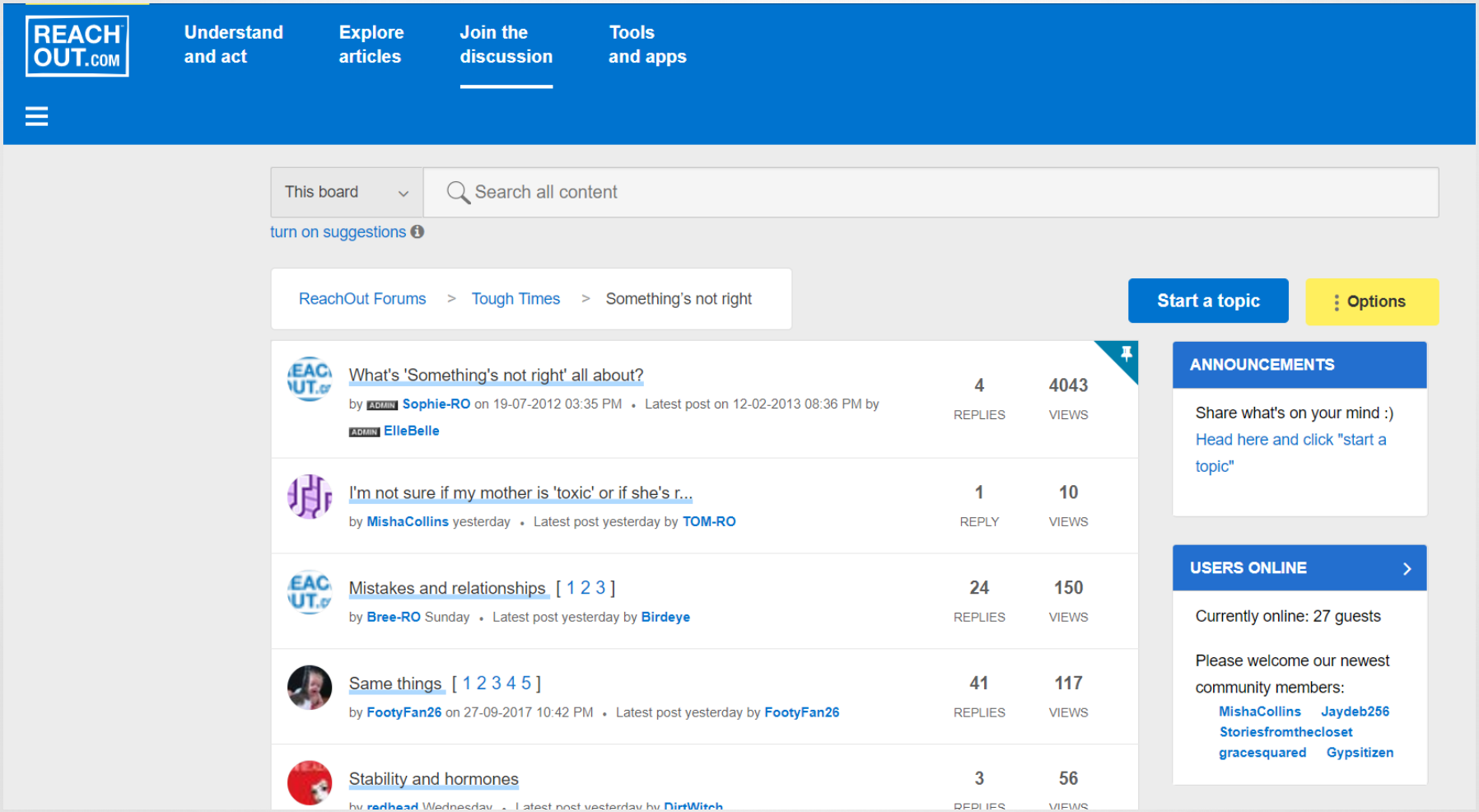
Project 8
Text Classification

Triaging content in online peer-support forums

Meng Han
Tim Walsh

Task Setting



Task Setting

mspaceK

Builder

28-07-2017 07:54 PM

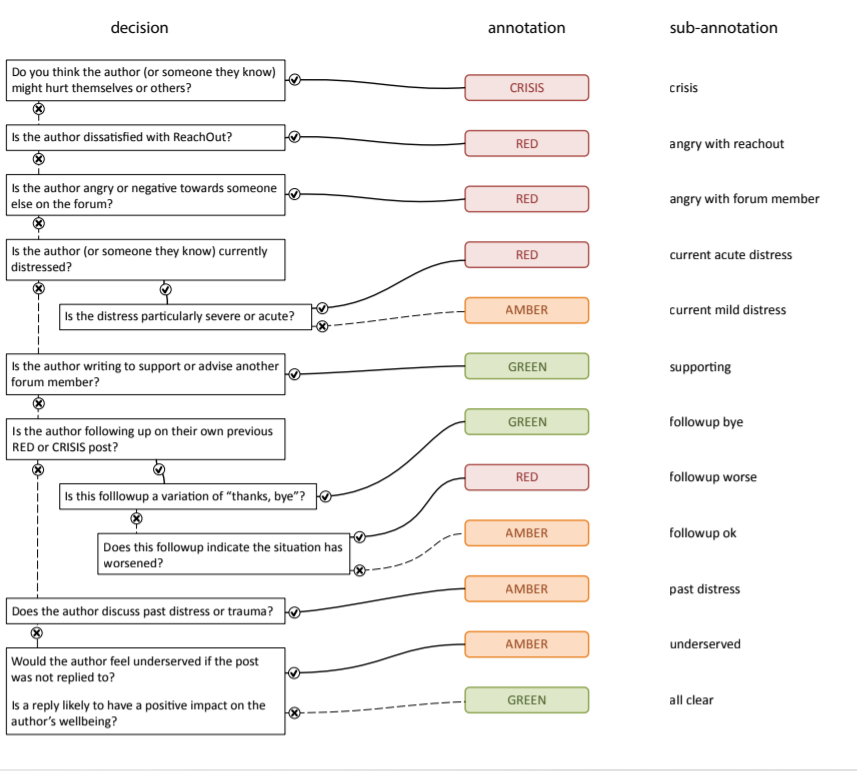
Anxiety through the roof

I'm not coping right now. I keep having freak out episodes. I just want to cry. I just want things to go smoothly. I don't want to get anxious anymore. I'm tired. I feel alone. I've been doing all this stuff to help myself but it is all taking its toll on me. I'm tired. I feel really tired with all of this. I don't want to spiral down that dark path again. I'm really struggling. I don't know what to do. :'(

~65,000 forum posts from 2012-2015

~1,200 posts labeled by panel of experts

- **Crisis** indicates that the author (or someone they know) is in imminent risk of being harmed, or harming themselves or others. Such posts should be prioritized above all others.
- **Red** indicates that a moderator should respond to the post as soon as possible.
- **Amber** indicates that a moderator should address the post at some point, but they need not do so immediately.
