The Detoxifiers

Empower Fruitful Discussions

Ksenia Gerasimovich, Daniel Guhr,
Katharina Neumüller & Kristin Stöcker

The Detoxifiers

Dr. Daniel Guhr
Physicist
Data Scientist

My Background

PhD Physics, Univ. of Constance
System Engineer
Project manager

Looking for projects (freelancer) as

- **Data Scientist**
- **Data Analyst**

remote

The Detoxifiers

Ksenia Gerasimovich
Data Scientist
Consultant

My Background

Business Informatics B.Sc.
Finance MBA
Business analyst
Consultant: ERP, BI implementation

Looking for a job as

- **Data Scientist**
- **Data Analyst**

in Düsseldorf oder remote

The Detoxifiers

Katharina Neumüller
Data Scientist

My Background

Computational Linguistics B.Sc.
Web-Development
Project Management

Looking for a position as

- **Data Scientist**
- **Data Analyst**

in Cologne or remote

The Detoxifiers

Kristin Stöcker
Linguist
Data Scientist

My Background

M.A. Linguistics
Research Assistant at FU Berlin

Looking for a job as

- **Data Scientist**
- **Data Analyst**
- **Data Engineer**

in NLP

in Berlin or remote

Attention

Trigger Warning

This presentation contains examples of profane, vulgar or offensive language that is likely to upset readers!

The
Background

The perks of online communication

free speech/ anonymity

exchange of opinions

independent of time and location

The price of online communication

41% of US adults experienced online harassment*

30% of affected users stopped using an online service*

27% of witnesses refrained from posting online*

*Pew Research Center: The State of Harassment, 2021

Consequences for website operators

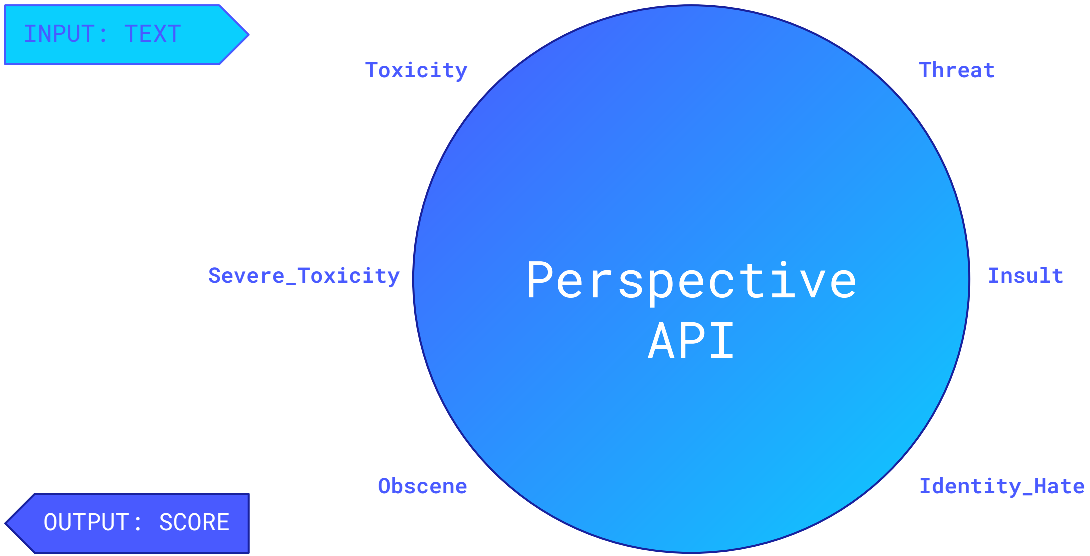
- content moderation presents enormous financial burden
- result: disabled comment sections
- New York Times: only 10% of articles allowed comments (before 2016)
- How can AI help to counter this problem?

