



Why are we Stressing Out? Stress and Sentiment Strength Detection for English Covid-19 Tweets

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Sentiment Strength Detection in the Social Web with *SentiStrength*

Detects positive and negative sentiment *strength* in short informal text.

- Does not rely on standard grammar and spelling
- Uses nonstandard emotion expression forms from the social web (e.g., :-) or haaapppppyyyy!!!).
- Classifies positive 1 to 5 AND negative -1 to -5 sentiment.

Thelwall, M., Buckley, K., & Paltoglou, G. (2012). [Sentiment strength detection for the social Web](#). *Journal of the American Society for Information Science and Technology*, 63(1), 163-173

Thelwall, M., Buckley, K., Paltoglou, G., Cai, D., & Kappas, A. (2010). [Sentiment strength detection in short informal text](#). *Journal of the American Society for Information Science and Technology*, 61(12), 2544-2558.

SentiStrength Algorithm - Core

- 2,489 positive and negative sentiment terms and strengths (1 to 5), e.g.
 - ache = -2, dislike = -3, hate=-4, excruciating -5
 - encourage = 2, coolest = 3, lover = 4
- Sentiment strength is highest in sentence; highest sentence if multiple sentences.

positive, negative

• My legs ⁻²ache. 1, -2

• You are the ³coolest. 3, -1

• I ⁻⁴hate Paul but ²encourage him. 2, -4

Extra rules examples

- **spelling correction** nicce -> nice
- **booster words** alter strength **very** happy
- **negating words** flip sentiments **not** nice
- **repeated letters** boost sentiment/+ve niiiice
- **emoticon list** :) =+2
- **exclamation marks** count as +2 unless -ve hi!
- **repeated punctuation** boosts sentiment good!!!
- **Negativity ignored in questions** u h8 me?
- **sentiment idiom list** shock horror = -2

Tests against human coders on data sets of >1000 texts

Also correlates with eyebrow muscle tension, foot sweat, & heart rate.



SentiStrength agrees with typical humans as much as they agree with each other.

Data set	Positive scores - correlation with humans	Negative scores - correlation with humans
YouTube	0.589	0.521
MySpace	0.647	0.599
Twitter	0.541	0.499
Sports forum	0.567	0.541
Digg.com news	0.352	0.552
BBC forums	0.296	0.591
All 6 data sets	0.556	0.565


1 is perfect agreement, 0 is random agreement

Why bad results for news and politics?

Irony, sarcasm and expressive language.

- Boris Johnson must be **very happy** that I have lost my job because of Brexit.
- Your argument is a **joke**.

19 Which are better? Dogs or people? ?
14 Answers · Cats · 2 days ago

5 What kind of dog is this?
 I found her in my backyard. What kind of dog is she? Should I keep her?
9 Answers · Dogs · 6 hours ago

23 What would this mixed breed be called?
My friend has a staffie/rottweiler mix. She got from a shelter. But they didn't use its breed guessing. What would it be called?
Staffweiler?
...Show more
11 Answers · Dogs · 1 day ago

3 Is my neighbor's dog pregnant?
She is a German Shepherd Rottweiler mix. I saw her laying down under a shady tree in our backyard. I don't know if she's pregnant or not.
8 Answers · Dogs · 9 hours ago

45 Has anyone heard of a Shorkie x Mauzer puppy. I was have 2 and I'm not sure what they would be. ?
18 Answers · Dogs · 3 days ago

SentiStrength application:



- Answers from people receiving positive comments are more highly ranked

Kucuktunc, O., Cambazoglu, B.B., Weber, I., & Ferhatosmanoglu, H. (2012). [A large-scale sentiment analysis for Yahoo! Answers](#), 5th ACM International Conference on Web Search and Data Mining.

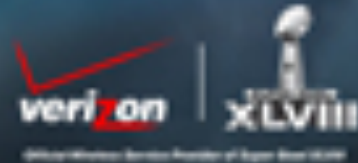
SentiStrength: Detects positive and negative social media posts during publicity campaigns.

