3Idiots at HASOC 2019: Fine-tuning Transformer Neural Networks for Hate Speech Identification in Indo-European Languages

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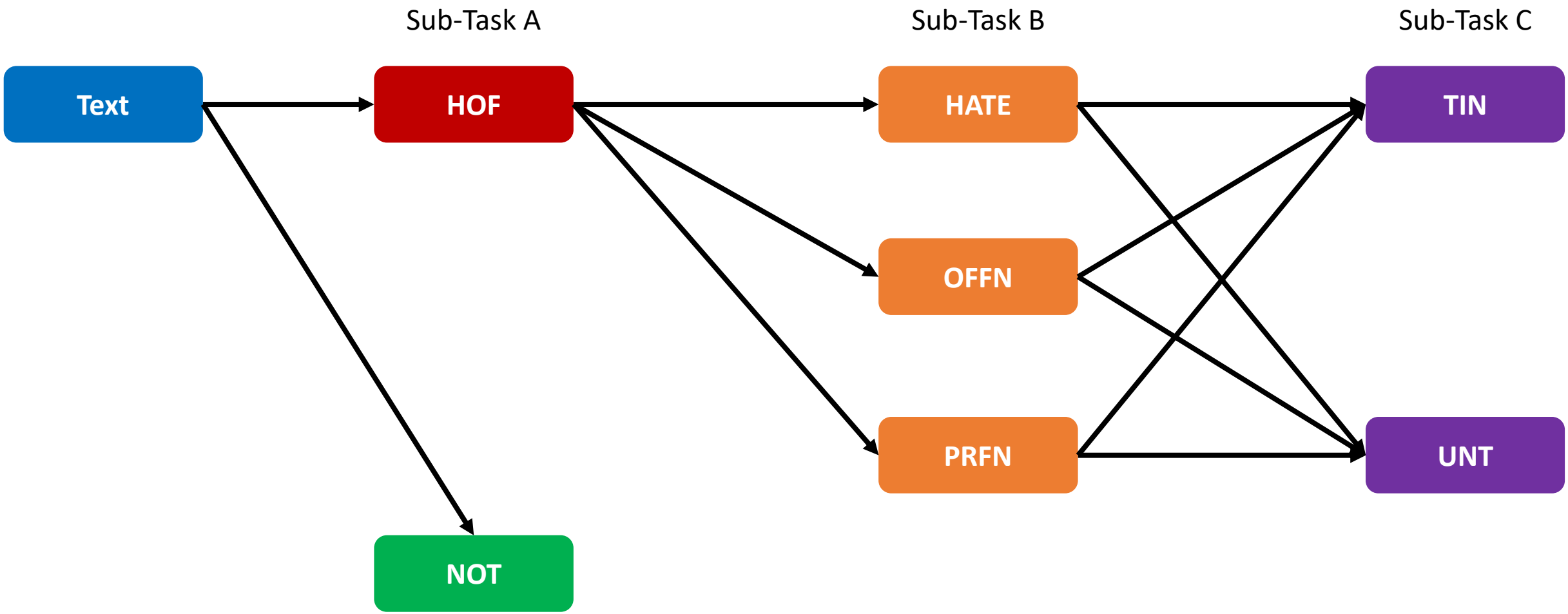
Our contributions

- Introduce pre-trained transformer models for HASOC tasks which give competitive performance on almost all tasks, winning 3/8 subtasks.
- Introduce a model based on joint labeling to tackle data sparsity issues.
- Open source code available at: https://github.com/socialmediaie/HASOC2019
- Slides available at: https://socialmediaie.github.io/HASOC2019/

