A Course on Social Engineering
Phishing & Email Analysis

Phishing Detection through Email Analysis

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Detecting Spams/Fake Reviews/Phishing Emails

- Two Types of Spams [2]:
  - Web Spam
    - The action of misleading search engines to rank some web pages higher than they deserve.
    - Classified:
      - Content spam: adding irrelevant word to the document to rank it high) and
      - Link spam: i.e., spam on hyperlink and URLs.
  - Email Spam
    - "unsolicited, unwanted email that was sent indiscriminately, directly or indirectly, by a sender having no current relationship with the user."
    - The problem definition: to classify review into two categories as spam and non spam.

Detecting Spams/Fake Reviews/Phishing Emails

- Online reviews [1]:
  - The primary factor in a customer's decision to purchase a product or service
  - valuable sources of information to determine public opinion on products or services
- Fake reviews: to falsely promote/devalue products and services
  - Opinion (Review) Spam: create manipulative and poison reviews (i.e., making fake, untruthful, or deceptive reviews) for profit or gain.
  - Review spams negatively impact businesses due to loss in consumer trust.
- Important to analyze texts using NLP approaches
  - Extracting meaningful linguistic features
- Use machine learning techniques to distinguish genuine and fake reviews

Review Spams

- Review spam has been categorized into three groups [2]:
  - Untruthful Reviews
    - deliberately mislead readers or opinion mining systems by giving undeserving:
      - positive reviews to some target objects to promote the objects (i.e., hyper spam) and/or
      - negative reviews to some other objects to damage their reputation (i.e., defaming spam).
  - Reviews on Brands
    - Concerned with the brand or the seller of the product
    - Are not targeted at the specific products and are often biased
  - Non-Reviews:.
    - Reviews that contain either unrelated text or advertisements
    - Two main sub-types:
      - Advertisements
      - Other irrelevant reviews containing no opinions (e.g., questions, answers, and random texts)

Detecting Spams/Fake Reviews/Phishing Emails

- It is hard for a human to judge which review is fake or authentic [1]:
- Review 1 (Authentic):
  - "Great Hotel This building has been fantastically converted into studios/suites. We only had a studio which was brilliant can't imagine how the suite could have bettered what we had. The kitchen had everything cooker microwave dishwasher and fridge freezer. Bathroom was a good size and again had everything you need including good quality toiletries. Hotel also has a good gym and swimming pool and excellent laundry facilities if you need them. The complimentary breakfast each morning was also very good and had an excellent choice. The parking in the hotel was secure and reason-ably priced. The location was pretty central and had easy access to the under ground city. Would definitely stay here again."
- Review 2 (Fake):
  - "During my latest business trip, both me and my wife recently stayed at the Omni Chicago Hotel in Chicago, Illinois, at one of their Deluxe suites. Unfortunately, and I think I speak for both of us, we were not fully satisfied with the hotel. The hotel advertises luxury-level accommodations, and while the rooms resemble what one can see in the pictures, the service is certainly sub-par. When one plans a stay at such an establishment, they expect a service that goes beyond having fresh towels in the bath-room when they check in. First of all, the air-conditioning in the room seemed to be in need of a new filter and when it was first turned on, the air coming out seemed musty. Second of all, the fitness center was only open until 10:30 pm. For people who like to exercise after dinner, this can certainly be a problem. Especially considering that it does not take much to have the fitness center available around the clock or until mid-night. For these, as well as other similar reasons, I would not recommend this hotel, if one is looking for luxury accommodations."

Detecting Fake Reviews - Guidelines

- 30 ways to identify fake reviews: Consumerist:
  - https://consumerist.com/2010/04/14/how-you-spot-fake-online-reviews/

1. "Marketing speak. Normal people do not write in marketing speak."
2. Beware "fake negative reviews… Shills will go onto, say, a weight loss pill site and leave an ad that says: "This product does NOT work as advertised! It said I'd lose 20 pounds guaranteed. Well I lost 4O POUNDS. That is not what I wanted!"
3. Reviewers have no other reviews on the site.
4. Multiple reviews that are exactly the same.
5. Even if they are not fakesters, anyone who writes in ALL CAPS is an idiot and should be ignored.
6. Beware the "polyamorous" reviewer, every product gets a glowing and unvarnished review…
7. And the "monogamous" reviewer, whose only reviews are for products by one manufacturer. All praise, natch.