JIGSAW Conversation.ai

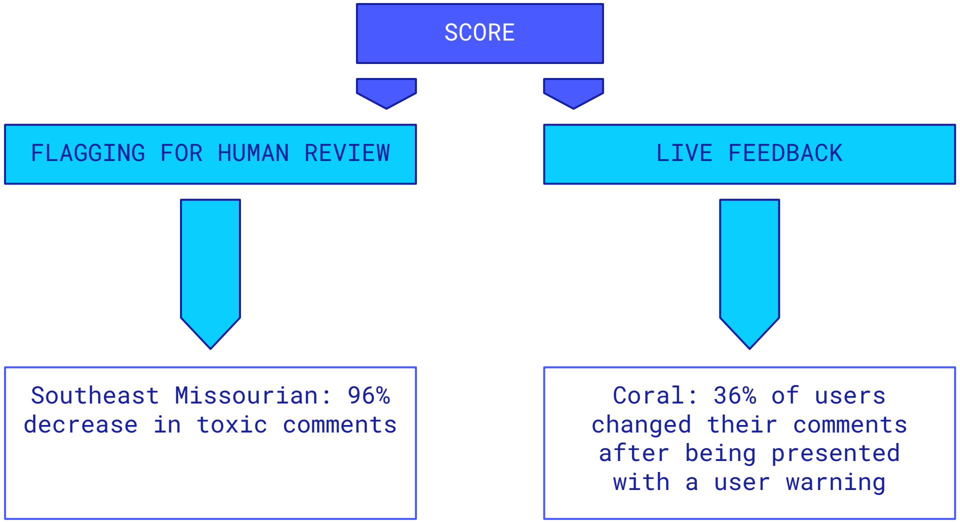
Application of Perspective API in online communication

"Shut up.
You're an idiot!"

Toxicity	0.99
Severe_Toxicity	0.81
Obscene	0.20
Threat	0.09
Insult	0.97
Identity_Hate	0.02



One API,
many applications



Toxic Comment Classification Challenge

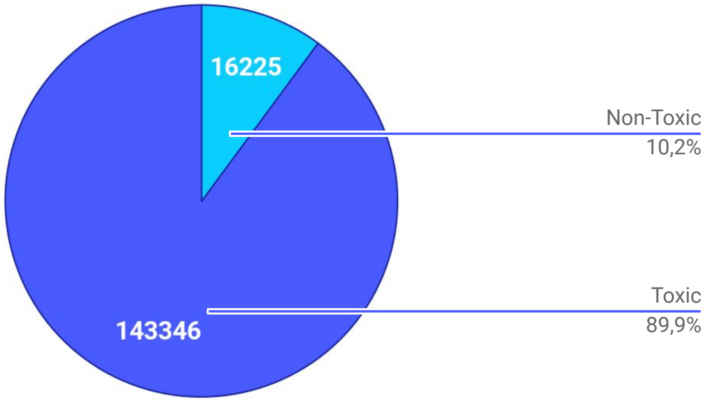
- goal: multi-headed model capable of detecting different types of toxicity like threats, obscenity, insults, and identity-based hate
- dataset of 160.000 comments from Wikipedia's talk page edits
- train data labelled by humans