HASOC task description

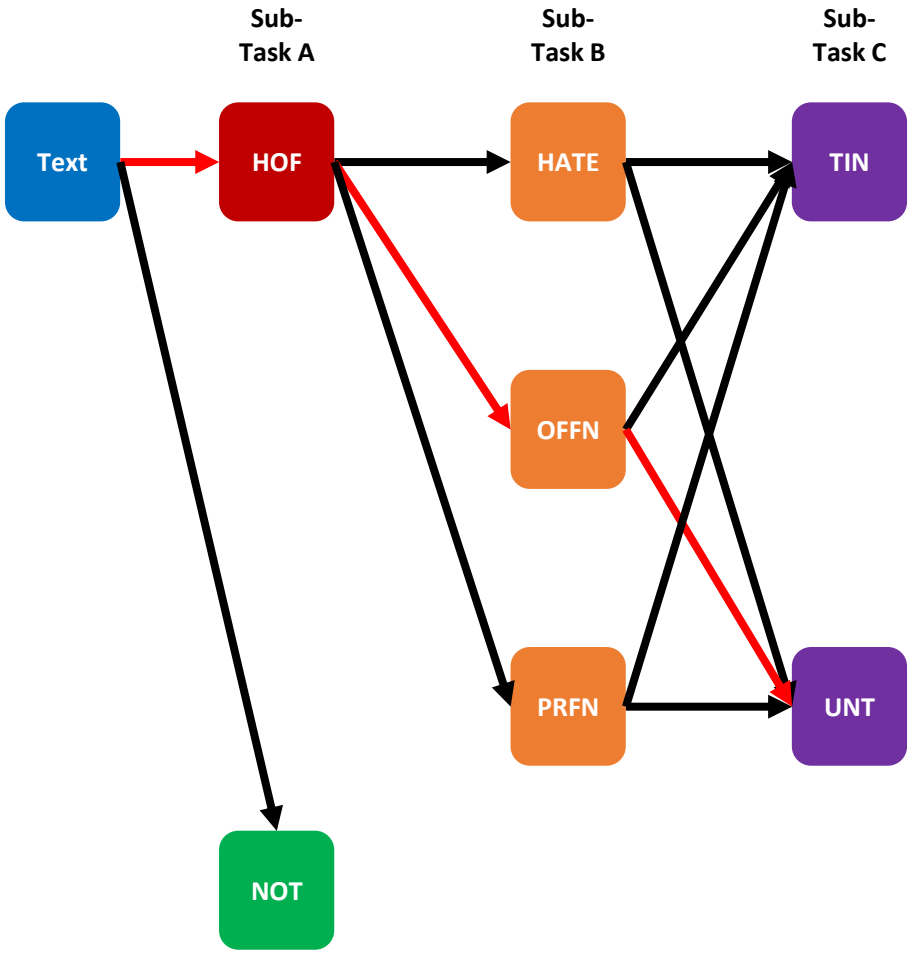


Data statistics

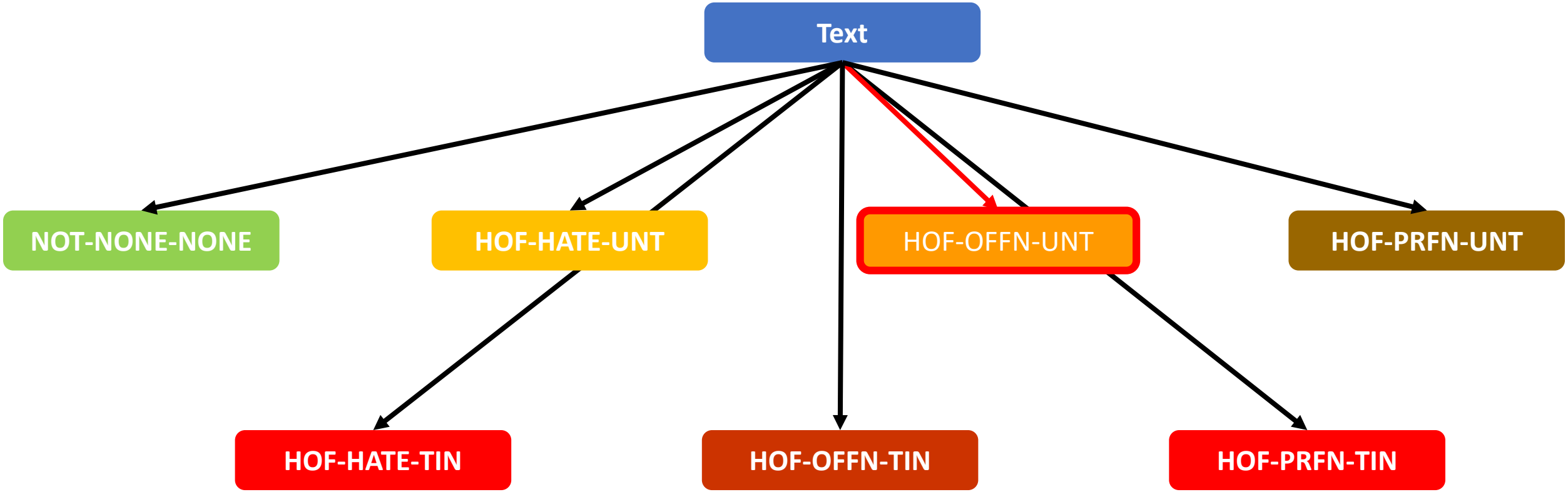
lang	DE			EN			HI		
task	**dev**	**test**	**train**	**dev**	**test**	**train**	**dev**	**test**	**train**
A	794	850	3819	505	1153	5852	136	1318	4665
B	794	850	407	302	1153	2261	136	1318	2469
C	0	0	0	299	1153	2261	72	1318	2469