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8. "The reviewers say the entire name and model of the product over and over." This is often a sign of a cheap attempt to game search engine results.
   - "The bright colors of the ABC Widget 3000X are the best I've ever seen and I never want to be without my ABC Widget 3000X! The ABC Widget 3000X is easy to use and the ABC Widget 3000X tastes great on toast!"
   - People do this because, "Some of the fake reviews are done to generate rankings within search engines. Yes, most search engines like to view the number of hyperlinks as a metric, but having a bunch of separate sites mentioning the exact name of an item or web page will work too. Just depends on how the search engine weighs the mentions vs. the hyperlinks vs. 'voodoo magic of the algorithms'. That's why some of the reviews look off to a normal person. They were written to catch the eye of a search engine's bot."

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9. "The person uses the "brand approved" version of the name. Something no normal person would write but a marketer would. Like the name of the product in all caps."
10. "While negative reviews are often a good source of specific product information, dig beneath the 1-stars to find out the review behind it…sometimes they're just drive-by lazy slams like
    - E.g., "This sux!"
11. "Hyperventilating negative reviews can be a sign either of mental imbalance or of another company trying to jack their competitor."
    - E.g., "DOES NOT WORK!!!!! Broke after 10 seconds, so I returned it and got an (insert name of competitor product) instead, and I couldn't be happier!"

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12. "They frequently feature people who claim they were turned off by the product at first, but after trying it for some really lame reason (after all why would they try something they were so disgusted by) they suddenly saw the light and wanted to spread it to the world."
13. "They give a discount code or tell you where to go to buy the product."
14. "They go into long-winded explanations why the product is so much better than other, pretty much identical, products sold under different brand names."
15. "They just smell like bullshit. For instance, one commenter wrote, "I saw a local restaurant review website, with obviously fake reviews for one particular Mexican place like:
    - "Guacamole like my grandmother in Mexico used to make! Sure it was a little pricey, but worth every penny due to the large portion sizes and excellent service!"

    Then another review right under it,"
    - "I had so much fun at happy hour, so many beautiful ladies! Spilled my margarita all over my shirt, and a gorgeous bartender dabbed it up for me and gave me a fresh one, on the house. I'm going back next week to see her again!"

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16. "The "Lazy & getting paid $0.10 per review": "I love their food, they have the best [appropriate food or drink] item around!" That's it. The whole review. For 12 places."
17. The "I have an axe to grind": The person who posted a 1 star "review" on every Planned Parenthood in three states with their view on abortion.
18. With a franchise operation, all the reviewers have reviewed the other locations of the national chain within a few days of one another.
19. There's "only a few reviews, all overwhelmingly positive."
20. "Reviews using many of the same buzzwords that the website uses in describing its products/services (or the same broken English that the website is written in)."
21. "All of the reviewers have accounts created around the same time, usually around the time the domain name was registered." You can figure out when a domain was registered by looking it up on a site like whois.net.

Detecting Fake Reviews - Guidelines

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22. The username has more than 3 numbers at the end. Especially if several of the other reviews are left by users with more than 3 numbers at the end. Usually a sign of an automated program leaving reviews.
23. If "the review [is] done weeks/months before said product is actually released."
24. "If the reviewer responds to the problems from negative reviews by saying something like, "Company X wouldn't do that" or "Company X makes quality products". Normal people would say that they didn't have that problem, say how they got around the problem, or even explain what other people are doing wrong."
25. "The reviewer doesn't actually say anything about the product itself."
26. "The reviewer includes a link to their site. It is almost always the case that the reviewer left the review just to post the link and the review itself is useless.

Detecting Fake Reviews - Guidelines

- 30 ways to identify fake reviews: Consumerist:
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27. "My favorite way to double check a fake review is to highlight a peculiar phrasing in the review and do a google search for it. Funny, but the bigger the company or product the more they just place cookie-cutter reviews. You'll see the phrase spring up all over the different review sites."
28. "I'm skeptical of any reviews for a product/company that has a built-in history of fan-boy wars. Apple vs. Microsoft, for example. I hate it when fans of the product "A" leave fake negative reviews of product "B" out of spite."
29. "I completely avoid 5 star and 1 star ratings, and go straight for the 2-4 stars. I find they are usually much more reliable."
30. Red flag words: "Treat" and any variation of "Recommend"

