

## Identifying Fine-grained Depression Signs in Social Media Posts

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- Depression sign assessment
  - Psychometric scales, questionnaires
  - Limited in terms of reach
- NLP + social media content

- NLP approaches
  - Binary classification task
  - assessment tools symptom sets (PHQ-9)

- Corpus annotated with a finer-grained set of 21 signs of depression
  - 18 symptoms
  - 3 additional categories

- Research questions
  - Which signs of depression are more frequent in online text?
  - Which of these signs are adequately identified by ML techniques typically seen in the literature?

## Data collection

- Brazilian university students
- Facebook posts
- Anonymous pages for venting feelings
- 780 posts selected for annotation

## Label Schema

- Specialist Committee
- Collective analysis of post samples
- Clinical experience with student population

## Label Schema - Symptoms

- Sleep Disorder
- Alteration in Efficiency/Functionality
- Helplessness/Social Harm/Loneliness
- Worry/Fear/Anxiety
- Despair
- Feeling of worthlessness/Low self-esteem



## Label Schema - Symptoms

- Irritation/Aggressiveness
- Physical symptom
- Feeling of guilt
- Difficulty in decision making
- Tiredness/Discouragement/Fatigue
- Attention/Memory deficit

## Label Schema - Symptoms

- Feeling of emptiness
- Alteration in weight/eating habits
- Loss/Diminishment of pleasure/libido
- Sadness/Depressed mood
- Suicide/Self-extermination
- Agitation/Restlessness

## Label Schema – External Factors

- Risk Factors
- Protective Factors
- Death/suicide of third party

## Annotation

- 4 annotators
- Annotators were free to label any span as pertaining to one or more signs
- Special Category: PDP

<b>Sign</b>	<b>Train</b>	<b>Test</b>
Agitation/Restlessness	5	0
Attention/memory deficit	9	4
Alteration in weight/eating habits	10	5
Loss/Diminishment of pleasure/libido	15	2
Physical symptom	16	8
Difficulty in decision making	22	4
Sleep disorder	17	10
Feeling of emptiness	28	6
Death/suicide of third party	37	10
Feeling of guilt	34	14
Irritation/Aggressiveness	50	38
Tiredness/Discouragement/Fatigue	81	25
Despair	85	27
Alteration in efficiency/functionality	85	28
Worry/Fear/Anxiety	111	29
Protective factor	115	52
Feeling of worthlessness/Low self-esteem	126	42
Suicide/Self-extirmination	218	26
Helplessness/Social harm/Loneliness	220	63
Risk factor	177	109
Sadness/Depressed mood	278	63
Neutral	593	89
Overall	2152	523

Table 1: Number of positive instances for each sign

Sign	Type
<b>Less than 100 train instances</b>	
Agitation/Restlessness	Behavioral
Attention/memory deficit	Behavioral
Alteration in weight/eating habits	Somatic
Loss/Diminishment of pleasure/libido	Behavioral
Physical symptom	Somatic
Difficulty in decision making	Behavioral
Sleep disorder	Somatic
Feeling of emptiness	Emotional
Death/suicide of third party	External
Feeling of guilt	Emotional
Irritation/Aggressiveness	Emotional
<b>Between 100 and 200 train instances</b>	
Tiredness/Discouragement/Fatigue	Behavioral
Despair	Emotional
Alteration in efficiency/functionality	Behavioral
Worry/Fear/Anxiety	Emotional
Protective factor	External
Feeling of worthlessness/Low self-esteem	Emotional
<b>More than 200 train instances</b>	
Suicide/Self-extirmination	Behavioral
Helplessness/Social harm/Loneliness	Emotional
Risk factor	External
Sadness/Depressed mood	Emotional

Table 2: Mapping of depression related signs to a simplified taxonomy

- Experimental Setup
  - Feature engineering approach
  - Pre-trained embeddings
  - Fine-tuned BERT models

Sign	Model	Average precision
Feeling of emptiness	XGBoost (word2vec)	0.248
Irritation/Aggressiveness	SVC (word2vec)	0.284
Alteration in efficiency/functionality	SVC (word2vec)	0.348
Despair	BERTimbau	0.379
Feeling of guilt	BERTimbau	0.387
Difficulty in decision making	RandomForest (engineered)	0.391
Feeling of worthlessness/Low self-esteem	XGBoost (word2vec)	0.391
Risk factor	BERTimbau	0.465
Tiredness/Discouragement/Fatigue	BERTimbau	0.483
Death/suicide of third party	BERTimbau	0.538
Loss/Diminishment of pleasure/libido	BERTimbau	0.540
Protective Factor	SVC (word2vec)	0.548
Helplessness/Social harm/Loneliness	MentalRoberta	0.614
Attention/memory deficit	XGBoost (word2vec)	0.645
Alteration in weight/eating habits	SVC (word2vec)	0.683
Physical symptom	BERTimbau	<b>0.700</b>
Suicide/Self-extirmination	MentalRoBERTa	<b>0.712</b>
Sadness/Depressed mood	BERTimbau	<b>0.745</b>
Worry/Fear/Anxiety	MentalBERT	<b>0.794</b>
Sleep disorder	LogisticRegression (engineered)	<b>0.900</b>

Table 5: Average precision scores for each sign. Models which achieved more than 0.7 average precision score are in bold.



<b>Sign</b>	<b>Average precision score</b>
Somatic	76.14% $\pm$ 12.08%
Behavioral	52.01% $\pm$ 14.18%
External	51.73% $\pm$ 4.50%
Emotional	48.07% $\pm$ 20.90%

Table 3: Macro average precision scores for each type of sign

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With each day that passes my world gets darker,  
and I can't see the future!

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Why do I talk about myself in the past? I'm still here,  
aren't I? Wasn't university supposed to be a den of  
knowledge? Why do I feel its a tomb swallowing me  
whole?

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If I had a mission here, I'm failing it

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Life is horrible by itself

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Nothing bears fruit for me

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Knowing I'll need months of therapy to get over this  
is horrible, I'm already torn apart now, imagine in  
the future...

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Table 4: Examples for the "Despair" sign instances.  
Note the use of figurative language and the varied  
ways users can broach the subject.

- RQ 1: Which signs of depression are more frequent in online text?
  - External factors and emotions
  - Some behavioral signs (Suicide, Alterations in functionality, Tiredness/Discouragment/Fatigue)

- RQ 2: Which of these signs are adequately identified by ML techniques typically seen in the literature?
  - Somatic signs, Sadness, Suicidal ideation and Anxiety
  - Models struggle with frequent signs
  - Domain specific models

Thanks!