

Engineering Metaphors

A Human-Computer collaboration in
writing poetry

Theory

The inspiration behind our project came when we encountered a problem (coming up with great metaphors) and we encountered a solution (having a computer come up with great metaphors).

1) On Metaphors

“It is up to the poet to establish the analogies among life’s realities, but when these associations grow stale, it is up to him to refresh his imagery and thereby preserve the vitality of language”

P. B. Shelley (1792-1822)

The first thing we were concerned with was the making of metaphors (or analogies as P.B. Shelley calls them here). This has been an age old problem of poets, and among other things, great poets come up with genius metaphors. [Read P.B. Shelley quote]. Here are some examples of his metaphors (or analogies) from his poem “Hymn to Intellectual Beauty”. [Next slide]



Examples of analogies...

from "Hymn to Intellectual Beauty" by P.B. Shelley

"Love, Hope, and Self-esteem, like clouds depart
And come, for some uncertain moments lent."



Examples of analogies...

from "Hymn to Intellectual Beauty" by P.B. Shelley, continuing in the same stanza as the previous slide,

"Thou messenger of sympathies,
That wax and wane in lovers' eyes;
Thou, that to human thought art nourishment,
Like darkness to a dying flame!"

2) On Human-Computer Collaboration

What does the computer do best?

- Searching and sorting
- Digesting large amounts of data quickly
- Fitting constraints
- Recursion / Mathematical computation
- **Having no "bias."** That is, it isn't accustomed or predisposed to using certain words or phrases over others, the way humans are.

Over the course of this class, we grew more convinced that there could be an amazing synergy between computer and human in the process of writing poetry, so we thought: let's bring together the strengths of a computer and the strengths of the human in creating poetry.

So we asked, what does a computer do best?

Here are a few "strengths" of a computer. We realized that the last bullet point could really be a great solution to the problem we outlined above, of coming up with "fresh associations" and imagery.

I'll give an example of what it means for a computer to lack "bias." Writing the lipogram was not a natural process for us. Claire mentioned in class getting stuck as she tried to find words that didn't have the letter-of-choice. We got stuck writing the lipogram because we have "priors" locked into our brains: Our brains feel that one word naturally proceeds the next, and when those words are taken away, all of a sudden we are stumped. Yet a computer does not have that problem. If a computer were in our position composing that lipogram, it would have simply sifted through synonyms for the next closest word that could be used, with no feeling that "this word is less perfect than the prohibited word!"



[If no time, cut this slide]

Another way to put it is like, the human brain is like the surface of the earth with valleys and rivers and streams already dug into it, so when rain falls the rain collects down these valleys and rivers and it's harder to make new rivers. But the computer is like a smooth surface with no divets or variations in the surface, so rain has the opportunity to etch a stream anywhere.

Making Metaphors with Machine (Mmm...)

accord is **attribute** is **elasticity** is
abstract entity is **energy**

So what did we do? We used WordNet to ask a computer to help us generate metaphors. Now I'm going to hand it over to Claire to explain the implementation of this. But before that, to whet your tastebuds, here are some metaphors we generated with WordNet and our machines.

Making Metaphors with Machine (Mmm...)

emotion is **self-regard** is **pride** is
feeling is **state** is **genetic endowment**

So what did we do? We used WordNet to ask a computer to help us generate metaphors. Now I'm going to hand it over to Claire to explain the implementation of this. But before that, to whet your tastebuds, here are some metaphors we generated with WordNet and our machines.

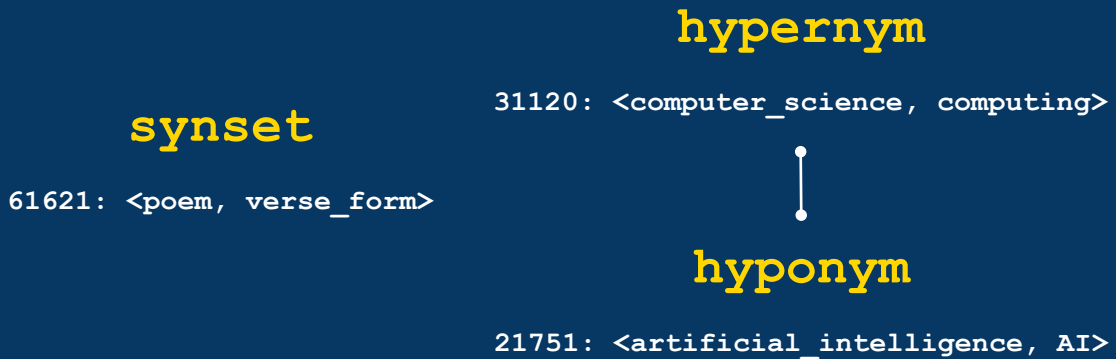
Making Metaphors with Machine (Mmm...)

cold fish is unpleasant person is
oppressor is disagreeable person is
pusher is **trespasser**

So what did we do? We used WordNet to ask a computer to help us generate metaphors. Now I'm going to hand it over to Claire to explain the implementation of this. But before that, to whet your tastebuds, here are some metaphors we generated with WordNet and our machines.