Training via joint labels (sub-task D)

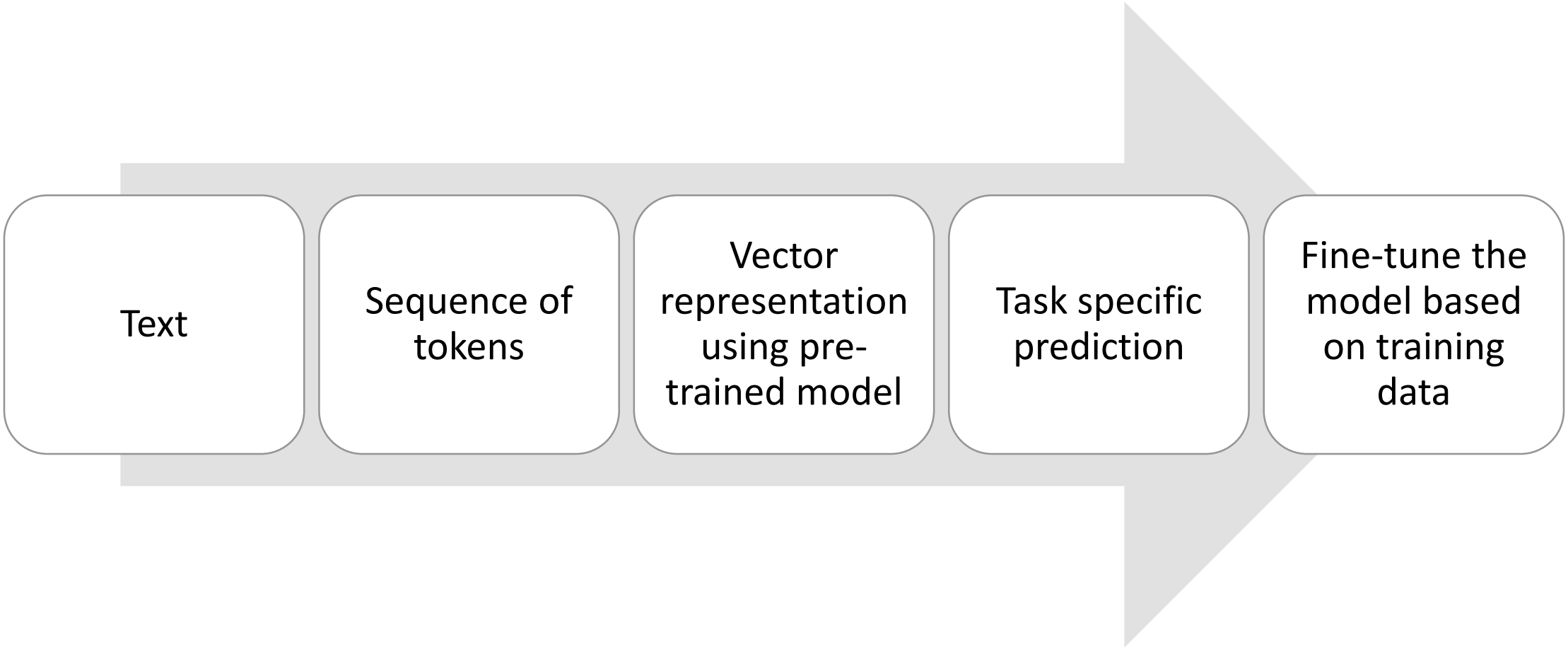
- Data sparsity is an issue for fine-grained subtasks B and C.
- However, learning about subtask A labels provides some signal for subtasks B and C.
- Labels of all sub-tasks can be organized in a DAG, such that each path can be encoded as a unique label.
- We train a single model for this task, followed by post-processing of labels for sub-task A, B and C.



