The language of mental health problems in social media

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Supplement

Determining relevant subreddits

In order to identify relevant subreddits, a heuristic method for searching on free text was applied. More specifically, we searched across the complete downloaded reddit archive for text in posts or comments that match against certain keywords (see Table 1 for the complete list of 134 keywords). This keyword list was expert-curated and is released as part of the PHEME project[1] (Kolliakou et al., 2015). The result set was grouped by subreddit and sorted by size. We then visited the top subreddits and curated a preliminary list of relevant subreddits. Based on this list, we fetched the complete data for these subreddits. The final list was compiled after eliminating subreddits that contained fewer than 5,000 communications. Table 2 displays this final list, together with an explanation of the purpose of this subreddit as provided on Reddit.

Table 1: List of keywords used for mining relevant subreddits.

'anxiety*' ,'autism*' ,'Abilify' ,'Abixa' ,'ACP 103' ,'ACP-103' ,'ACP103' ,'Akatinol' ,'alzheimer*' ,'Amazeo' ,'Amidone' ,'Amipride' ,'amisulpride' ,'Amival' ,'Aricept' ,'aripiprazole' ,'Ativan' ,'Atosil' ,'Avanza' ,'Avomine' ,'Axit' ,'Axura' ,'brexpiprazole' ,'Brintellix' ,'Buprenex' ,'buprenorphine' ,'Butrans' ,'cariprazine' ,'Celexa' ,'Cibalith S' ,'Cipramil' ,'citalopram' ,'Clopine' ,'clozapine' ,'Clozaril' ,'Convulex' ,'dementia' ,'depress*' ,'Diastat' ,'Diastat AcuDial' ,'diazepam' ,'Dolophine' ,'donepezil' ,'Ebixa' ,'Effexor' ,'Epilim' ,'Episenta' ,'Epival' ,'Eskalith' ,'Exelon' ,'Fargan' ,'Farganesse' ,'FazaClo' ,'fluoxetine' ,'galantamine' ,'Haldol' ,'haloperidol' ,'Heptadon' ,'Imovane' ,'Invega' ,'Lanzek' ,'Latuda' ,'Lergigan' ,'Lithobid' ,'lorazepam' ,'lurasidone' ,'Lustral' ,'Lycoremine' ,'memantine' ,'Memox' ,'methadone' ,'Methadose' ,'Mirtaz' ,'mirtazapine' ,'Mirtazon' ,'Namenda' ,'Nivalin' ,'Nuplazid' ,'obsessive compulsive' ,'ocd' ,'OCP34712' ,'olanzapine' ,'OPC 34712' ,'OPC-34712' ,'paliperidone' ,'Phenergan' ,'Physeptone' ,'pimavanserin' ,'promethazine' ,'Promethegan' ,'Prothiazine' ,'Prozac' ,'quetiapine' ,'Razadyne' ,'Receptozine' ,'Remeron' ,'Reminyl' ,'RGH 188' ,'RGH-188' ,'RGH188' ,'Risperdal' ,'risperidone' ,'rivastigmine' ,'Romergan' ,'Sarafem' ,'schizo affective' ,'schizoaffective' ,'schizophren*' ,'self harm*' ,'selharm*' ,'Seroquel' ,'sertraline' ,'Solian' ,'Soltus' ,'Sominex' ,'Subutex' ,'suicid*' ,'Sulpitac' ,'Sulprix' ,'Symoron' ,'Trintellix' ,'Valium' ,'valproate' ,'venlafaxine' ,'Versacloz' ,'vortioxetine' ,'Zaponex' ,'Zetran' ,'Zimovane' ,'Zispin' ,'Zoloft' ,'zopiclone' ,'Zypadhera' ,'Zyprexa'

Generation of language features for posts and comments from Reddit

To generate the language features, we used a Python implementation. All relevant scripts are available on our github repository[2]. The core Python modules used for our analysis include Pandas (data analysis)[3], spaCy (NLP)[4], seaborn (statistical data visualisation)[5] and scikit-learn (machine learning)[6]. We briefly present some details behind the implementation.

Regarding the language features, we used spaCy for analysing the free text. The library provides a parse tree which contains syntactic information about the token-words in each sentence. These tokens were used to identify the pronouns (i.e. pronouns, definite articles), verbs and verb phrases (sequences of verbs), as well as nouns and noun chunks (sequences of nouns). Furthermore, the tree for each sentence was used in order to calculate its height. Similarity between adjacent sentences (see LF10 and LF11 in Table 2, manuscript) was implemented using a cosine similarity function.