- **Green** identifies posts that do not require direct input from a moderator, and can safely be left for the wider community of peers to respond to.



Literature Reviewed

Source Collection:
Proceedings of the Third Workshop on Computational Lingusitics and Clinical Psychology
http://www.aclweb.org/anthology/W/W16/#0300

W16-0312 [bib]: David N. Milne; Glen Pink; Ben Hachey; Rafael A. Calvo
CLPsych 2016 Shared Task: Triaging content in online peer-support forums

W16-0313 [bib]: Sunghwan Mac Kim; Yufei Wang; Stephen Wan; Cecile Paris
Data61-CSIRO systems at the CLPsych 2016 Shared Task

W16-0314 [bib]: Shervin Malmasi; Marcos Zampieri; Mark Dras
Predicting Post Severity in Mental Health Forums

W16-0315 [bib]: Chris Brew
Classifying ReachOut posts with a radial basis function SVM

W16-0316 [bib]: Arman Cohan; Sydney Young; Nazli Goharian
Triaging Mental Health Forum Posts

W16-0317 [bib]: Bart Desmet; Gilles Jacobs; Véronique Hoste
Mental Distress Detection and Triage in Forum Posts: The LT3 CLPsych 2016 Shared Task System

W16-0318 [bib]: Ehsaneddin Asgari; Soroush Nasiriany; Mohammad R.K. Mofrad
Text Analysis and Automatic Triage of Posts in a Mental Health Forum