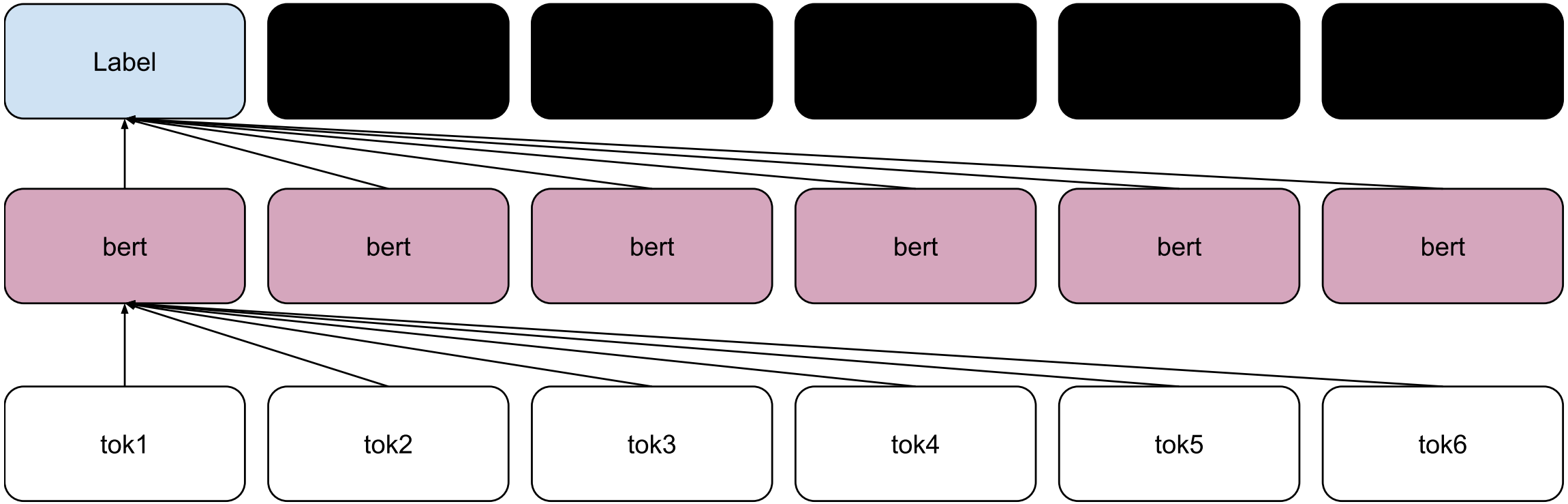
Subtask D labels



Our approach



Bidirectional Encoder Representation from Transformers (BERT) classifier



BERT pre-trained models used

- English:
  - bert - base- cased
  - bert - base - uncased
- Hindi:
  - bert - base - multilingual - cased
  - bert - base - multilingual - uncased
- German:
  - bert - base - german - cased
  - bert - base - multilingual - cased

Training

- Epochs: 5
- Batch size: 32
- Max Sequence Length: 128 (BERT tokens)
- Adam Optimizer:
  - Learning rate: 5e-5
  - Epsilon: 1e-8
  - Weight Decay: 0.0
  - Max Gradient Norm: 1.0
- No hyperparameter tuning was done
- Implemented using pytorch-transformers library: https://github.com/huggingface/transformers

Submission process

Models among the top 3 based on macro-F1 scores on dev dataset were used as the submission models.

English training dev evaluations

			macro		weighted	
task	**model**	**run_id**	**dev**	**train**	**dev**	**train**
A	bert-base-cased	1	0.567	0.958	0.558	0.961
	bert-base-cased (D)		0.577	0.877	0.574	0.885
	bert-base-uncased	3	0.61	0.964	0.606	0.966
	bert-base-uncased (D)	2	0.603	0.902	0.596	0.908
B	bert-base-cased	1	0.303	0.852	0.338	0.873
	bert-base-cased (D)		0.325	0.806	0.387	0.849
	bert-base-uncased	3	0.314	0.846	0.349	0.867
	bert-base-uncased (D)	2	0.332	0.839	0.401	0.875
C	bert-base-cased	1	0.542	0.957	0.858	0.985
	bert-base-cased (D)		0.401	0.691	0.537	0.856
	bert-base-uncased	3	0.627	0.942	0.88	0.98
	bert-base-uncased (D)	2	0.393	0.651	0.548	0.874

