



Ling 131A

Assignment Project Exam Help

Introduction to NLP with Python

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WordNet

Marc Verhagen, Fall 2018

Today

- Assignment 3 – questions?
 - Assignment 2 – feedback
 - Word Lists and WordNet
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WordNet

- A lexical knowledgebase based on conceptual lookup
- Organizing concepts in a semantic network
- Organize lexical information in terms of word meaning, rather than word form
 - WordNet can be used as a thesaurus
- <http://wordnet.princeton.edu>

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WordNet

- It's big
 - 155,287 words and 117,659 synonym sets.
- It's free.
- Originally designed as a model of human semantic memory (Miller, 1985)
- Widely used in NLP

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Synonymy

One of the main guiding principles in building WordNet

Distribution principle:

Words A and B are called 'synonyms' if their distribution is identical in a corpus. That means they can replace each other in any context. (Strong requirement – ideal)

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Pure synonym:

If A and B are synonyms in all context (can replace in all contexts) they are pure synonyms. It has been very difficult to find pure synonyms.

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Question: How to ensure replaceability in

- Syntax
- Semantics

Lexical Matrix

Word meanings	Word Forms				
	F_1	F_2	F_3	$F_{...}$	F_n
M_1	$E_{1,1}$	$E_{1,2}$			
M_2		$E_{2,2}$			
M_3			$E_{3,3}$		
$M_{...}$					
M_m					$E_{m,n}$

Synonymous words

Polysemous words

Lexical Matrix

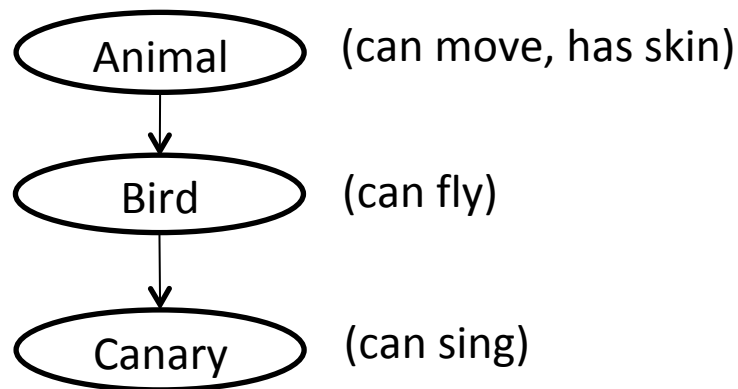
Word meanings	Word Forms				
	F ₁	F ₂	F ₃	F...	F _n
M ₁	(depend) E _{1,1}	(bank) E _{1,2}	(rely) E _{1,3}		
M ₂		(bank) E _{2,2}			
M ₃		(bank) E _{3,2}			
M...					
M _m					E _{m,n}

synset

lemma

Psycholinguistic Theory

- Human lexical memory for nouns as a hierarchy.
 - *Can a canary sing?* – Pretty fast response.
 - *Can a canary fly?* – Slower response.
 - *Does a canary have skin?* – Slowest response.



Wordnet as a lexical reference system based on psycholinguistic theories of human lexical memory.

Synsets

- Synset ID: a unique number identifying a synset
- Category: POS category of the words
- Name: name of the synset
- Definition: definition of the synset
- Example: One or more examples of the words in the synset being used in sentences
- lemmas: The set of synonymous words comprised in the synset

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Synsets

{house} is ambiguous.

{house, home}

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has the sense of *a social unit living together*;

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Is this the minimal unit?

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{family, household, house, home, menage}

will make the unit completely unambiguous.
ordered according to frequency.

