SM-FEEL-BG - The First Bulgarian Datasets and Classifiers for Detecting Feelings, Emotions, and Sentiments of Bulgarian Social Media Texts

Presenter: **Irina Temnikova, PhD**

SOFIA UNIVERSITY
St. KLIMENT OHRIDSKI

GATE
big data for smart society

Presenter

Irina Temnikova,

GATE R2, Exper. researcher,

Computational linguist

Contributors at various stages:

Irina Temnikova, GATE R2, Exper. researcher

Iva Marinova Chief Data Scientist at Identrics

Silvia Gargova GATE R1, Junior researcher
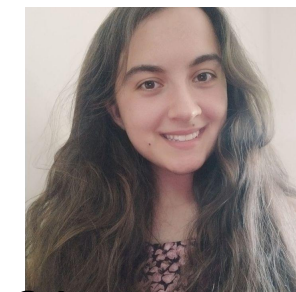
Ruslana Margova GATE R1, Junior researcher

Alexander Komarov GATE intern, 3rd year student in Computer Science, Sof. Univ.

Stefan Minkov GATE intern, 2nd year student in Computer Science and Engineering, Ghent University.
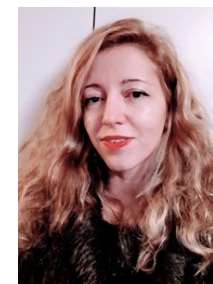
Dimana Vyatrova Past GATE intern, 4th year student in Computer Science, Sofia University

Veneta Kireva, Past GATE intern, 2nd year student in Computer Science, Sof. Univ.

Tsvetelina Stefanova, GATE intern, 3rd year student in Bulgar. Linguistics, Sofia Univer., and Comp.Sc., Univ. of Rousse

Nevena Grigorova GATE, M.A, Computational Linguistics, Bulgarian Linguistics, Sofia University

Yordan Mandevski, GATE intern, 2nd year student in Data Analytics, Sof. Univ.

GATE
big data for smart society

Motivations 1 (of 4):

- **Detecting emotions/feelings in texts – useful for:**

  - Detecting deception

  (sentiment analysis is not enough as precise emotions/feelings are necessary)

  - Various psychology tasks

Motivations 2 (of 4):

Problem:

No existing models/datasets for detecting emotions/feelings of texts in Bulgarian

… but there are sentiment analysis models/datasets for Bulgarian

Problems:

- The language of social media texts is specific
- There are no publicly accessible sentiment analysis datasets of <u>social media texts</u> nor models for Bulgarian

SOFIA UNIVERSITY
St. KLIMENT OHRIDSKI

GATE
big data for smart society

Motivations 3 (of 4):

Problem:

Manual annotations of emotions take time, and effort, and have high disagreement between annotators

Possible solution: use Machine Translation (MT) to translate automatically datasets in other languages into Bulgarian

BUT Problem: Using machine Translation (MT) would lose the language/culture-related specificities of emotions/feelings

SOFIA UNIVERSITY
ST. KLIMENT OHRIDSKI

GATE
big data for smart society

Motivations 4 (of 4):

Problem:

The most used social media platform in Bulgaria is Facebook

BUT Facebook texts cannot be publicly shared

SOFIA UNIVERSITY
St. KLIMENT OHRIDSKI

GATE
big data for smart society

Our Solutions:

We present a new SM-FEEL-BG Package, containing publicly accessible:

   1) **Datasets with social media texts from Twitter and Telegram** with two sets of labels:
       1.1.) For 21 emotions/feelings
       1.2.) For sentiments (positive, neutral, negative)
   2) **Emotion detection and sentiment analysis models**
       2.1.) Trained on Facebook, Twitter, Telegram texts
       2.2.) Trained Only on Twitter and Telegram texts (no Facebook)

Our Solutions:

We present a new SM-FEEL-BG Package, containing publicly accessible:

   1) **Datasets with social media texts from Twitter and Telegram** with two sets of labels:
      1.1.) For 21 emotions/feelings
      1.2.) For sentiments (positive, neutral, negative)
  2) **Emotion detection and sentiment analysis models**
      2.1.) Trained on Facebook, Twitter, Telegram texts
      2.2.) Trained Only on Twitter and Telegram texts (no Facebook)
  3) **Guidelines for manual annotation** of emotions/feelings in social media texts in Bulgarian language

More details:

Datasets used for training the models (part of which publicly accessible)

Source	Publicly accessible?	Emotions/Feelings.. Sentiments?	Manual processing?	Number of Texts
EMO-SM-BG2022				
Facebook	**No**	● Manually annotated emotions/feelings ● Autom. merged into 3 sentiments	manual annotation of emotions/feelings	2250
Twitter	**Yes (tweet IDs)**			2250
Telegram	**Yes (texts)**			500
EMO-SM-BG2023				
Twitter	**Yes (tweet IDs)**	● Manually annotated emotions/feelings ● Autom. merged into 3 sentiments	manual annotation of emotions/feelings	1000
ChatGPT-generated				
ChatGPT	**Yes (texts)**	● Autom. generated emotions/feelings ● Autom. merged into 3 sentiments	manual filtering of emotions/feelings	310

GATE
big data for smart society

Manual annotation of datasets with feelings/emotions

Annotation of emotions/feelings

- Guidelines in Bulgarian/translated into English:

- 20 emotions/feelings + "Other"
	- the 6 basic ones of Ekman
	- some from Plutchik
	- merging into larger categories

- Primary and Secondary emotions + Comments

○ Neutral (without emotion)   ○ Positive: Satisfaction/Approval   ○ Positive: Happiness/Joy   ○ Positive: Wishes/Greetings
○ Positive: Appreciation/Gratitude   ○ Positive: Hope   ○ Positive: Offering help/support   ○ Positive: Sympathy/Compassion
○ Positive: Joke   ○ Sarcasm/Irony: Rather negative   ○ Negative: Distrust   ○ Negative: Disapproval   ○ Negative: Regret
○ Negative: Sadness/Sorrow   ○ Negative: Fear/Anxiety   ○ Negative: Suffering/Pain   ○ Negative: Anger/Outrage/Disgust/Hate
○ Call for Action/Request/Call for Help   ○ Warning/Informing/Notice   ○ Surprise   ○ Other

Annotation tool
Sheffield's GATE Teamware:
https://gate.ac.uk/teamware/

Annotate: Emotions in social media posts

Annotator guideline
Whose is the emotion in the post/text?

Each post can contain:

+ Show

Annotate a document

#1 ✔ 2 ✏ 2

Post:

Честит рожден ден скъпи приятелю! 😊 🎉 #ЧРД

Primary emotion

Please, select the primary emotion of the post.

○ Neutral (without emotion) ○ Positive: Satisfaction/Approval ○ Positive: Happiness/Joy ○ Positive: Wishes/Greetings
○ Positive: Appreciation/Gratitude ○ Positive: Hope ○ Positive: Offering help/support ○ Positive: Sympathy/Compassion
○ Positive: Joke ○ Sarcasm/Irony: Rather negative ○ Negative: Distrust ○ Negative: Disapproval ○ Negative: Regret
○ Negative: Sadness/Sorrow ○ Negative: Fear/Anxiety ○ Negative: Suffering/Pain ○ Negative: Anger/Outrage/Disgust/Hate
○ Call for Action/Request/Call for Help ○ Warning/Informing/Notice ○ Surprise ○ Other

Comment for primary emotion:

Secondary emotion

Please, select the secondary emotion of the post.