The Data


Toxic
Severe Toxic
Obscene
Threat
Insult
Identity Hate

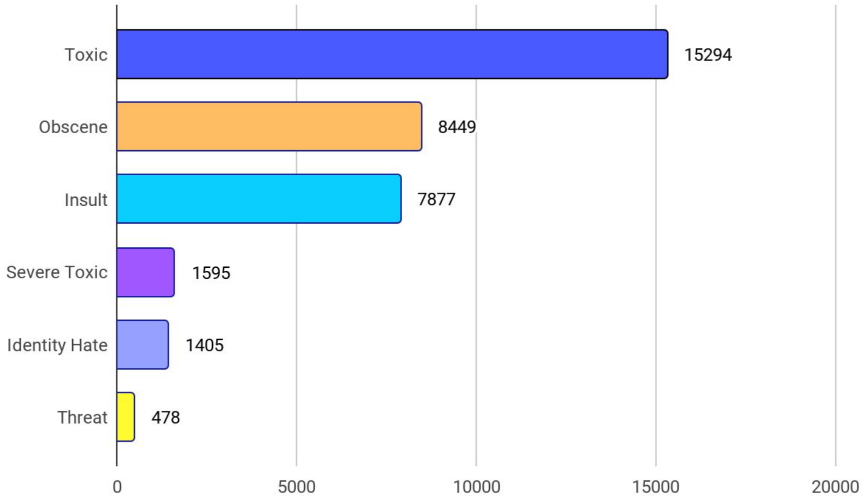
Data

Toxicity Distribution

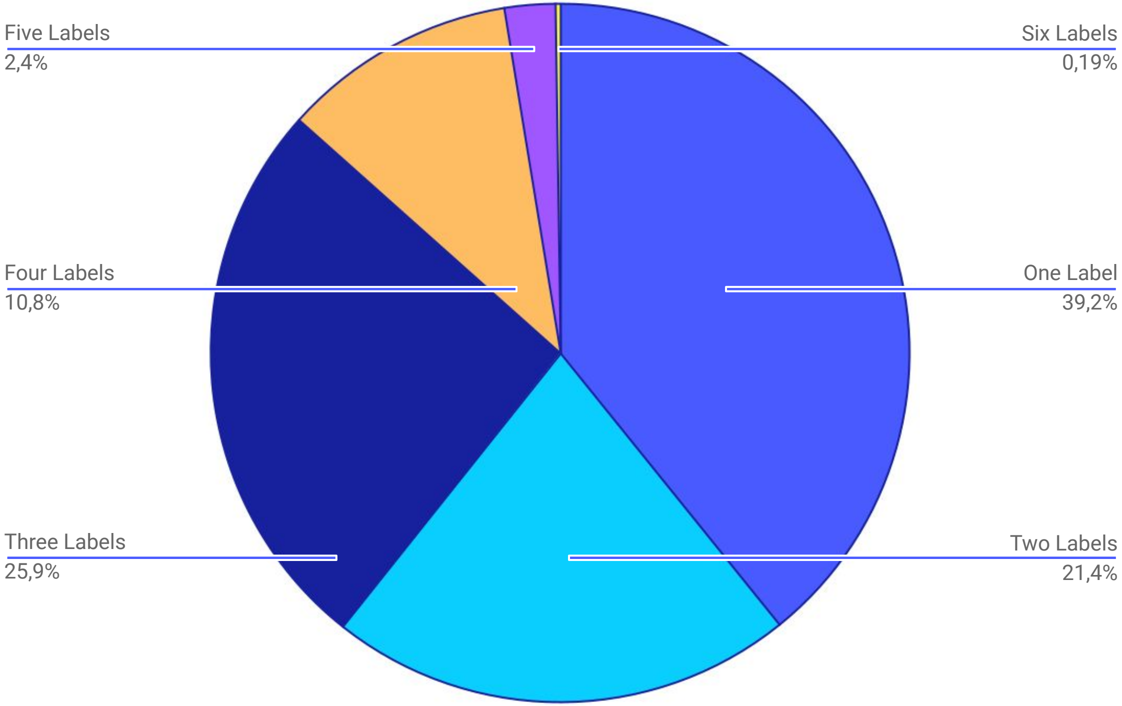


Dataset of 159571 Samples

Category Counts

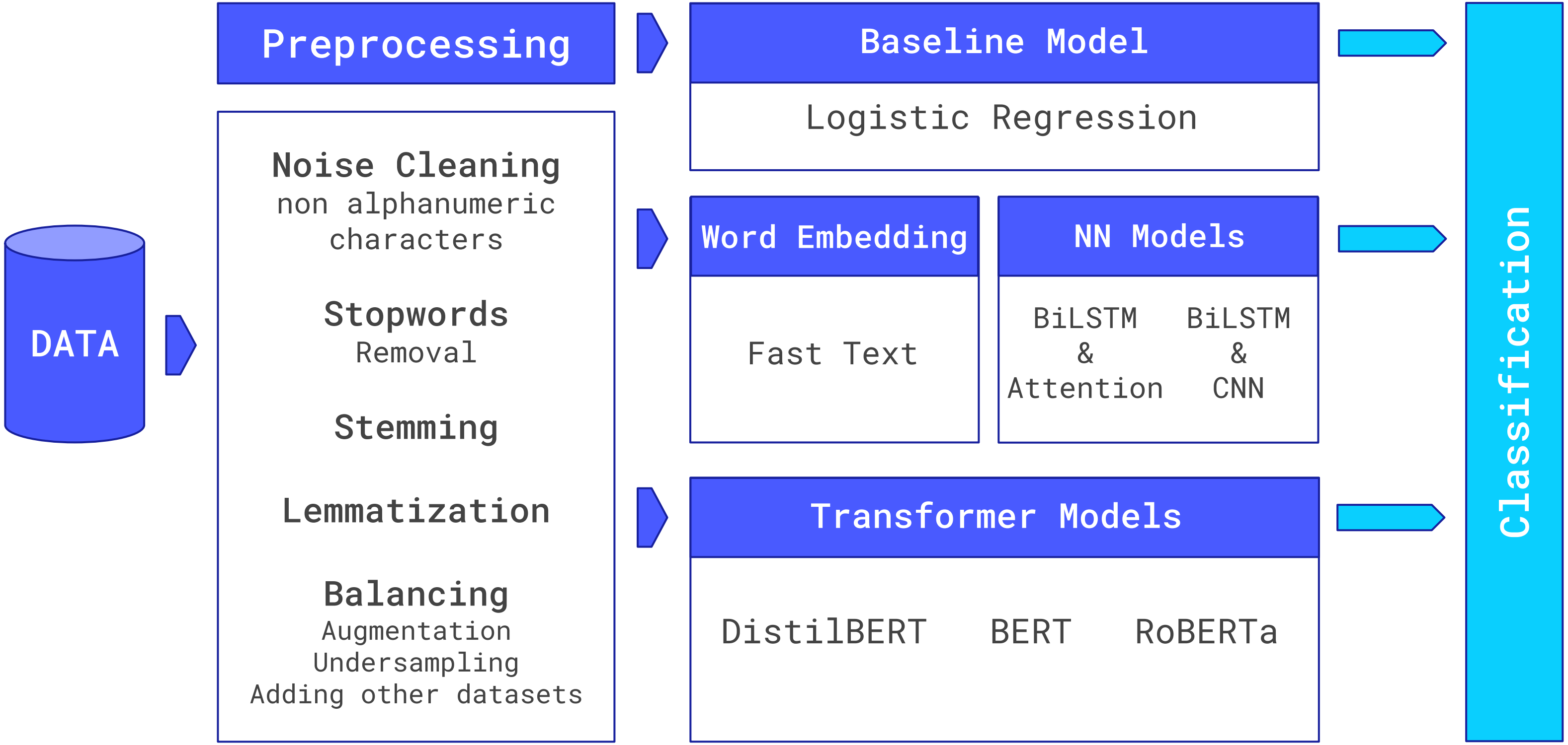


Comments with multiple labels



Approach & Results

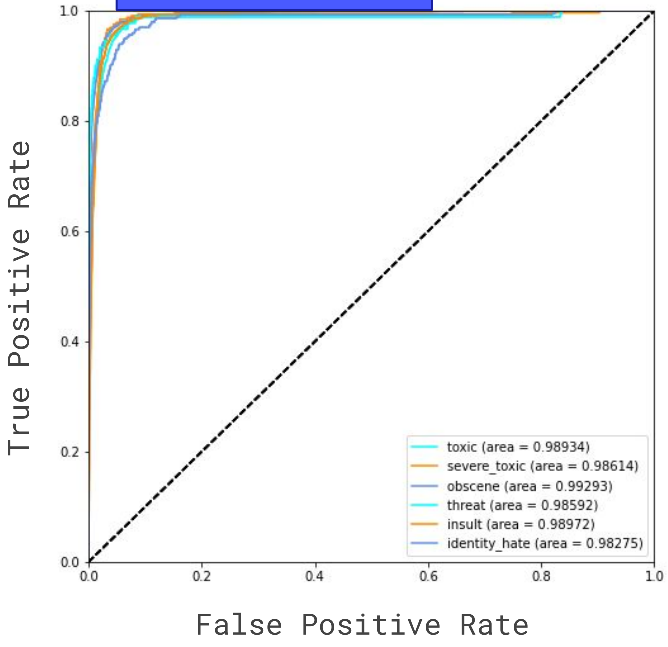
A Modular Approach



RoBERTa Classification Results

labels	precision	recall	f1-score	support
toxic	0.94	0.90	0.92	3102
severe_toxic	0.60	0.45	**0.51**	**345**
obscene	0.86	0.91	0.88	1772
threat	0.64	0.69	**0.66**	**102**
insult	0.78	0.88	0.83	1613
identity_hate	0.65	0.72	**0.69**	**277**
micro avg	0.85	0.87	0.86	7211
macro avg	0.75	0.76	**0.75**	7211

ROC AUC



mean column-wise ROC AUC		
	train	0.98780
	test	**0.98482**

Error Analysis

Contextual Issues

"I'm glad you have gone do not come back"

Category	True	Predicted
toxic	1	0
severe_toxic	0	0
obscene	0	0
threat	0	0
insult	0	0