Implementation

WordNet



To actually build these metaphors, we used WordNet, a database created by Christiane Fellbaum, a professor in the computer science department. In WordNet, words are separated into synsets, which are groups of synonyms, such as poem/verse form, which each have a unique numerical ID. These synsets are then related as hypernyms and hyponyms, which are more general and more specific instances of synsets. For example, the synset artificial intelligence/AI is a type of computer science/computing, so the computer science is a hypernym/"parent" of AI, and AI is its hyponym/"child". If you think about the entire graph, it's like a tree with more general terms higher up, and more specific terms lower down.

Synset Navigation

synsets.txt

21751: <artificial_intelligence, AI>

...

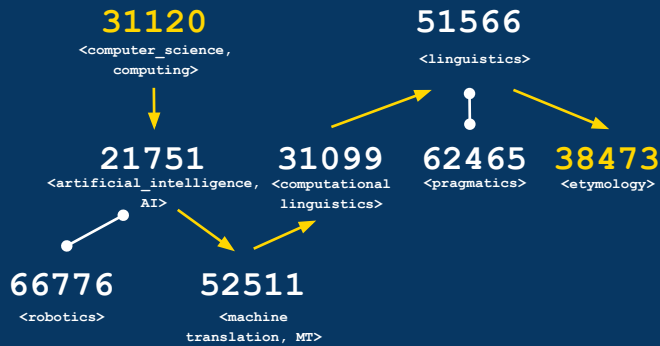
31120: <computer_science, computing>

hypernyms.txt

21751, 31120

For our project, we specifically used two WordNet files from the 226 WordNet Assignment: `synsets.txt`, which lists around 80,000 noun synsets with ID numbers, and `hypernyms.txt`, where each line is a synset ID followed by the IDs of any hypernym or “parent” synsets. To navigate between synsets, we devised `find_parent` and `find_child` functions in our code, which would take a synset ID, and then find its parent or child, if it existed.

Metaphor Generation



computing is **etymology**

To generate metaphors, you simply have to start with a word in 1 synset, move randomly up and down in the synset tree for a number of steps, choose a second word, and continue for as many words as you want in your metaphor, linking each with "is".

Implementation in Code

```
create_metaphor (  
    firstID,  
    numWords,  
    numSteps,  
    probUpwards  
)
```

To expand on the code-side of things: For the function that went through WordNet and got the metaphors, here are the parameters we put in. In each of these instances, you could give the computer more influence or you could give the human more influence on the **mechanics** side.

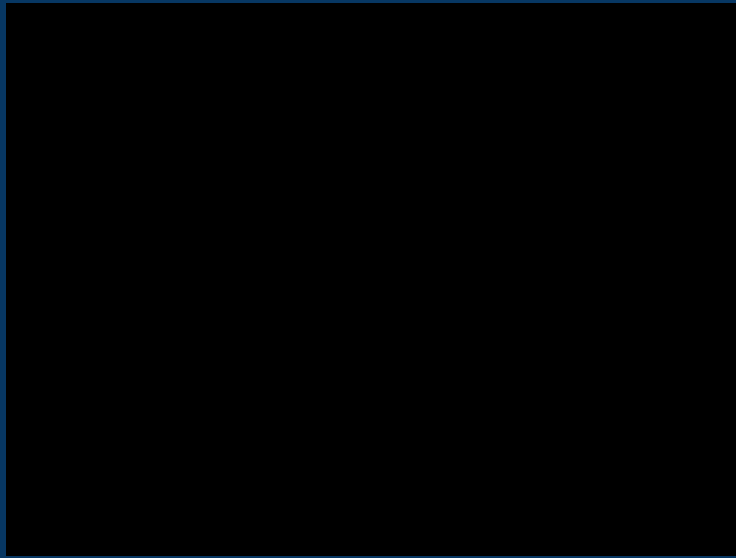
You could choose the starting word or have the computer choose the starting word.

You could choose the number of words generated or the computer could.