Determination of discriminability of subreddits based on subreddit-specific vocabularies

Our approach to determine language homogeneity across subreddits, examines the number of occurrences of unigrams (words) and bigrams (sequences

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[1]http://www.pheme.eu/

[2]https://github.com/gkotsis/
reddit-mental-health.
[3]http://pandas.pydata.org/
[4]https://spacy.io/
[5]https://stanford.edu/~mwaskom/software/
seaborn/
[6]http://scikit-learn.org/stable/

Table 2: The subreddits used in our study, together with a short description as retrieved from their website.

subreddit	description	URL
Anxiety	Posters on this subreddit are likely to be anxiety sufferers, though there are no specific intensions set for this subreddit.	https://www.reddit.com/r/Anxiety/
BPD	A place for those who have Borderline Personality Disorder, their family members and friends, and anyone else who is interested in learning more about it.	https://www.reddit.com/r/BPD
BipolarReddit	Aims to be a community of Bipolar sufferers, as opposed to *BipolarSOs*.	https://www.reddit.com/r/BipolarReddit/
BipolarSOs	Community that is composed of people either being affected themselves and/or are in a relationship with someone being affected by Bipolar Disorder.	https://www.reddit.com/r/BipolarSOs/
OpiatesRecovery	Provides support and advise to everyone trying to overcome opiate addiction by others in similar situations.	https://www.reddit.com/r/OpiatesRecovery/
StopSelfHarm	A lot of teenagers and adults suffer with self-harm issues, or consider using self-harm as a way of coping with their struggles. Self-harming can be a very difficult habit to break, if you know someone or you struggle with self-harm get help. You are not alone.	https://www.reddit.com/r/StopSelfHarm
addiction	No description provided	https://www.reddit.com/r/addiction
aspergers	For safe and helpful conversation with people who have Aspergers or live with someone who does. We also welcome people with other autism spectrum conditions.	https://www.reddit.com/r/aspergers
autism	Autism news, information and support. Please feel free to submit articles to enhance the knowledge, acceptance, understanding and research of Autism and ASD.	https://www.reddit.com/r/autism
bipolar	A safe haven for bipolar related issues. We are a community here not just a help page. Be a part of something that cares about who you are.* /r/bipolar Feel free to post, discuss or just lurk. There is no judgement in this place, we are here for each other.	https://www.reddit.com/r/bipolar
cripplingalcoholism	Provides an exchange board for people that are addicted to alcohol, but primarily those that consider alcoholism a life-style choice.	
depression	A safe, supportive space for anyone struggling with depression.	https://www.reddit.com/r/depression
opiates	No description provided.	https://www.reddit.com/r/opiates
schizophrenia	This is a community meant for a discussion of Schizophrenia and schizophrenia related issues (including psychotic symptoms in general, Schizoid, Schizotypal, and Paranoid Personality Disorders).	https://www.reddit.com/r/schizophrenia
selfharm	A subreddit for self-harmers to relate to each other, ask questions, and build up a community. Giving instructions on methods of self-harm is not allowed on this subreddit.	https://www.reddit.com/r/selfharm
SuicideWatch	No description provided. Guidelines are very strict and thorough.	https://www.reddit.com/r/SuicideWatch

of 2 words) in each document. The numbers of occurrences for uni- and bigrams were the input for a Naive Bayes classifier. Because the sizes (in terms of number of communications) of the subreddits varied significantly (imbalanced datasets), we aimed to set up the classification datasets in a uniform and consistent way. The balanced dataset is produced by randomly selecting 5k posts from each subreddit, or the maximum number of posts from the smallest of the two (whichever is the highest). The overall accuracy of this classification task (number of correctly classified instances over total instances) is the average accuracy produced from 10 folds. Hence, we consider the produced mean accuracy to represent a language proximity feature between two subreddits: a high accuracy score means that the two subreddits are distinctive in terms of language (low proximity), whereas a low accuracy score depicts a shared vocabulary across two subreddits (high proximity).

Assessment of affection in subreddits

To determine sentiment in post of the relevant subreddits, we used two specific methods: LabMT (Dodds et al., 2011) and AFINN (Nielsen, 2011). For both methods, we used the list of words as published with the respective paper. The result of this normalisation was that words with low score (e.g. "suicide", "death") received negative values and words with high score (e.g. "laughter", "love")

received positive score. The score of each document was calculated by taking the sum of the values of each word found. The final score value was then further normalised by dividing the sum by the square root of the number of words found. For the AFINN feature, the word list already contained positive and negative values for the so-called "valence" of each word and was implemented in a similar approach.

References

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