identity_hate	0	0

Context Awareness

PROBLEM Lack of context in training samples

SOLUTION Additional labeling of comments with frequent word repetitions and retraining

Subjectivity in labelling

"And I know I am a dickhead"

Category	True	Predicted
toxic	1	1
severe_toxic	0	0
obscene	1	1
threat	0	0
insult	1	0
identity_hate	0	0

Label Assignment Error

PROBLEM Correct model predictions

SOLUTION Pseudolabelling

Lack of profanity and context to train the model

"islams you motha fers"

Category	True	Predicted
toxic	1	1
severe_toxic	1	0
obscene	1	0
threat	0	0
insult	1	1
identity_hate	0	1

Context Awareness: Insults on political and religious grounds

PROBLEM Context awareness exists, but in insufficient volume

SOLUTION More samples for training

Outlook

- Try out other Transformers - XLNet
- More training data (from other sources like Twitter)
- Further fine-tuning
- Ensemble models
- Out-Of-Vocabulary Words
  - Training own embeddings

Thank you

Questions, comments and discussions are welcome.

Back up

Error analysis: Possible solution approaches

Contextual issues:

-> Additional labeling of comments with frequent word repetitions and retraining

Subjectivity in the case of labelling:

-> Pseudolabelling

OOV words (Lack of profanity and context to train the model):

-> Training own embeddings

-> TODO Add this point to outlook

Error Analysis

Lack of profanity and context to train the model

Vs

Comment		toxic	severe_toxic	obscene	threat	insult	identity_hate	
islams you mutha fers	True labels	1	1	1	0	1	0	Context awareness: insults on political and religious grounds
	Predicted labels	1	0	0	0	1	1	Context awareness exists, but in insufficient volume

Error Analysis

Contextual issues

Vs

		toxic	severe_toxic	obscene	threat	insult	identity_hate	
im glad you have gone do not come back	True labels	1	0	0	0	0	0	Context awareness
	Predicted labels	0	0	0	0	0	0	Lack of train context data