Who's gonna win
SUPER BOWL XLVIII?

Tweet your answer to the daily question above with #WhosGonnaWin and watch the Empire State Building tonight to see if your team's color will take over.

NY/NJ Super Bowl XLVIII Week: Powered by the Most Powerful Network

Join The Action



SentiStrength application 3: Sentiment search filters in *Mozdeh* social media analytics

analysis2 - [dad: 394741 matches found out of 17461560 (2.3%) (word ID= 593)]

Analyse Networks Data Subprojects About

to match all words; AND/OR priority IGNORED: processing is left to right

Boolean Search
(or)

Previous

Show original text (slow)

Next

[More help](#)

erling Co-word comparisons

1 ID of first item to show

2013.7.28 First date to show

Results to show

Hide #tags and @s

Hide duplicates (v. slow)

return results from this
label tweeters (case sensitive)

ts only from this Tweeter/feed ID

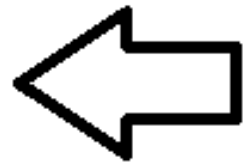
Select alternative subproject

der

Advanced Search Tips

- AND - results must match the part of the query to the left of AND and the term to the right
- OR - is the default and is ignored
- () - brackets can be used in conjunction with AND for more complex Boolean searches
- - (minus) before term excludes all matches of the query to the left of the term also matching the term (e.g., put -term at query end to exclude matches containing term).
- " " - quotes ensure that the exact phrase in quotes matches the search (slow)

<= +ve sentiment <= <= -ve sentiment <=



can a proud dad get a shout out for his daughter jenny wedding today #jennychriswedding
my dad is in a super mad mood and he all sassy and has a terrible attitude dad stop you can't get mad at me after
to start tonight me and my dad watch it every year
me to a chinese for tea to cheer me up love
i hope you wouldnt dad lol and yea i know i might come out there today
dy love each other very much dad we we did is fuck
to talk to my dad
eatest person to walk the face of this

Feed #6277 Info:
URL: OfficialTRIGMI
Topic: dad
Name: #TRIGMI ☆ #BMB

Item #12647 Text:
@timholmgren lol i hope you wouldnt dad lol
and yea i know i might come out there today

TensiStrength

- Adapted from SentiStrength
 - Additional stress-related terms
 - Modified term strengths
- Goal: detect stress, especially transport-related, from social media posts
- Contrasts stress with relaxation

<http://sentistrength.wlv.ac.uk/TensiStrength.html>

Thelwall, M. (2017). TensiStrength: Stress and relaxation magnitude detection for social media texts. *Information Processing & Management*, 53(1), 106–121.

Gopalakrishna Pillai, R., Thelwall, M., & Orasan, C. (2018). Detection of stress and relaxation magnitudes for tweets. In *Companion Proceedings of the The Web Conference 2018* (pp. 1677-1684).

Stress/relaxation terms

- E.g., **Late, delayed, didn't work, nervous wreck, late for.**
 - The train is very **late**. (1, -5)
- E.g., Sleep, peaceful, a walk, on time.
 - I went to sleep (4, -1)
- Some negative terms are not very stressful
 - Never trust a man with a **filthy** kitchen (1,-2)

Evaluation: TensiStrength [top] /SentiStrength [bottom] vs. human stress/relaxation scores