Literature Reviewed

W16-0319 [bib]: Meir Friedenberg; Hadi Amiri; Hal Daumé III; Philip Resnik
The UMD CLPsych 2016 Shared Task System: Text Representation for Predicting Triage of Forum Posts about Mental Health

W16-0320 [bib]: Juri Opitz
Using Linear Classifiers for the Automatic Triage of Posts in the 2016 CLPsych Shared Task

W16-0321 [bib]: Ayah Zirikly; Varun Kumar; Philip Resnik
The GW/UMD CLPsych 2016 Shared Task System

W16-0322 [bib]: Nicolas Rey-Villamizar; Prasha Shrestha; Thamar Solorio; Farig Sadeque; Steven Bethard; Ted Pedersen
Semi-supervised CLPsych 2016 Shared Task System Submission

W16-0323 [bib]: Chen-Kai Wang; Hong-Jie Dai; Chih-Wei Chen; Jitendra Jonnagaddala; Nai-Wen Chang
Combining Multiple Classifiers Using Global Ranking for ReachOut.com Post Triage

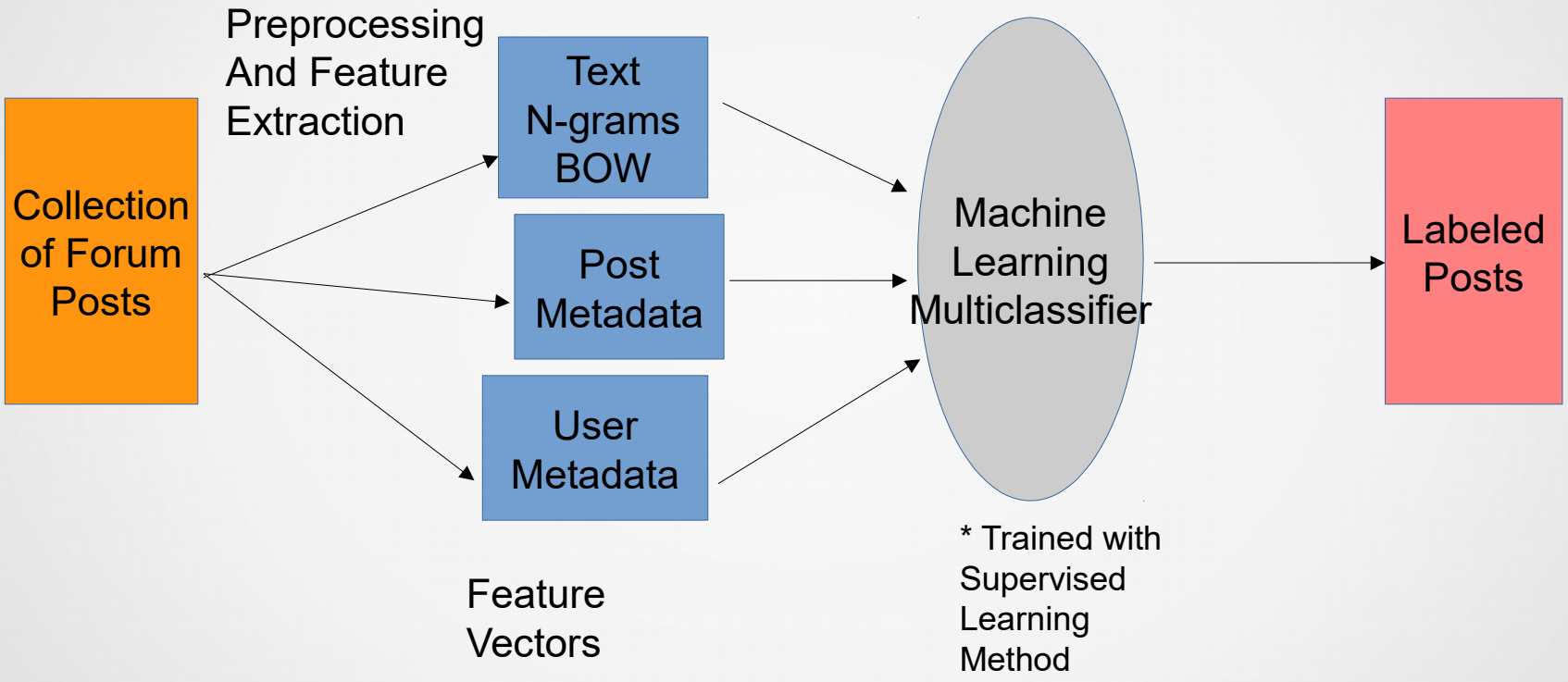
W16-0324 [bib]: Glen Pink; Will Radford; Ben Hachey
Classification of mental health forum posts