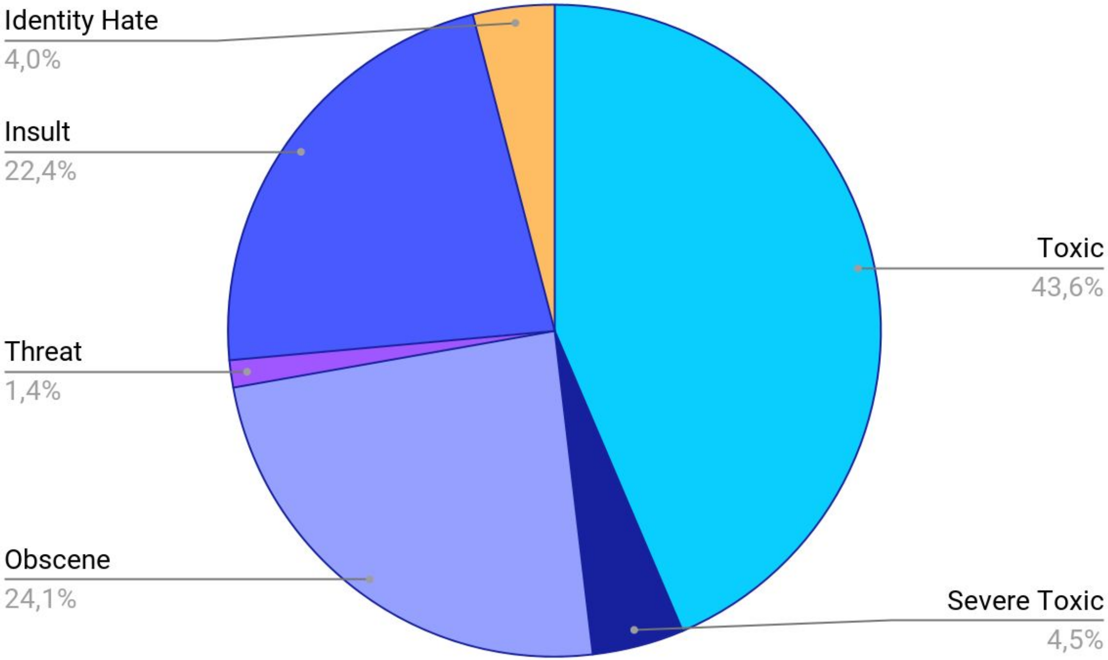
Error Analysis

Subjectivity in the case of labelling

		toxic	severe_toxic	obscene	threat	insult	identity_hate
and i know i am a dickhead	True labels	1	0	1	0	1	0
	Predicted labels	1	0	1	0	0	0

Label assignment error
Correct model predictions

Category Count - Pie Chart



Benchmark models

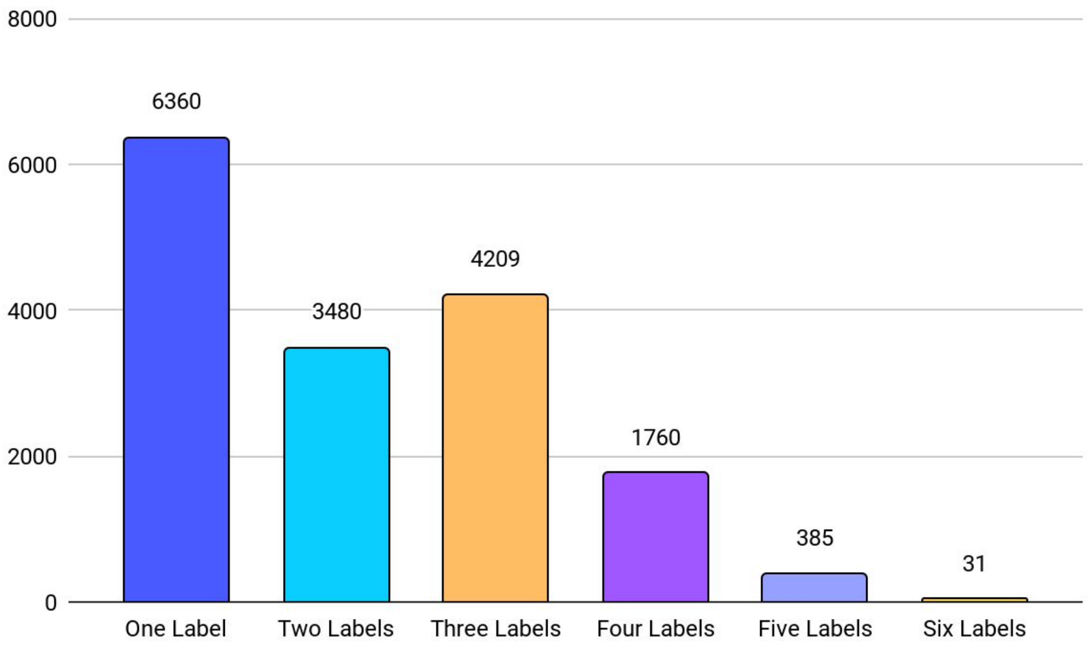
1st	.9885	RNN (BiGru)	☑ Diverse pre-trained embeddings
			☑ train and test-time augmentation (TTA) using translations to other language
			☐ Train on translation
			☑ Pseudolabelling
			☑ Enssembling
			    ☑ Averaging
			    ☑ Stacking
			☐ Feature engineering
			☐ Training own embeddings for OOV words
			-- 	