Detecting Fake Reviews - Guidelines

- 30 ways to identify fake reviews: Consumerist:
  - https://consumerist.com/2010/04/14/how-you-spot-fake-online-reviews/
  - Additional cues:
    - Have zero caveats, and are full of empty adjectives and pure glowing praise with no downsides.
    - Are all left within a short period of time of each other.
    - Mainly tally off product features. (Real users talk more about performance, reliability, and overall value).
    - Reviewers names are all variations of one another, i.e. happykat1234, happykat7593, happykat6687

Detecting Fake Reviews - Guidelines

- 3 ways to identify fake reviews: MoneyTalksNews:
- https://www.moneytalksnews.com/3-tips-for-spotting-fake-product-reviews-%e2%80%93-from-someone-who-wrote-them/
  - Avoid reviews that are overly general or "salesy."
  - Be cautious of too many five-star reviews.
    - No product is going to please all of the people all of the time.
  - Look at the date/time stamps on the reviews.
    - If you find a bunch of reviews posted around the same date/time, be wary.

Spams: Feature Engineering/Extraction

- Two categories of features [1]:
  - Review centric features
    - Features that are constructed using the information contained in a single review
  - Reviewer centric features.
    - A holistic look at all of the reviews written by any particular reviewer along with information about the particular reviewer .

Spams: Feature Engineering/Extraction

- Two categories of features [1]:
  - Review centric features
    - Bag-of-words
    - Bag-of-words combined with term frequency features
    - Linguistic Inquiry and Word Count (LIWC)
    - parts of speech (POS) tag frequencies
    - Stylometric and Syntactic features
    - Features that refer to information about the review not extracted from the text

Spams: Feature Engineering/Extraction

- Two categories of features [1]:
  - Review centric features
    - Bag-of-words
      - Individual or small groups of words from the text are used as features, called n-grams
      - These are made by selecting n contiguous words from a given sequence, i.e., selecting one, two or three contiguous words from a text.
      - Denoted as a unigram, bigram, and trigram (n = 1, 2 and 3).

Spams: Feature Engineering/Extraction

- Two categories of features [1]:
  - Review centric features
    - Bag-of-words
      - An example of the unigram text features extracted from three sample reviews.
        - » Review1: The hotel rooms were so great
        - » Review2: We had a great time at this hotel great stay
        - » Review3: The rooms service is bad
      - Each occurrence of a word within a review will be represented by a“1”if it exists in that review and “0”otherwise

Review	the	hotel	rooms	were	so	great	we	had	a	time	at	this	service	is	bad	stay
Review1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Review2	0	1	0	0	0	1	1	1	1	1	1	1	0	0	0	1
Review3	1	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0

Spams: Feature Engineering/Extraction

- Two categories of features [1]:
  - Review centric features
    - Term frequency features
      - Similar to bag of words but also include term-frequencies.
      - Instead of simply being concerned with the presence or absence of a term, we are concerned with the frequency with which a term occurs in each review,
      - We include the count of occurrences of a term in the review.
      - Example:
        - » Review4: The hotel rooms were so great, were so comfort
        - » Review5: We had a great time at this hotel great stay
        - » Review6: The rooms service is bad so bad

Review	the	hotel	rooms	were	so	great	comfort	we	had	a	time	at	this	service	is	bad	stay
Review4	1	1	1	2	2	1	1	0	0	0	0	0	0	0	0	0	0
Review5	0	1	0	0	0	1	0	1	1	1	1	1	1	0	0	0	1
Review6	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	2	0

Spams: Feature Engineering/Extraction

- Two categories of features [1]:
  - Review centric features
    - Linguistic Inquiry and Word Count (LIWC)
      - A text analysis software tool in which users can “build [their] own dictionaries to analyze dimensions of language specifically relevant to [their] interests.
      - ”Part of Speech (POS) tagging involves tagging word features with a part of speech based on the definition and its context within the sentence in which it is found
      - “Personal text” refers to text associated with personal concerns such as work, home or leisure activities
      - “Formal text” refers to text disassociated from personal concerns, consisting of psychological processes, linguistic processes and spoken categories.
      - Below Review 7 is the review along with POStags for each word. Table 4 shows the meaning of each POS tag8, while Table 5 presentsthe frequencies of these tags within the review.