Corpus	Tweets	Corr.	Exact	Within 1	MAD
Common short words	608	0.505	327 (53.9%)	555 (91.4%)	0.552
		0.511	328 (54.0%)	551 (90.8%)	0.562
Emotion terms	619	0.419	302 (48.9%)	552 (89.3%)	0.633
		0.467	274 (44.3%)	529 (85.6%)	0.715
Insults	180	0.329	97 (54.2%)	168 (93.9%)	0.531
		0.422	76 (42.5%)	155 (86.6%)	0.726
Opinions	476	0.452	271 (57.1%)	437 (92.0%)	0.518
		0.506	232 (48.8%)	424 (89.3%)	0.636
Stress terms	655	0.377	239 (36.5%)	517 (79.1%)	0.893
		0.385	300 (45.9%)	571 (87.3%)	0.682
Transport	528	0.457	273 (51.8%)	473 (89.8%)	0.594
		0.451	276 (52.4%)	464 (88.0%)	0.605
All combined	3066	0.444	1512 (49.3%)	2705 (88.3%)	0.642
		0.471	1489 (48.6%)	2698 (88.0%)	0.647
All combined (unrounded)	3066	0.465	950 (31.0%)	2845 (92.8%)	0.660
		0.495	932 (30.4%)	2837 (92.5%)	0.664

Performance comparison summary

- TensiStrength only slightly better at detecting stress than SentiStrength – despite many individual differences.
- Machine learning works better than TensiStrength – by detecting stressful contexts as well as expressions of stress.

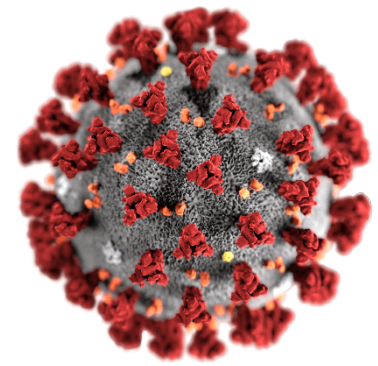
TensiStrength application

- Detecting travel problems in real time through stress hotspots.



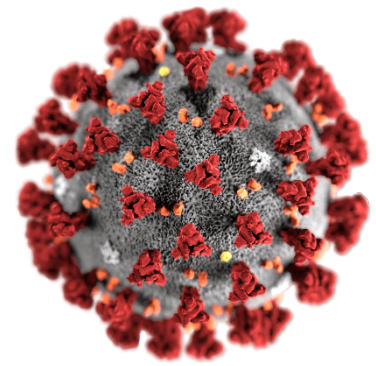
Salas, A., Georgakis, P., Nwagboso, C., Ammari, A., & Petalas, I. (2017). Traffic event detection framework using social media. *IEEE International Conference on Smart Grid and Smart Cities* (pp. 303-307).

Covid-19 Pragmatic Comparison



- Goal 1: detect stress related issues expressed on Twitter during Covid-19.
- Goal 2: compare the results of three different detection methods.
- Why? To compare alternative methods for a practical stress-related task.

Experiment methods



- Data: Tweets mentioning Covid19, coronavirus from March 10 to 2020.
- Step 1:
 - Identify stressed tweets with TensiStrength
 - Identify negative tweets with SentiStrength
 - Identify tweets containing key stress terms (stress stresses stressed, stressing, stressful, tense, tension, tenseness, pressure, pressured, pressurised, pressurising, tensing).
- Step 2: Identify words in a higher proportion of stressed/negative/key term tweets than the remaining tweets.
- Step 3: Classify the top 500 terms for usefulness for each set, ignoring stopwords and lexicon words.
- Step 4: Compare the results.

Results 1: Coverage

- Stress and sentiment detection identify vastly more stressed/negative tweets.

Set of tweets	Tweets	%
Stress key words	83,944	0.5%
Stressed	4,631,578	27.0%
Negative	3,679,679	21.5%
All Covid-19 tweets	17,129,025	100.0%

Results 2a: Word association terms

Top ten terms for **stressed** set.