link

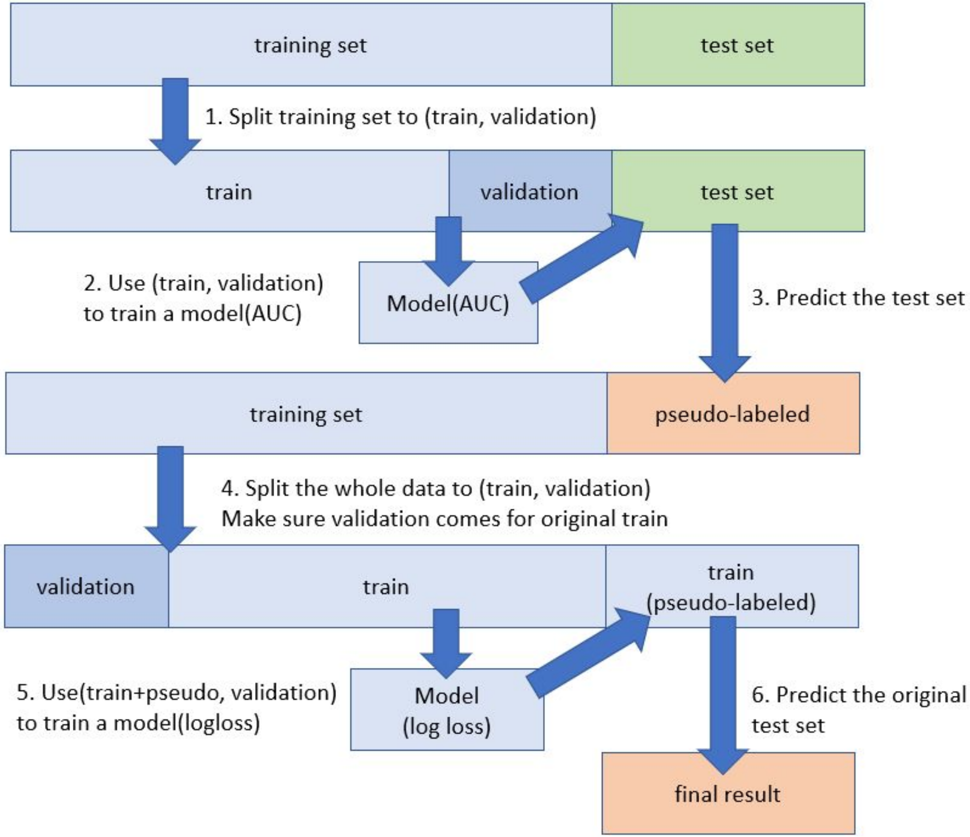
neongen
2nd place
	.9882	RNN, DPCNN and GBM	☑ Diverse pre-trained embeddings
			☑ train and test-time augmentation (TTA) using translations to other language
			☑ Train on translation
			☐ Pseudolabelling
			☑ Enssembling
			    ☑ Averaging
			    ☐ Stacking