Spams: Feature Engineering/Extraction

- Two categories of features [1]:
  - Review centric features
    - Linguistic Inquiry and Word Count (LIWC)
      - E.g.,
      - Review7: I like the hotel so much, the hotel rooms were so great, the room service was prompt, I will go back for this hotel next year. I love it so much. I recommend this hotel for all of my friends.
      - Review7: I_PRP like_VBP the_DT hotel_NN so_RB much_RB,_, The_DT hotel_NNrooms_NNS were_VBD so_RB great_JJ,_, the_DT room_NN service_NN was_VBDprompt_JJ,_, I_PRP will_MD go_VB back_RB for_IN this_DT hotel_NN next_JJyear_NN ._. I_PRP love_VBP it_PRP so_RB much_RB ._. I_PRP recommend_VBPthis_DT hotel_NN for_IN all_DT of_IN my_PRP$ friends_NNS ._.

Spams: Feature Engineering/Extraction

- Two categories of features [1]:
  - Review centric features
    - Linguistic Inquiry and Word Count (LIWC)
      - E.g.,
      - Review7: I like the hotel so much, the hotel rooms were so great, the room service was prompt, I will go back for this hotel next year. I love it so much. I recommend this hotel for all of my friends.
      - Review7: I_PRP like_VBP the_DT hotel_NN so_RB much_RB,_, The_DT hotel_NNrooms_NNS were_VBD so_RB great_JJ,_, the_DT room_NN service_NN was_VBDprompt_JJ,_, I_PRP will_MD go_VB back_RB for_IN this_DT hotel_NN next_JJyear_NN ._. I_PRP love_VBP it_PRP so_RB much_RB ._. I_PRP recommend_VBPthis_DT hotel_NN for_IN all_DT of_IN my_PRP$ friends_NNS ._.
      - LIWC Results:

LIWC Dimension	Your data	Personal texts	Formal texts
Self-references (I, me, my)	12.50	11.4	4.2
Social words (Mate, talk, they, child)	2.50	9.5	8.0
Positive emotions (Love, nice, sweet)	5.00	2.7	2.6
Negative emotions (Hurt, ugly, nasty)	0.00	2.6	1.6
Overall cognitive words (cause, know, ought)	0.00	7.8	5.4
Articles (a, an, the)	7.50	5.0	7.2
Big words (>6 letters)	7.50	13.1	19.6

Spams: Feature Engineering/Extraction

- Two categories of features [1]:
  - Review centric features
    - Linguistic Inquiry and Word Count (LIWC)
      - E.g.,
      - POS abbreviation:

Tag	Description	Tag	Description
CC	Coordinating conjunction	PRP$	Possessive pronoun
CD	Cardinal number	RB	Adverb
DT	Determiner	RBR	Adverb, comparative
EX	Existential there	RBS	Adverb, superlative
FW	Foreign word	RP	Particle
IN	Preposition or subordinating conjunction	SYM	Symbol
JJ	Adjective	TO	to
JJR	Adjective, comparative	UH	Interjection
JJS	Adjective, superlative	VB	Verb, base form
LS	List item marker	VBD	Verb, past tense
MD	Modal	VBG	Verb, gerund or present participle
NN	Noun, singular or mass	VBN	Verb, past participle
NNS	Noun, plural	VBP	Verb, non-3rd person singular present
NNP	Proper noun, singular	VBZ	Verb, 3rd person singular present
NNPS	Proper noun, plural	WDT	Wh-determiner
PDT	Predeterminer	WP	Wh-pronoun
POS	Possessive ending	WP$	Possessive wh-pronoun
PRP	Personal pronoun	WRB	Wh-adverb

Spams: Feature Engineering/Extraction

- Two categories of features [1]:
  - Review centric features
    - Linguistic Inquiry and Word Count (LIWC)
      - E.g.,
      - POS tagging frequencies for Review 7:

POS Tag		DT	IN	JJ	MD	NN	NNS	PRP	RB	VB	VBD	VBP
Review	Review 7	6	3	3	1	7	2	6	6	1	2	3

Spams: Feature Engineering/Extraction

- Two categories of features [1]:
  - Review centric features
    - Stylometric and Syntactic features
      - Lexical Features (Character, word-based lexical)
        - » An indication of the types of words and characters that the writer likes to use
        - » It includes features such as number of upper case characters or average word length.
      - Syntactic Features
        - » Try to "represent the writing style of the reviewer
        - » It includes features such as the amount of punctuation or number of function words such as "a", "the", and "of"
    - Features that refer to information about the review not extracted from the text