○ Neutral (without emotion) ○ Positive: Satisfaction/Approval ○ Positive: Happiness/Joy ○ Positive: Wishes/Greetings
○ Positive: Appreciation/Gratitude ○ Positive: Hope ○ Positive: Offering help/support ○ Positive: Sympathy/Compassion
○ Positive: Joke ○ Sarcasm/Irony: Rather negative ○ Negative: Distrust ○ Negative: Disapproval ○ Negative: Regret
○ Negative: Sadness/Sorrow ○ Negative: Fear/Anxiety ○ Negative: Suffering/Pain ○ Negative: Anger/Outrage/Disgust/Hate
○ Call for Action/Request/Call for Help ○ Warning/Informing/Notice ○ Surprise ○ Other

Comment for secondary emotion:

Submit Clear Reject document

Annotation of emotions/feelings

Annotation procedure for EMO-SM-BG2022:

- *5 annotators (native speakers of Bulgarian),*
- *3 annotators per text, random assignment*
- *3 smaller batches (~110 texts) with all 20 emotions, followed with discussion lead by the most experienced annotator*
- *.. annotation of the 2794 remaining texts*

SOFIA UNIVERSITY
St. KLIMENT OHRIDSKI

GATE
big data for smart society

Emotions/Feelings Inter-Annotator Agreement (IAA) for EMO-SM-BG2022:

Dataset		Annotators	Posts	Fleiss' Kappa			Simpl.Per.Agr.	
				Kappa	z	p-value	Posts	%-agree
Emo-SM-BG2022	Primary Emot.	3	5000	**0.317**	122.768	0	5000	**20.5**
	Second. Emot.	3	1579	-0.136	-19.975	0	25	12.0
Facebook	Primary Emot.	3	2250	0.348	89.667	0	2250	24.04
	Second. Emot.	3	726	-0.142	-13.515	0	10	10.0
Telegram	Primary Emot.	3	500	0.272	32.737	0	500	17.8
	Second. Emot.	3	262	-0.112	-6.96	0	8	0.0
Twitter	Primary Emot.	3	2250	0.276	69.5	0	2250	17.56
	Second. Emot.	3	591	-0.153	-13.498	0	7	28.57

GATE
big data for smart society

Annotation of emotions/feelings

<u>Improved Annotation procedure for EMO–SM–BG2023:</u>

- *5 annotators (4 native and 1 advanced speakers of Bulgarian),*
- *5 annotators per text*
- *4 smaller batches (100,100,200,200 texts),*
- *followed with a discussion lead by a reviewer (the most experienced annotator of EMO-SM-BG2022)*
  - *only on texts with 2 agreed annotators or all different annotations of the primary emotion*
- *.. annotation of the 400 remaining texts*

SOFIA UNIVERSITY
St. KLIMENT OHRIDSKI

GATE
big data for smart society

Improved Emotions/Feelings Inter-Annotator Agreement for EMO-SM-BG2023:

| Dataset | | Annotators | Posts | Fleiss' Kappa | | p-value | Simpl.Per.Agr. | |
				Kappa	z		Posts	%-agree
Emo-SM-BG2023	Primary Emot.	5	1000	**0.469**	139.981	0	985	**25.482**
	Second. Emot.	5	85	0.306	24.489	0	85	10.588
	Both Emotions	5	1000	0.306	136.844	0	985	11.878

GATE
big data for smart society

Annotation of emotions/feelings

EMO-SM-BG2023 Annotation Results:

- *Increase in the IAA percentage:*
  - *Batches 1-3: 3+ annotators agreed on Primary emotion in 73% texts*
  - *Batch 4: 77.5%*
  - *Batch 5: 81.75%*
  - *Overall IAA %: 77.3%*

SOFIA UNIVERSITY
St. KLIMENT OHRIDSKI

GATE
big data for smart society

Annotation of emotions/feelings

Qualitative observations

- *Concrete annotator's mood change in different days*
- *Annotators were influenced by*
  - *personal experiences*
  - *own interpretation*
  - *cultural/age specificities*

- *Frequent disagreement on which is the Primary and which is the Secondary emotion (but the same unordered set)*