Term*	Stress	Others	Chisq	Rank		
				Stressed	Negative	Key
people	11.9%	6.6%	126860	1	2	1000+
against	3.7%	1.3%	103185	2	3	1000+
toll	1.1%	0.1%	98959	3	1	1000+
lie	1.1%	0.2%	60861	4	5	1000+
Trump	4.6%	2.5%	54037	5	4	1000+
American	2.5%	1.1%	48545	6	6	1000+
rate	1.8%	0.7%	47091	7	8	1000+
@realdonaldtrump	3.5%	1.8%	41195	8	7	1000+
cause	1.4%	0.5%	38035	9	9	125
because	4.5%	2.7%	37670	10	10	500+

Negative rather than specifically stressful.
Similar rank for negative sentiment.

Results 2b: Word association terms

Top ten terms for **negative** set.

Term*	Stress	Others	Chisq	Rank		
				Negative	Stressed	Key
toll	1.3%	0.1%	115119	1	3	1000+
people	12.2%	6.9%	106399	2	1	1000+
against	3.9%	1.4%	94388	3	2	1000+
Trump	5.2%	2.4%	76261	4	5	1000+
lie	1.2%	0.2%	71398	5	4	1000+
American	2.9%	1.0%	68980	6	6	1000+
@realdonaldtrump	4.0%	1.8%	64464	7	8	1000+
rate	2.0%	0.7%	48928	8	7	1000+
cause	1.5%	0.6%	34278	9	9	125
because	4.6%	2.8%	33738	10	10	500+

Similar to stress set.

Results 2c: Word association terms

Top ten terms for **key stress terms** set.

				Rank		
Term*	Stress	Others	Chisq	Stressed	Negative	Key
mental	4.7%	0.4%	39742.3	1	500+	1000+
post-traumatic	0.2%	0.0%	29053.1	2	1000+	1000+
cope	1.8%	0.1%	24037.8	3	500+	1000+
feeling	3.2%	0.3%	21083.8	4	500+	500+
blood	2.9%	0.3%	20308.5	5	1000+	1000+
coping	1.5%	0.1%	18114.8	6	1000+	1000+
manage	1.7%	0.2%	12767.1	7	1000+	1000+
oxidative	0.1%	0.0%	11336.3	8	1000+	1000+
tip	2.6%	0.4%	11058	9	1000+	1000+
#mentalhealth	1.4%	0.1%	10107.5	10	1000+	1000+

More directly related to stress.

Focus on medical stress and health.

Results 3: Top 1000 terms overlaps

- The top 1000 terms from each method have substantial overlap between TensiStrength and SentiStrength, but much smaller for the key stress terms.
- Coronavirus-specific types of stress might not have been adequately represented within the TensiStrength lexicon.

Set of tweets	Stressed	Negative
Stress key words	22.2%	16.5%
Stressed	-	74.1%

Results 4: Useful terms overlap

Classification	Substantive terms in top 500	Also Stress words	Also Stressed	Also Negative
Stress words	348	100%	7%	4%
Stressed	112	21%	100%	76%
Negative	108	13%	79%	100%

- There was a similar overlap pattern for words judged useful in the top 500.
- Terms associating with key stress words include:
 - medical terminology (e.g., #mentalhealth, post-traumatic, oxidative, diabetes, cortisol)
 - stress treatments (e.g., tip, yoga, #ManagingStress)
 - geopolitics (e.g., #EndGazaBlockade, US-China [tensions])
 - school exams (e.g., exam).



Summary

- TensiStrength and SentiStrength are lexical programs that detect stress and sentiment, respectively.
- For the task of detecting useful words indicating stress contexts, stress and negative sentiment detection with Tensi/SentiStrength give similar results.
 - For Covid-19, stressful events seem to be generally negative events.
- Using stress/pressure/tension words identifies only 2% as many tweets as TensiStrength stress detection.
 - Within these tweets, stressful events tend to be medical, treatments, geopolitics, and exams.
- Simplifying the stress detection method dramatically changes the nature of the stress detected, even on a huge corpus.
- Perhaps 98% of stressful issues during Covid-19 were tweeted about without explicitly referring to stress.
 - This is a challenge for stress detection.