Spams: Feature Engineering/Extraction

- Two categories of features [1]:
  - Review centric features
    - Features that refer to information about the review not extracted from the text
      - These features contain metadata about the reviews rather than information on the text content of the review.
      - E.g. of features: review length, date, time, rating, reviewer id, review id, store id or feedback.
      - Example: Reviews characteristics

Review	Review ID	Product ID	Reviewer ID	Rating	Helpfulness	Review char	Review words	Date	Time
Review4	152	012345	226	1	1	38	9	8/5/2013	09:24
Review5	153	012345	789	5	0	35	10	9/1/2015	12:06
Review6	154	012345	789	5	0	25	7	9/1/2015	12:07

      - Example: Reviewers characteristics

Reviewer#	Product ID	Reviewer ID	Reviewer name	Email address	# of Reviews	First review	Last review	Max # reviews per day	Average rating	Date	Time
Reviewer1	123456	152	JO	jo@gmail	2000	09/01/13	09/30/14	30	5	09/30/14	12:05
Reviewer2	123456	153	LI	jo@gmail	2300	09/01/13	09/30/14	31	5	09/30/14	12:06
Reviewer3	123456	154	SA	sa@gmail	3	05/02/11	06/05/14	1	4	06/05/14	12:00

Spams: Feature Engineering/Extraction

- Two categories of features [1]:
  - Reviewer centric features
    - Maximum number of reviews
      - About 75 % of spammers write more than 5 reviews per day
    - Percentage of positive reviews
      - Approximately 85% of spammers write more than 80% of their reviews as positive ones
    - Review length
      - About 80 % of spammers have no reviews longer than 135 words
      - More than 92 % of reliable reviewers have an average review length of > 200 words.
    - Reviewer deviation
      - spammers' ratings tend to deviate from the average review rating at a far higher rate than legitimate reviewers
    - Maximum content similarity
      - The presence of similar reviews for different products by the same reviewer is a strong indication of a spammer.
      - Use techniques such as cosine similarities

LIWC

- LIWC (Linguistic Inquiry and Word Count) [3]:
  - A transparent text analysis program that counts words in psychologically meaningful categories.
  - Reads a given text and counts the percentage of words that reflect different emotions, thinking styles, social concerns, and parts of speech.
  - developed by researchers with interests in social, clinical, health, and cognitive psychology,
  - The language categories were created to capture people's social and psychological states.
  - Includes the main text analysis module (in Java) along with a group of built-in dictionaries.
    - Reads written/transcribed verbal texts
    - The text analysis module then compares each word in the text against a user-defined dictionary.
    - The dictionary identifies which words are associated with which psychologically-relevant categories.

LIWC

- LIWC (Linguistic Inquiry and Word Count) [3]:
  - After the processing module has read and accounted for all words in a given text, it calculates the percentage of total words that match each of the dictionary categories.
    - E.g., if LIWC analyzed a single speech that was 2,000 words and compared them to the built-in dictionary, it might find that there were 150 pronouns and 84 positive emotion words used. It would convert these numbers to percentages, 7.5% pronouns and 4.2% positive emotion words.
  - The text analysis module identifies and categorizes words, the major component of LIWC is a group of dictionaries that tells the text analysis module which words to identify and classify.
  - For each dictionary word, there is a corresponding dictionary entry that defines one or more word categories.
    - E.g., the word "cried" is part of five word categories: Sadness, Negative Emotion, Overall Affect, Verb, and Past Focus. All sadness words will be categorized as negative emotion and overall affect words.

LIWC

- LIWC (Linguistic Inquiry and Word Count) [3]:
  - Measuring psychological dimensions
    - For every LIWC dimension, a separate list or dictionary made up of relevant words is built.
    - E.g., LIWC2015 (the LIWC dictionary) measures the degree to which texts reveal interests in power, status, and dominance using its Power dictionary.
      - Someone who is concerned with power is more likely to be sizing other people up in terms of their relative status.
      - Such a person will be more likely to use words such as boss, underling, president, Dr., strong, and poor when compared with someone who simply doesn't care about power and status.
      - The hard part of building a power-related dictionary is in determining what words should be in the dictionary.
      - One way to build such a dictionary: rely on human judges.
      - Started with well-known standard dictionaries and thesauruses and, then, asked linguistic experts to generate every word they could think of related to power, dominance, and status.