SOFIA UNIVERSITY
St. KLIMENT OHRIDSKI

GATE
big data for smart society

Machine Learning (ML) Classifiers

Fine-tuned
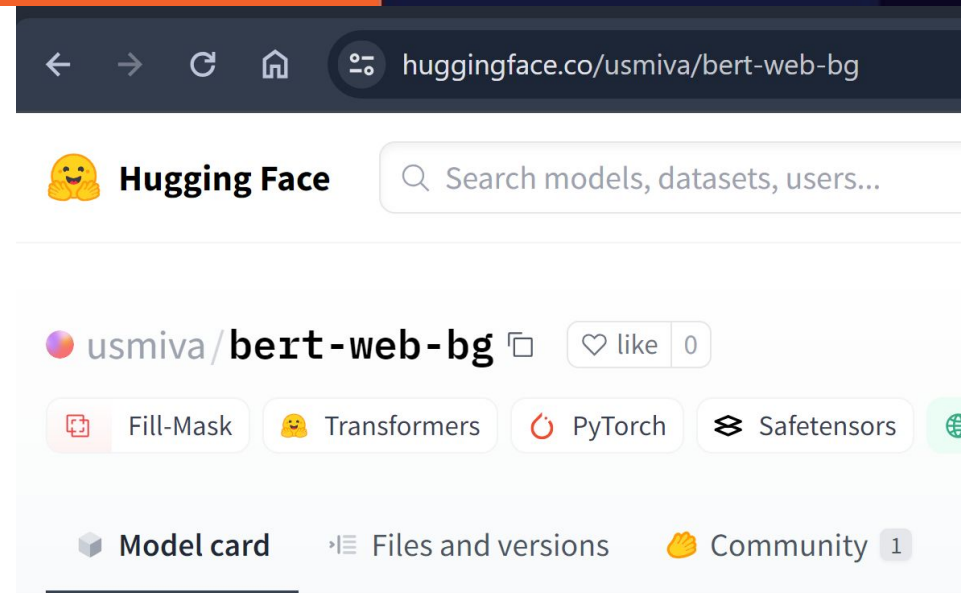
Social media platforms	Categories	
	Emotions/Feelings	Sentiments
With Facebook	✓	✓
Without Facebook	✓	✓

GATE
big data for smart society

Emotion/Feelings Classifiers

- 5 Experiments (1-4 with Facebook; version of 4th without Facebook)
- Different Methods for determining each message's final label
- Merging/removal of Emotion/feelings categories

SOFIA UNIVERSITY
St. KLIMENT OHRIDSKI

GATE
big data for smart society

- Emotions-Experiment 2 (with Facebook) - 16 labels
- Label selection: only texts with only 1 most frequent label
- 16 Categories: Merged Warning/Informing/Notice into Neutral (without emotion); removed "Other"
- Number of texts: 4536

Exper.	Category	Acc.	Prec.	Rec.	F1	Test
	All categories	**0.61**	**0.62**	**0.61**	**0.61**	**454**
	Negative: Fear/Anxiety		0.5	0.69	0.58	13
	Call for Action/Request/Call for Help		0.64	0.61	0.63	44
	Negative: Disapproval		0.3	0.39	0.34	28
	Sarcasm/Irony: Rather Negative		0.49	0.57	0.53	72
Emotions-Exper. 2 +FB (16 labels)	Positive: Satisfaction/Approval		0.62	0.61	0.62	46
	Neutral (without Emotion)		0.75	0.71	0.73	90
	Negative: Distrust		0.33	0.17	0.22	12
	Negative: Sadness/Sorrow/Regret, Suffering/Pain		0.8	0.36	0.5	11
	Negative: Anger/Outrage/Disgust/Hate		0.66	0.57	0.61	65
	Surprise		0.5	0.5	0.5	2
	Positive: Joke		0.38	0.38	0.38	8
	Positive: Happiness/Joy		0.56	0.62	0.59	8
	Positive: Wishes/Greetings		0.91	0.91	0.91	32
	Positive: Hope		0.58	0.88	0.7	8
	Positive: Appreciation/Gratitude		0.73	0.67	0.7	12
	Positive: Offering Help/Support, Sympathy/Compassion		0	0	0	3

TE
art society

- Emotions-Experiment 3 (with Facebook) - 11 labels
- Label selection: same as Exp. 2
- 11 Categories: Merged "Negative: Disapproval" with "Negative: Anger/Outrage/Disgust/Hate" into one; Merged "Positive: Satisfaction/Approval", "Positive: Happiness/Joy"
- Removed texts with "Surprise", "Positive: Joke", and "Sarcasm/Irony: Rather negative"