You could even choose how far away each word was from each other in the WordNet, called "Number of steps between words"

You could even choose the probability of traveling up or down the WordNet tree at each node

Metaphor Generation Demo



This video is an example of our implementation and parameters in action. In this case, the starting synset is randomly generated, the number of words is randomly chosen from 2 to 10, the number of steps taken between each word is randomly chosen from 10 to 25, and the probability of moving upwards or downwards is 50% each time.

Creation

So what did we do with the output that the computer gave us? Well we had two main considerations to think about, **how** the human and computer would collaborate, and **how** we would display the human-computer creation.

1)

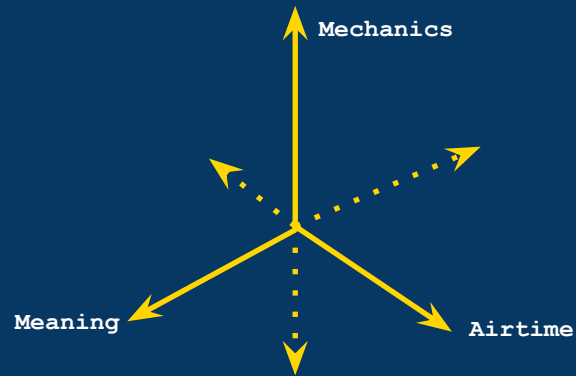
Before we got cracking, we paused to think about: **What does human-computer collaboration look like?**

Is it when a human takes the computer
output, say **cold fish is trespasser**,
and adds some words?

Or is it when a human `reads` the
computer output, say `cold fish is`
`trespasser`, and `makes meaning of it`?

On Human-Computer Collaboration

Three Dimensions



All these are ways of human-computer collaboration and we want to capture all of them. So, we divided human-computer collaboration into three axes or dimensions.

Meaning

Human
manipulates
machine output
so computer is a
meaning-making
prosthesis

Human adds
generic
grammatical
connector
between
metaphors to
show that they
are metaphors

Human reads
the
computer
output

Use WordNet
to generate
metaphors

Human Influence

Computer Influence

Meaning: How much does the human or the computer influence what the poem means, in the human sense of the word? (Meaning: something meant or intended; some special or hidden significance; having significance or perceptible purpose)

Airtime

Human generated text makes up almost all of the poem

Human chooses one word to go between each metaphor (i.e. "is")

All text is machine output

Human Influence

Computer Influence

Airtime: How many words does the human get to add to the poem?

Mechanics

Human chooses where and how many words she wants to insert into the poem

Computer chooses where and how many words human can insert into the poem **within a human delimited range**

Computer chooses where and how many words human can insert into the poem

Human Influence

Computer Influence

Mechanics: Who decides things like: Will the poem be grammatical? How many words is the human allowed to contribute?

Mechanics: The Computer's "Choice"

```
#-----  
# humanConstraints.py generates random constraints for the word count,  
# line count, etc. for the human poet.  
#-----  
  
import random  
from random import randint  
  
numWords = 3 # number of words in metaphor chain  
  
print("You get this many words to explain each metaphor: ", randint(0, 50))  
  
for i in range(numWords - 1):  
    print("You get this many words between word %i and word %i: " %(i+1, i+2),  
          randint(0, 50))
```

This program, `humanConstraints.py`, simulates the process of the computer “making choices” to influence the **Mechanics** axis. It randomly generates constraints in terms of word count that the human poet can use between each word, whether it’s an overall word limit, or a specific limit between each pair of words.

Consider this scenario

Computer output: **cold fish is trespasser**

Words allocated to human (0 to 15): **15**



Consider this scenario:

- The computer outputs this metaphor, “cold fish is trespasser”
- The computer chooses (by random sampling between 0 and 15) how many words the human can add to the poem. By choosing the amount of words that the human can add, the computer is exercising greater influence in the **mechanics** area, hence you see where this scenario falls on the “Mechanics” axis.
- In a range from 0 to 15, computer lands on 15 words, giving the human a decent amount of **airtime**, hence you see where this scenario falls on the “Airtime” axis.
- With the max number of words possible, the human has great agency to influence the **meaning** and direction of the poem, hence you see where this scenario falls on the “Meaning” axis.

2)

How would we **display** our
creation?

Display is something we've been talking about in this class. Medium is the message.

Metaphor Only

dawn is abstraction is physical entity

This was generated on metaphor_v3.py with the parameters: 3 words, random first synset, 15 - 25 steps between words, always 50% moving upwards or downwards.