German training dev evaluations

task	model	run_id	macro dev	macro train	weighted dev	weighted train
A	bert-base-german-cased		0.783	0.999	0.926	1
	bert-base-german-cased (D)	3	0.811	0.994	0.935	0.998
	bert-base-multilingual-cased	1	0.769	0.84	0.923	0.943
	bert-base-multilingual-cased (D)	2	0.722	0.939	0.909	0.977
B	bert-base-german-cased	3	0.486	0.791	0.455	0.813
	bert-base-german-cased (D)		0.446	0.884	0.896	0.984
	bert-base-multilingual-cased	1	0.14	0.247	0.112	0.367
	bert-base-multilingual-cased (D)	2	0.282	0.409	0.865	0.918

Hindi training dev evaluations

task	model	run_id	macro		weighted	
			dev	train	dev	train
A	bert-base-multilingual-cased	2	0.558	0.973	0.552	0.973
	bert-base-multilingual-uncased	1	0.742	0.961	0.742	0.961
	bert-base-multilingual-uncased (D)	3	0.823	0.941	0.822	0.941
B	bert-base-multilingual-cased	2	0.222	0.726	0.264	0.772
	bert-base-multilingual-uncased	1	0.322	0.701	0.466	0.749
	bert-base-multilingual-uncased (D)	3	0.459	0.736	0.757	0.826
C	bert-base-multilingual-cased	2	0.55	0.59	0.8	0.635
	bert-base-multilingual-uncased	1	0.55	0.866	0.8	0.877
	bert-base-multilingual-uncased (D)	3	0.537	0.622	0.769	0.724

Results

- Top submission for 3/8 subtasks (EN B, EN C, HI B)
- Within 1% of top submission score for 5/8 subtasks
- Among top 5 submissions for 7/8 subtasks

Note: Our systems paper has a typo. We achieved first place in the English sub-tasks B and C, not sub-tasks A and B (as reported).

English Results

task	run_id	model	macro f1	weighted f1	rank
A	-	best	0.788	0.84	1
	1	bert-base-cased	0.739	0.79	14
	2	bert-base-uncased (D)	0.747	0.801	7
	3	bert-base-uncased	0.74	0.79	11
B	-	best (ours)	0.545	0.728	1
	1	bert-base-cased	0.517	0.701	3
	2	bert-base-uncased (D)	0.537	0.698	2
	3	bert-base-uncased	0.545	0.728	1
C	-	best (ours)	0.511	0.756	1
	1	bert-base-cased	0.500	0.753	2
	2	bert-base-uncased (D)	0.476	0.764	6
	3	bert-base-uncased	0.511	0.756	1

German Results

task	run_id	model	macro f1	weighted f1	rank
A	-	best	0.616	0.791	1
	1	bert-base-multilingual-cased	0.577	0.789	4
	2	bert-base-multilingual-cased (D)	0.573	0.799	6
	3	bert-base-german-cased (D)	0.522	0.778	12
B	-	best	0.347	0.775	1
	1	bert-base-multilingual-cased	0.249	0.756	12
	2	bert-base-multilingual-cased (D)	0.276	0.778	4
	3	bert-base-german-cased	0.274	0.773	6

Hindi Results

task	run_id	model	macro f1	weighted f1	rank
A	-	best	0.815	0.82	1
	1	bert-base-multilingual-uncased	0.802	0.802	10
	2	bert-base-multilingual-cased	0.8	0.801	11
	3	bert-base-multilingual-uncased (D)	0.811	0.814	3
B	-	best (ours)	0.581	0.715	1
	1	bert-base-multilingual-uncased	0.553	0.688	7
	2	bert-base-multilingual-cased	0.553	0.675	6
	3	bert-base-multilingual-uncased (D)	0.581	0.715	1
C	-	best	0.575	0.736	1
	1	bert-base-multilingual-uncased	0.565	0.727	2
	2	bert-base-multilingual-cased	0.549	0.748	5
	3	bert-base-multilingual-uncased (D)	0.55	0.758	4

Conclusion

- We found pre-trained transformer models based on BERT give a competitive performance on all HASOC tasks.
- Subtask D allowed us to address data sparsity issue but was not always the top performing model.
- Hyperparameter tuning might help improve our models further, however this is computationally expensive and hence the untuned version of our models can be a very promising approach.
- Code for reproducing our results can be found at: https://socialmediaie.github.io/HASOC2019/

Thank You

- More tools related to social media information extraction can be found at the SocialMediaIE project: https://socialmediaie.github.io/
- There will be a hands-on tutorial on Information extraction from social media using SocialMediaIE at LREC 2020 Marseille on May 11: https://lrec2020.lrec-conf.org/en/workshops-and-tutorials/tutorials/
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