disembark) and fence, fencing (a barrier that serves to enclose an area):
     artifact, artefact (a man-made object taken as a whole)

- gate (passageway (as in an air terminal) where passengers can embark or disembark) and fence (a dealer in stolen property):
  whole, unit (an assemblage of parts that is regarded as a single entity) "how big is that part compared to the whole?"; "the team is a unit"

I think that distance in the hierarchy tells me something about semantic relatedness because having more common ancestors means that the two words are more similar to each other in meaning and usage, and thus they are more semantic related when using them.