Metaphor Only

dawn is abstraction is physical entity

You get this many words between word 1 and word 2: 20

You get this many words between word 2 and word 3: 36

These constraints were generated with `humanConstraints.py`

Horizontal

dawn **is** **abstraction** **is** **physical** **entity**

the analog rise
of fifty-six geometries of pink tangerine
the HSV range binding the space
from zero to one

carbon lines, one angstrom wide, curve between
the hydrogen
atoms, where in their energy bands
electrons dream of diving down through the waves
slipping off perfect ellipsoid shelves to embrace
her
their love
collapsing the universe

Using the generated metaphor and constraints, this is one method of display, where the metaphor stretches over the poem and the words explaining these links are shown below. The word limit constraints helped a lot with setting a guideline when writing this.

Vertical

dawn the analog rise
of fifty-six geometries of pink tangerine

is the HSV range binding the space
from zero to one

abstraction carbon lines, one angstrom wide, curve
between
the hydrogen
atoms, where in their energy bands
electrons dream of diving down through

is the waves
slipping off perfect ellipsoid shelves to
embrace
her
their love

physical entity collapsing the universe

This is another method of visual display, where the metaphor runs down the side, and the human poetry is presented more like a typical poem with vertical verses. The words on the side are similar to illuminated initials, being larger and separated and more important, defining the text after them.

Matrix

dawn is abstraction is physical entity

If A is B is C, and they are all equivalent, then, logically, you can move these words around in the metaphor and form a matrix of metaphor relationships, where each word is equivalent to each other word.

Matrix

```

You get this many words in cell (1, 1): 18
You get this many words in cell (1, 2): 7
You get this many words in cell (1, 3): 4
You get this many words in cell (2, 1): 8
You get this many words in cell (2, 2): 7
You get this many words in cell (2, 3): 8
You get this many words in cell (3, 1): 17
You get this many words in cell (3, 2): 15
You get this many words in cell (3, 3): 0

```

	dawn	is	abstraction	is	physical	entity
dawn	18		7		4	
is						
abstraction	8		7		8	
is						
physical						
entity	17		15		0	

These are constraints generated for each of those relationships in the matrix, using a 0 - 20 RNG, showing where the word counts are and where the verses will be.

Matrix

	dawn	is	abstraction	is	physical entity
dawn	necks tilted away from the earth we watch the golden pageant unfurl above us,		the two cousins are perfect, pink-stained		snatching photons from clouds
is	envious in our flatness.				
abstraction	the aunts paint a 1920 x 1080 sky		here, the best of all possible mornings		six million bytes guarded by the hermetic seal
is	the strangers carried me to this island to this cliff to this sunrise		but we'll print them anyways, glossy attempts to forget the space between what's memory, what's		
physical entity	it's not like photos				

This is the same metaphor as a 3x3 matrix, where each verse links two words, has a word limit, and attempt to form a cohesive whole. Again, the word limit constraints were very helpful in composing the poem, and this time, since the RNG ran over a smaller number range due to the limitations that a matrix shape enforces, there were a lot of shorter verses. Also, it was interesting that because of the greater amount of repetition of metaphors and words in this poem (ex. “Dawn is dawn”, “dawn is abstraction” “abstraction is dawn”) I felt a greater need to make the poem more thematically cohesive and have each verse somewhat relate to each other verse. This is compared to the horizontal/vertical poems, where I didn't feel especially compelled to make the two verses cohesive, and the furthest words (dawn/physical entity) felt much less connected.

The Small Screen

Image is the spontaneous meeting of two very distant realities **whose relationship is grasped solely by the mind.**

Anna Balakian "The Surrealist Image"

This surrealist idea that (1) words themselves can be brought together to "explode in a dynamic image" where thoughts don't give birth to words but word combinations give birth to thoughts.

(2) The reader supplies the meaning when he sees these words. Explanation is not needed. The surrealist poem could follow the conventions of the language, or they could just be "a series of noun clauses which do not pretend to be parts of complete sentences."

The Small Screen

Is this the kind of poetry suitable for
the **small display of a mobile device**?

Go to bit.ly/phone-poetry

- (1) The screen is small and it scrolls.
- (2) This medium is conducive to instantaneous reaction or meaning generation rather than a deep, close reading of text.
- (3) Does our “metaphor-train,” this string of metaphors, fit this medium?

[Demo]

Thank you! Any questions?

GitHub Repository:

<https://github.com/claired976/HUM470>

References

Balakian, Anna. "The Surrealist Image." *Romantic Review*, vol. 44, no. 4, 1953. ProQuest, <https://search-proquest-com.ezproxy.princeton.edu/docview/1290921759?accountid=13314>.

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