- **S: (n) house** (a dwelling that serves as living quarters for one or more families) *"he has a house on Cape Cod"; "she felt she had to get out of the house"*
- **S: (n) firm, house, business firm** (the members of a business organization that owns or operates one or more establishments) *"he worked for a brokerage house"*
- **S: (n) house** (the members of a religious community living together)
- **S: (n) house** (the audience gathered together in a theatre or cinema) *"the house applauded"; "he counted the house"*
- **S: (n) house** (an official assembly having legislative powers) *"a bicameral legislature has two houses"*
- **S: (n) house** (aristocratic family line) *"the House of York"*
- **S: (n) house** (play in which children take the roles of father or mother or children and pretend to interact like adults) *"the children were playing house"*
- **S: (n) sign of the zodiac, star sign, sign, mansion, house, planetary house** ((astrology) one of 12 equal areas into which the zodiac is divided)
- **S: (n) house** (the management of a gambling house or casino) *"the house gets a percentage of every bet"*
- **S: (n) family, household, house, home, menage** (a social unit living together) *"he moved his family to Virginia"; "It was a good Christian household"; "I waited until the whole house was asleep"; "the teacher asked how many people made up his home"; "the family refused to accept his will"*
- **S: (n) theater, theatre, house** (a building where theatrical performances or motion-picture shows can be presented) *"the house was full"*
- **S: (n) house** (a building in which something is sheltered or located) *"they had a large carriage house"*

House – all nouns

1. (n) **house** (a dwelling that serves as living quarters for one or more families) "*he has a house on Cape Cod*"; "*she felt she had to get out of the house*"
2. (n) **firm, house, business firm** (the members of a business organization that owns or operates one or more establishments) "*he worked for a brokerage house*"
3. (n) **house** (the members of a religious community living together)
4. (n) **house** (the audience gathered together in a theatre or cinema) "*the house applauded*"; "*he counted the house*"
5. (n) **house** (an official assembly having legislative powers) "*a bicameral legislature has two houses*"
6. (n) **house** (aristocratic family line) "*the House of York*"
7. (n) **house** (play in which children take the roles of father or mother or children and pretend to interact like adults) "*the children were playing house*"
8. (n) **sign of the zodiac, star sign, sign, mansion, house, planetary house** ((astrology) one of 12 equal areas into which the zodiac is divided)
9. (n) **house** (the management of a gambling house or casino) "*the house gets a percentage of every bet*"
10. (n) **family, household, house, home, menage** (a social unit living together) "*he moved his family to Virginia*"; "*It was a good Christian household*"; "*I waited until the whole house was asleep*"; "*the teacher asked how many people made up his home*"; "*the family refused to accept his will*"
11. (n) **theater, theatre, house** (a building where theatrical performances or motion-picture shows can be presented) "*the house was full*"
12. (n) **house** (a building in which something is sheltered or located) "*they had a large carriage house*"

Semantic relations in Wordnet

1. Synonymy (equality)
2. Hypernymy / Hyponymy (super/sub)
3. Antonymy (opposites)
4. Meronymy / Holonymy (part/whole)
5. Entailment (if-then)
6. Troponymy (manner)

1 and 3 are lexical (lemma to lemma), the others are semantic (synset to synset).

Semantic Relations

- Hypernymy and Hyponymy
 - Relation between word senses (*synsets*)
 - X is a hyponym of Y if X is a kind of Y
 - Hyponymy is transitive and asymmetrical
 - Hypernymy is inverse of hyponymy
 - Path: (lion → animal → animate entity → entity)
 - Distance between synsets often used to determine how closely related to concepts are

Semantic Relations (continued)

- Meronymy and Holonymy
 - Part-whole relation, branch is a part of tree
 - X is a meronym of Y if X is a part of Y
 - Holonymy is the inverse relation of Meronymy

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{kitchen} {house}

Kinds of Meronymy

Component-object	Head - Body
Staff-object	Wood - Table
Member-collection	Tree - Forest
Feature-Activity	Speech - Conference
Place-Area	Palo Alto - California
Phase-State	Youth - Life
Resource-process	Pen - Writing
Actor-Act	Physician - Treatment

Lexical Relation

- Antonymy

- Opposites in meaning
- Relation between word forms
- Often determined by phonetics, word length etc.
- ({rise, ascend} vs. {fall, descend})