LIWC

- LIWC (Linguistic Inquiry and Word Count) [4]:
  - The LIWC program has two central features:
    - The processing component and
    - The dictionaries
  - Example:
    1. "It was a dark and stormy night"
    2. The program first look at the word "it" and then see if "it" was in the dictionary.
    3. It is and is coded as a function word, a pronoun, and, an impersonal pronoun.
    4. All three of these LIWC categories would then be incremented.
    5. Next, the word "was" would be checked and would be found to be associated with the categories of verbs, auxiliary verbs, and past tense verbs.
    6. After going through all the words in the novel, LIWC would calculate the percentage of each LIWC category.
    7. For example: we might discover that 2.34% of all the words in a given book were impersonal pronouns and 3.33% were auxiliary verbs. The LIWC output, then, lists all LIWC categories and the rates that each category was used in the given text.

LIWC - History

- LIWC (Linguistic Inquiry and Word Count) [4]:
  - The creation of the dictionary
    - Goal: We want the computer to calculate the percentage of positive and negative emotion words within a text.
    - We need to specify exactly which words to look for
    - Based on the judges' ratings, we also want to include measures of thinking styles:
      - E.g., signs of self-reflection, and causal thinking.
    - 80 categories created
      - All category word lists were updated by the following set of rules:
        1. a word remained in the category list if two out of three judges agreed it should be included;
        2. a word was deleted from the category list if at least two of the three judges agreed it should be excluded; and
        3. a word was added to the category list if two out of three judges agreed it should be included.
    -

LIWC

- LIWC (Linguistic Inquiry and Word Count) [4]:
  - Content vs. Style words
    - Two broad categories of words with different psychometric and psychological properties
    - Content words are generally nouns, regular verbs, and many adjectives and adverbs.
      - They convey the content of a communication.
      - "It was a dark and stormy night": the content words are: "dark," "stormy," and "night."
    - Style words are function words
      - Style or function words are made up of pronouns, prepositions, articles, conjunctions, auxiliary verbs, and a few other esoteric categories.
      - "It was a dark and stormy night": the style words are "it," "was," "a," and "and."
    - Style words reflect how people are communicating, whereas content words convey what they are saying
    - style words are much more closely linked to measures of people's social and psychological worlds
    - The ability to use style words requires basic social skills.

LIWC

- LIWC (Linguistic Inquiry and Word Count) [4]:
  - Content vs. Style words
    - E.g., “I will meet you here later.”
      - Grammatically correct, but meaningless
      - The assumption: the reader knows who “I” and “you” refers to, where “here” is, and when “later” would be.
      - Speaker and listener share the same knowledge of these style words

LIWC

- LIWC (Linguistic Inquiry and Word Count) [4]:
  - The Social and Psychological Meaning of Words
    - Attentional Focus: Pronouns and Verb Tense
    - Emotionality: Positive and Negative Emotions
    - Social Relationships
    - Status, Dominance, and Social Hierarchy
    - Social Coordination and Group Processes
    - Honesty and Deception
    - Close Relationships

LIWC

- LIWC (Linguistic Inquiry and Word Count) [4]:
  - The Social and Psychological Meaning of Words
    - Attentional Focus: Pronouns and Verb Tense
      - Tracking people's attention reveals information about their priorities, intentions, and thoughts
      - Our attention can oscillate from our external worlds to our internal feelings or sensations
        - » E.g., . If we are playing tennis, we might bruise our arm and not notice because our full attention is on the game itself.
        - » Alternatively, if the injury is significant, the pain may be so attention grabbing that we no longer are aware of the game at all.
      - Tracking language use, such as tracking people's gaze, can tell us where they are attending
      - Content word categories explicitly reveal where individuals are focusing
        - » Money, health, etc.
      - Function words, such as personal pronouns, also reflect attentional allocation.
        - » People use more first-person singular pronoun, if they are experiencing physical or emotional pain tend to have their attention drawn to themselves

LIWC

- LIWC (Linguistic Inquiry and Word Count) [4]:
  - The Social and Psychological Meaning of Words
    - Attentional Focus: Pronouns and Verb Tense
      - Attention can reveal not just who someone is attending to but how they are processing the situation
        - » Peopleuse more first-person singular and fewer third-person pronouns (e.g., “he,” “she”) when describing an event
      - Personal pronouns provide information about the subject of attention, analyses of the tense of common verbs can tell us about the temporal focus of attention.
      - Studying attention also gives us a deeper understanding of how people are processing a situation or event.
      - Pronouns and verb tense are useful linguistic elements that can help identify focus, which, in turn, can show priorities, intentions, and processing.