Exper.	Category	Acc.	Prec.	Rec.	F1	Test
Emot.-Exper. 3 +FB (11 l.)	**All categories**	**0.67**	**0.68**	**0.67**	**0.67**	**366**
	Negative: Fear/Anxiety		0.57	0.63	0.6	19
	Call for Action/Request/Call for Help		0.71	0.71	0.71	52
	Negative: Anger/Outrage/Disgust/Hate/Disapproval		0.68	0.77	0.72	77
	Positive: Satisfaction/Approval/Happiness/Joy		0.57	0.62	0.6	50
	Neutral (without Emotion)		0.62	0.68	0.65	74
	Negative: Distrust		0.56	0.38	0.45	13
	Negative: Sadness/Sorrow/Regret, Suffering/Pain		0.5	0.31	0.38	13
	Positive: Wishes/Greetings		1	0.94	0.97	36
	Positive: Hope		1	0.36	0.53	11
	Positive: Appreciation/Gratitude		0.73	0.57	0.64	14
	Positive: Offering Help/Support, Sympathy/Compassion		0.6	0.43	0.5	7

GATE
big data for smart society

- Emotions-Experiment 4 (with Facebook) - 11 labels
- Label selection: same as Exp. 2
- 11 Categories: Same as Exp. 3
- Added ChatGPT-4-generated texts with clear emotions in the categories with >20 texts in the test split
- 4080 texts

Exper.	Category	Acc.	Prec.	Rec.	F1	Test
Emot.-Exper. 4 +FB (11 l.)	All categories	0.70	0.72	0.70	0.70	408
	Negative: Fear/Anxiety		0.58	0.58	0.58	19
	Call for Action/Request/Call for Help		0.63	0.72	0.67	47
	Negative: Anger/Outrage/Disgust/Hate/Disapproval		0.7	0.73	0.72	83
	Positive: Satisfaction/Approval/Happiness/Joy		0.83	0.56	0.67	63
	Neutral (without Emotion)		0.72	0.69	0.71	72
	Negative: Distrust		0.42	0.47	0.44	17
	Negative: Sadness/Sorrow/Regret, Suffering/Pain		0.56	0.74	0.64	19
	Positive: Wishes/Greetings		0.9	0.9	0.9	30
	Positive: Hope		0.68	0.89	0.77	19
	Positive: Appreciation/Gratitude		0.83	0.86	0.84	22
	Positive: Offering Help/Support, Sympathy/Compassion		0.73	0.65	0.69	17

GATE
big data for smart society

- Emotions-Experiment 4 (NO Facebook) - 11 labels
- Label selection: same as Exp. 2
- 11 Categories: Same as Exp. 3
- 2674 texts (incl. ChatGPT-4-generated)

Exper.	Category	Acc.	Prec.	Rec.	F1	Test
Emot.-Exper. 4 -FB (11 l.)	**All categories**	**0.73**	**0.75**	**0.73**	**0.73**	**273**
	Negative: Fear/Anxiety		0.58	0.47	0.52	15
	Call for Action/Request/Call for Help		0.60	0.50	0.55	18
	Negative: Anger/Outrage/Disgust/Hate/Disapproval		0.81	0.71	0.76	55
	Positive: Satisfaction/Approval/Happiness/Joy		0.63	0.84	0.72	49
	Neutral (without Emotion)		0.64	0.83	0.72	42
	Negative: Distrust		0.67	0.57	0.62	14
	Negative: Sadness/Sorrow/Regret, Suffering/Pain		0.91	0.71	0.80	14
	Positive: Wishes/Greetings		0.95	0.78	0.86	23
	Positive: Hope		0.82	0.60	0.69	15
	Positive: Appreciation/Gratitude		0.93	0.93	0.93	15
	Positive: Offering Help/Support, Sympathy/Compassion		1.00	0.77	0.87	13