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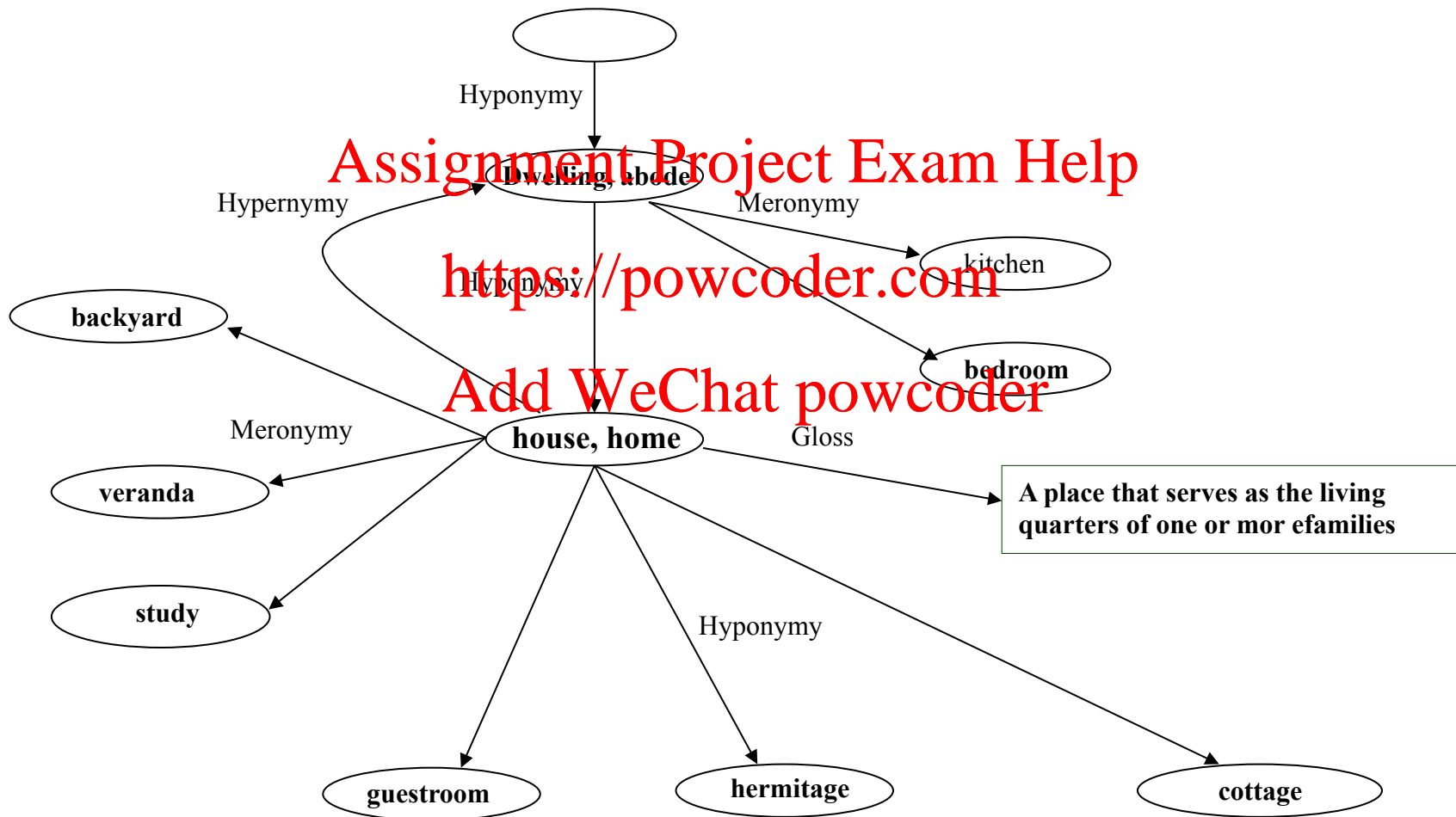
Kinds of Antonymy

Size	Small - Big
Quality	Good – Bad
State	Warm – Cool
Personality	Dr. Jekyll - Mr. Hyde
Direction	East- West
Action	Buy – Sell
Amount	Little – A lot
Place	Far – Near
Time	Day - Night
Gender	Boy - Girl

Entailment.

- Snoring entails sleeping.
- Buying entails paying.
- Proper Temporal Inclusion.
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- Inclusion can be in any way.
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 - Sleeping temporally includes snoring.
 - Buying temporally includes paying.

WordNet Sub-Graph (English)



WordNet goes global

- PrincetonWordNet
 - The first wordnet in the world was for English developed at Princeton over 15 years (Miller 1995, Fellbaum 1998).
- EuroWordNet
 - linked structure of European language wordnets was built in 1998 over 3 years with funding from the EC.
- Global WordNet:
 - Building on Princeton WordNet and EuroWordNet
 - <http://www.globalwordnet.org>