W16-0325 [bib]: Hayda Almeida; Marc Queudot; Marie-Jean Meurs
Automatic Triage of Mental Health Online Forum Posts: CLPsych 2016 System Description

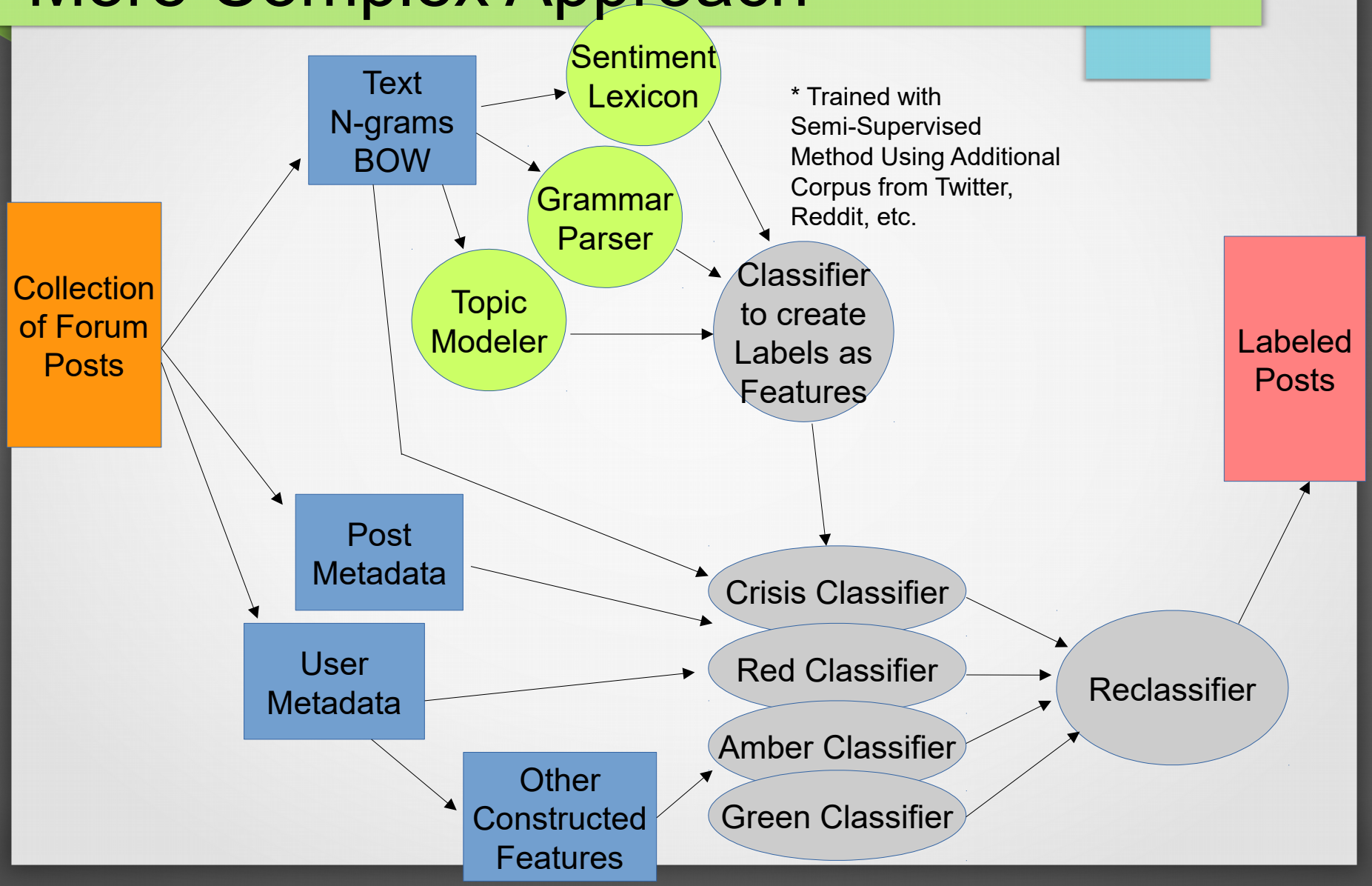
W16-0326 [bib]: Benjamin Shickel; Parisa Rashidi
Automatic Triage of Mental Health Forum Posts