https://www.youtube.com/watch?v=_-VeZU4JyBo

Comments with multiple labels - Bar Chart



Pseudolabelling



https://www.kaggle.com/c/jigsaw-toxic-comment-classification-challenge/discussion/52557

the perks of online communication

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anonymity

exchange
of opinions

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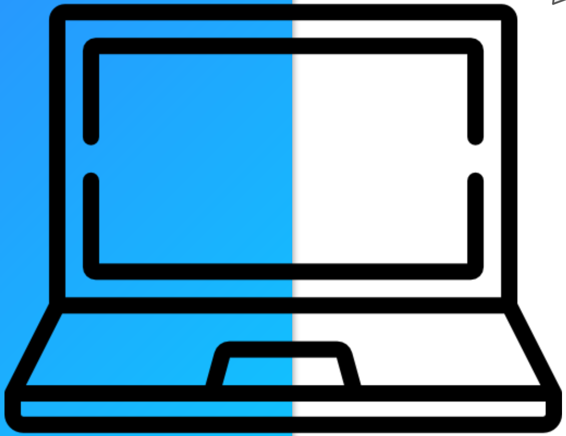
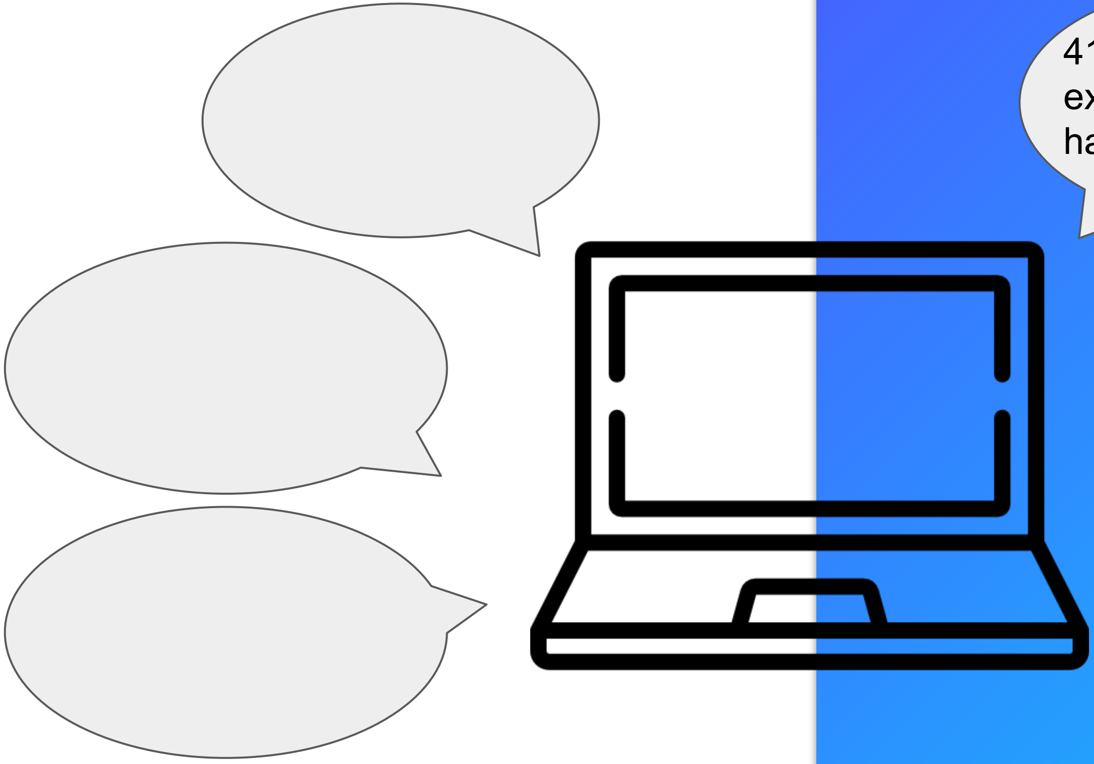


the price of online communication



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