GATE
big data for smart society

Sentiments Classifiers

- 4 Experiments (1-3 with Facebook; version of 3rd without Facebook)
- Automatic merging of emotions/feelings into 3 sentiments
- Corresponding to:
  - Sentiments-Experiment 1 --- Emotions-Experiment 3
  - Sentiments-Experiment 2a --- Emotions-Experiment 4
  - Sentiments-Experiment 2b --- Emotions-Experiment 4 (no Facebook)

SOFIA UNIVERSITY
St. KLIMENT OHRIDSKI

GATE
big data for smart society

Sentiment Classifiers Results

Experiment	Category	Acc.	Prec.	Rec.	F1
Sentiments-Experiment 1 **+FB**	**all categories**	**0.77**	**0.77**	**0.77**	**0.77**
	negative		0.76	0.80	0.78
	neutral		0.72	0.72	0.72
	positive		0.82	0.79	0.81
Sentiments-Experiment 2 **+FB**	**all categories**	**0.79**	**0.79**	**0.79**	**0.79**
	negative		0.72	0.83	0.77
	neutral		0.80	0.71	0.76
	positive		0.85	0.80	0.83
Sentiments-Experiment 2 **-FB**	**all categories**	**0.80**	**0.80**	**0.80**	**0.80**
	negative		0.76	0.81	0.78
	neutral		0.68	0.68	0.68
	positive		0.90	0.85	0.88

GATE
big data for smart society

Limitations

- EMO-SM-BG2022 is focussed on limited topics (lies, Covid-19)
- The emotion categories are adapted to EMO-SM-BG2022 texts
- Some emotion/feelings categories are missing (e.g. envy, shame)
- Only texts in Cyrillic (there are Latin transliterations of Bulgarian in Internet slang)
- Only social media texts

SOFIA UNIVERSITY
St. KLIMENT OHRIDSKI

GATE
big data for smart society

Future work

- We will include other, more accessible types of texts (e.g. news articles)
- We will expand the selection of emotions/feelings
- We will possibly add Bulgarian texts, written in Latin transliterations

SOFIA UNIVERSITY
St. KLIMENT OHRIDSKI

GATE
big data for smart society

Ethical and Legal Aspects

- Annotators Payment:
  - the annotators - all part of the same research team
  - annotation - part of their job: average rate was 8 euros per hour
  - the younger annotators - training in Natural Language Processing, co-authors of this article
- Part of the texts: subset of published datasets, allowing their reuse with the same license
- The Telegram texts - carefully anonymized
- The Twitter rules - only the tweet ids

SOFIA UNIVERSITY
St. KLIMENT OHRIDSKI

GATE
big data for smart society

Links to Resources

- Datasets in Zenodo:
  - https://zenodo.org/records/10870509; https://zenodo.org/records/10870526;
  - SM-FEEL-BG Sentiments-Experiment 2 - No FB Dataset Splits (zenodo.org)
- Models in Zenodo:
  - SM-FEEL-BG Sentiments-Experiment 2 - No FB - Fine-tuned BERT-WEB-BG model (zenodo.org)
  - SM-FEEL-BG Emotions-Experiment 4, No FB - Fine-tuned BERT-WEB-BG model (zenodo.org)
  - SM-FEEL-BG Emotions-Experiment 4, With FB - Fine-tuned BERT-WEB-BG model (zenodo.org)
  - SM-FEEL-BG Sentiments-Experiment 2 - With FB - Fine-tuned BERT-WEB-BG model (zenodo.org)

SOFIA UNIVERSITY
ST. KLIMENT OHRIDSKI

GATE
big data for smart society

Acknowledgements

- Thankful to the LREC-Coling 2024 reviewers
- Grateful to Dr. Milena Dobreva for inspiring us to create new Bulgarian ML models
- Grateful to Prof. Petya Osenova for finding us a very useful collaborator
- Grateful to Prof. Silvia Ilieva for giving us the opportunity to work on this topic

SOFIA UNIVERSITY
St. KLIMENT OHRIDSKI

GATE
big data for smart society

You are welcome to visit our poster!
For questions/comments:
irina.temnikova@gate-ai.eu