W16-0327 [bib]: Hector-Hugo Franco-Penya; Liliana Mamani Sanchez
Text-based experiments for Predicting mental health emergencies in online web forum posts

Basic Approach



More Complex Approach



Overview of 2016 CLPsych Systems

		Selected or Constructed Features																															
System	**Score**	token unigrams	token bigrams	kudos	author rank and/or affiliation	board	time	Part-of-speech tags	token trigrams	character n-grams	views	negative/positive sentiment	LIWC word categories	topic model	first in thread	skipgrams	grammatical tree structures	replies	thread	thread length	author	LIWC affective attributes	MPQA subjective/objective	DepecheMood emotion	post length	number of emotion words	emotion category cosine similarity	@ mention count	emoticon counts	imperative mood	1st and 2nd person alternation	**Classifier(s)**
Kim et al	0.42	X	Y		Y				Y		Y																		Y			Logistic regression
Malmasi et al	0.42	X	X		X	X		X	X	X						X																Support vector machine
Brew	0.42	X	X	X	X										X																		Support vector machine
Cohan et al	0.41	X	X											X						X		X	X	X									Logistic regression
Desmet et al	0.40	X	X	X	X	X	X		X	X		X	X	X	X															X	X	X	Support vector machine
Opitz	0.37	X	X	Y			Y		X												Y												Support vector machine
Zirikly et al	0.36	X				X	X	X			X	X	X												X	X		X					SVM + Logistic regression
Rey-Villamizar et al	0.34	X	X	X						X			X																				Multinomial Naive Bayes
Pink et al	0.33	X	X																Y														Logistic regression
Asgaria et al	0.32	X		X	X		X				X								X		X												Random forest
Amiri et al	0.31	X	X											X														X					Support vector machine
Wang et al	0.30	X		X	X	X	X				X			Y															X				Support vector machine
Almeidi et al	0.29		X					X				X																					Logistic model tree
Shickel and Rashidi	0.23	X		Y	Y	Y					Y	Y		Y				Y		Y													Linear regression
Franco-Penya and Sanchez	0.13	X	X	Y	Y	Y					Y				Y		X																Linear regression

Example 1

Triaging Content Severity in Online Mental Health Forums*

- Features
- Analysis of Features
- Learning Models

*Cohan et al., Triaging Content Severity in Online Mental Health Forums

Features

- Bag of Words
- Skip Thought Vectors
- Topic Modeling
- Psycholinguistic
  - Linguistic Inquiry and Word Count
  - Emotions
  - Subjectivity
- Contextual
  - Prior posts of the author
  - Prior discussion of the author
  - Last sentence of a post
- Forum Metadata
  - Number of post views
  - Length of the thread
  - Number of likes

*Cohan et al., Triaging Content Severity in Online Mental Health Forums

Features

Bag of Words | word count | vectors
Skip Thought Vectors | relate words with sentence | representation of text

Topic Modeling

Psycholinguistic

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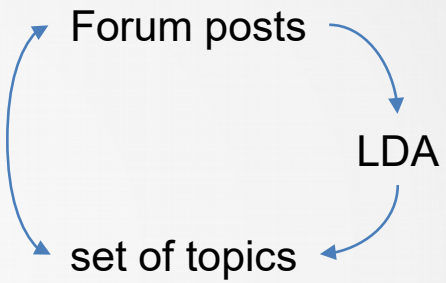