LIWC

- LIWC (Linguistic Inquiry and Word Count) [4]:
  - The Social and Psychological Meaning of Words
    - Emotionality: Positive and Negative Emotions
      - People react to events in different ways
      - How people react may say a lot about how they cope with the event and the extent to which the event plays a role in the future.
      - At the heart of reacting and coping with events is people's emotional response.
      - LIWC identifies emotion in language use
        - » positive emotion words (e.g., love, nice, sweet) are used in writing about a positive event, and
        - » negative emotion words (e.g., hurt, ugly, nasty) are used in writing about a negative event
      - Higher use of emotion words show more immersion in the traumatic event, which led to increased experience of physical pain.
        - » Eg., home violence
      - Emotion words are negatively correlated with articles, prepositions, and relativity words.
      - Emotion words are positively correlated with pronoun use, auxiliary verb use and negation use

LIWC

- LIWC (Linguistic Inquiry and Word Count) [4]:
  - The Social and Psychological Meaning of Words
    - Social Relationships
      - Word choice provides information about person perception.
      - Certain language clues give away relationships.
        - » Pronouns reveal how an individual is referencing those in the interaction and outside of it.
        - » Word count explains who is dominating the conversation and how engaged they are in the conversation.
      - Assents and positive emotion words measure levels of agreement.

LIWC

- LIWC (Linguistic Inquiry and Word Count) [4]:
  - The Social and Psychological Meaning of Words
    - Status, Dominance, and Social Hierarchy
      - Higher-status individuals speak more often and freely make statements that involve others.
      - Lower-status language is more self-focused and tentative.
      - Higher-ranked individuals asked fewer questions compared with lower-ranked people.
      - Increased use of first-person plural is a good predictor of higher status
      - Small groups are rated as being more involved and task focused by their teammates if they use more words;
        - » It supports the assertion that total word count may also indicate status

LIWC

- LIWC (Linguistic Inquiry and Word Count) [4]:
  - The Social and Psychological Meaning of Words
    - Social Coordination and Group Processes
      - More communication, more unity, and positive feedback may promote better group performance.
      - More first-person plural may show group cohesion;
      - Assents and question marks show how individuals are responding to each other.

LIWC

- LIWC (Linguistic Inquiry and Word Count) [4]:
  - The Social and Psychological Meaning of Words
    - Honesty and deception
      - Deceptive statements compared with truthful ones are moderately descriptive, distanced from self, and more negative.
      - Liars use more negative emotion, more motion words (e.g., arrive, car, go), fewer exclusion words, and less first-person singular.
      - Motion, exclusion, and sense words all indicate the degree to which an individual elaborated on the description of the scenario.
      - Deceptive statements are balanced in descriptiveness because enough description is required to convince the other person of an untruthful statement but too much information might reveal inaccuracies
      - Deceivers use some language features that show less diversity and complexity

LIWC

- LIWC (Linguistic Inquiry and Word Count) [4]:
  - The Social and Psychological Meaning of Words
    - Close relationships
      - Pronoun use is very important in showing the quality of a close relationship, because it shows how individuals are referring to each other
      - first-person plural (“we”) has not been found to be related to higher relationship quality,
      - use of second person (“you”) is more important in predicting lower-quality relationships
      - use of second-person pronouns was negatively related to relationship quality.

Detecting Spams/Fake Reviews/Phishing Emails

- Review centric review spam detection [1]
  - Types of machine learning techniques
    - Supervised learning refers to the task of learning from labeled data
    - unsupervised learning (e.g., clustering) uses unlabeled data to find unseen relation-ships between instances independent of a class attribute.
    - Semi-supervised learning is a combination of the two and uses a few labeled instances in combination with a large number of unlabeled instances to train a classifier and has shown promise in the area of review spam detection

Method	Attributes
Supervised Learning	Learning from a set of labeled data
	Requires labeled training data
	Most common form of learning
Unsupervised Learning	Learning from a set of unlabeled data
	Finds unseen relationships in the data independent of class label
	Most common form is clustering
Semi-supervised Learning	Learning from labeled and unlabeled data
	Only requires a relatively small set of labeled data which is supplemented with a large amount of unlabeled data
	Ideal for cases such as review spam where vast amounts of unlabeled data exist

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