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LIWC
text ------ psychological categories

fear amusement anger annoy
apathy happiness inspiration sadness

subjective posts are more likely
to be a severe post

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Analysis of Features

	Features	Macro average over non-GREEN categories: Accuracy	F1 score	Precision	Recall
Single model	baseline(body)	87.6	34.8	33.5	36.6
	skip thought	87.5	33.5	33.4	34.1
	body+contextual	90.3	38.5	36.5	40.8
	+meta+subjectivity	90.5	38.8	36.5	41.6
	+lexical clues	90.9	40.2	38.3	41.3
	+last sentence	92.3	42.8	43.0	42.8
	+emotion	92.7	44.1	44.6	44.0
	+topic	92.9	45.8	45.5	46.2
	-topic+LIWC	91.8	41.9	41.7	42.6
	+topic	93.9	47.2	48.9	45.8
Ensemble model		94.7	50.5	51.6	49.5

body

skip thought

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contextual

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metadata
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- body
- contextual
- metadata
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- lexical clues
- last sentence
- emotion
- topic modeling

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*Cohan et al., Triaging Content Severity in Online Mental Health Forums

Learning Models

Single model

- Support Vector Machine classifier

Ensemble model

- An ensemble of XGBoost*

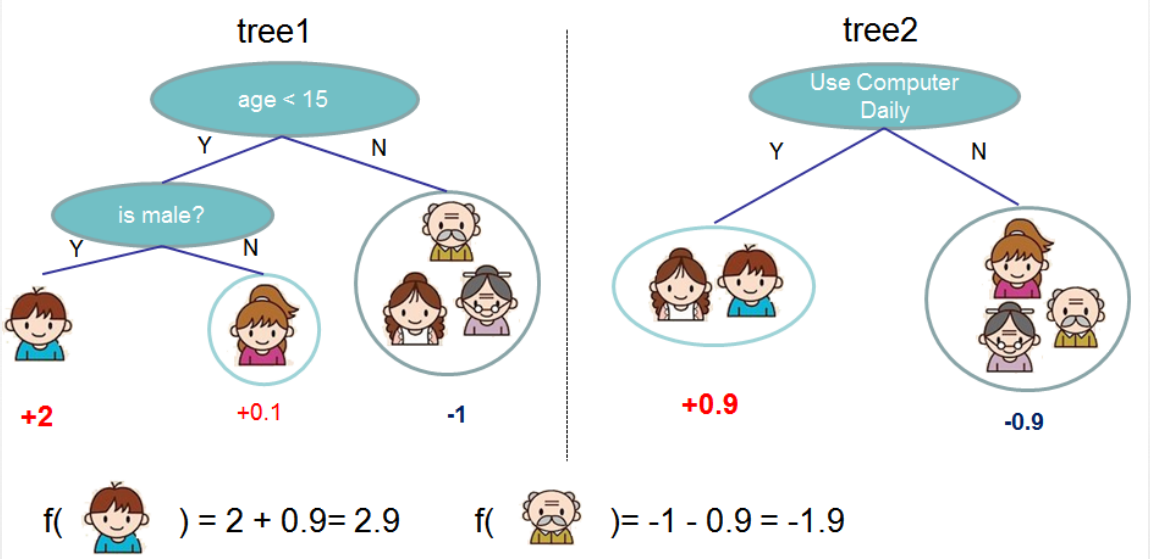
*Cohan et al., Triaging Content Severity in Online Mental Health Forums

Learning Models

Ensemble model

An ensemble of XGBoost*

Boosting system for regression trees



*Chen et al., XGBoost: A Scalable Tree Boosting System

Learning Models

Ensemble model

An ensemble of XGBoost*

	Ensemble model					
Features	XGBoost 1	XGBoost 2	XGBoost 3	XGBoost 4	XGBoost 5	XGBoost 6
body	⊙	⊙	⊙	⊙	⊙	⊙
metadata	⊙					⊙
subjectivity	⊙					
emotion	⊙	⊙		⊙		
contextual		⊙	⊙		⊙	⊙
LIWC		⊙				⊙
last sentence			⊙	⊙		
topic modeling					⊙	
lexical clues						⊙

*Chen et al., XGBoost: A Scalable Tree Boosting System

Example 2

Mental Distress Detection and Triage in Forum Posts:
The LT3 CLPsych 2016 Shared Task System *

- Features
- Learning Models

*Desmet et al., Mental Distress Detection and Triage in Forum Posts: The LT3 CLPsych 2016 Shared Task System

Features

Bag of Words

Term Lists

Domain specific terms
Generated by terminology extraction tool based on mental health boards

LIWC

Topic Modeling

Syntactic Features

Y/N – imperative mood
Y/N – person alternation occurred

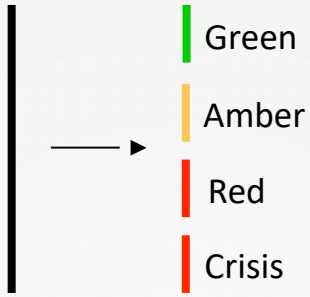
Forum Metadata

- Posted time
- Post position in a thread
- The board the post is in

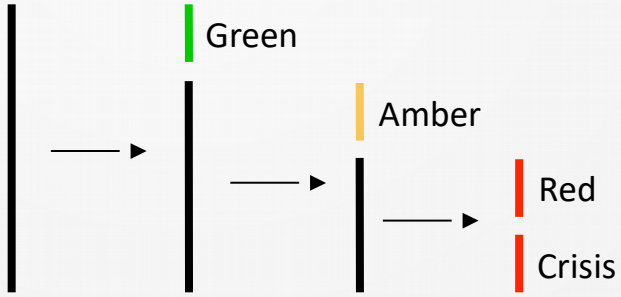
*Desmet et al., Mental Distress Detection and Triage in Forum Posts: The LT3 CLPsych 2016 Shared Task System

Learning Models

Multiclass SVM



Binary SVM



Feature filtering:

- Information Gain
- Bi-Normal Seperation

Ensemble

- Majority vote
- Priority

*Desmet et al., Mental Distress Detection and Triage in Forum Posts: The LT3 CLPsych 2016 Shared Task System

Results

	dev		test	
system	**F**	**accuracy**	**F**	**accuracy**
multiclass-unopt	0.00	0.64	0.00	0.69
multiclass-hyper	0.36	0.75	0.41	0.80
multiclass-nf	0.50	0.75	0.40	0.80
multiclass-ig	0.36	0.74	0.35	0.78
binary-nf	0.39	0.69	0.36	0.74
binary-ig	0.36	0.75	0.32	0.77
binary-bns	0.38	0.64	0.19	0.54
ensemble-majority	0.54	0.79	0.35	0.77
ensemble-priority	0.51	0.75	0.37	0.78

Feature filtering:

-nf: No Feature Filtering
-ig: Information Gain
-bns: Bi-Normal Seperation

*Desmet et al., Mental Distress Detection and Triage in Forum Posts: The LT3 CLPsych 2016 Shared Task System

Existing Shortcoming

train set	Crisis(39)			Red(110)			Amber(249)			Green(549)		
	P	R	F1	P	R	F1	P	R	F1			F1
Run1	33.33	20.53	25.40	52.00	47.27	49.52	68.75	66.27	67.48			85.30
Run2	32.26	25.64	28.57	45.45	50.00	47.62	70.04	63.86	66.81			86.12
Run3	30.30	25.64	27.78	47.06	50.91	48.91	68.78	61.04	64.68			85.60

Results breakdown by category (**training** set)

test set	Crisis(1)			Red(27)			Amber(47)			Green(766)		
	P	R	F1	P	R	F1	P	R	F1			F1
Run1	0	0	0	62.50	55.65	58.82	50.00	63.83	56.07			82.00
Run2	0	0	0	50.00	51.85	50.91	45.45	53.19	49.02			80.00
Run3	0	0	0	59.26	59.26	59.26	58.93	70.21	64.08			81.00

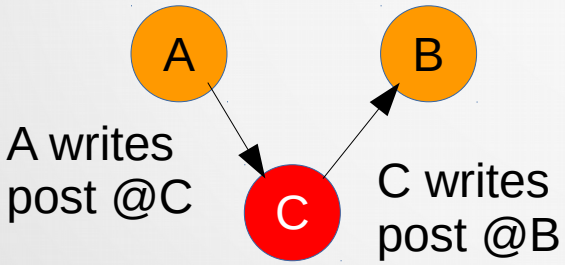
Results breakdown by category (**test** set)

*Cohan et al., Triaging Mental Health Forum Posts

Way Ahead

1) Replicate, combine, and refine top performing systems

2) Experiment with unexplored social link graph idea



C has history
of red/crisis posts