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Exploring SBERT and Mixup Data Augmentation in Rhetorical Role Labeling of Indian Legal Sentences

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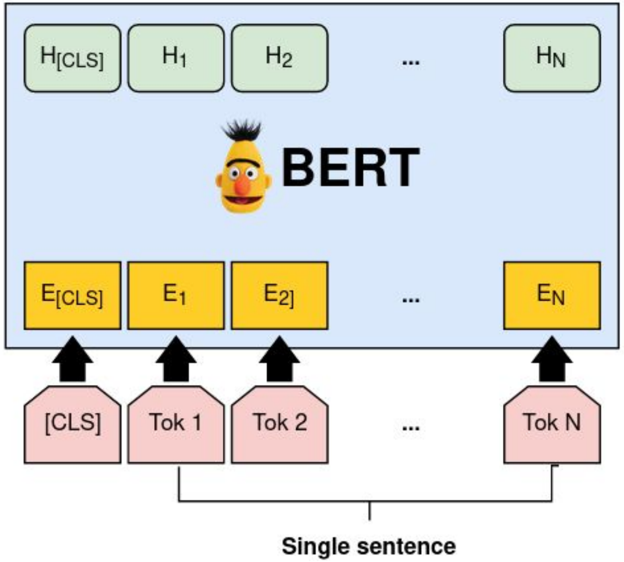
Introduction

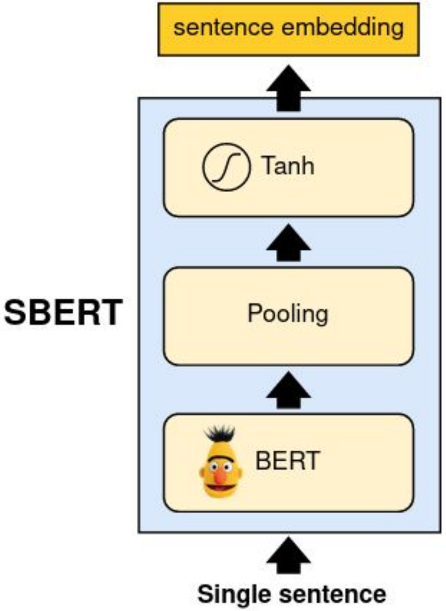
- The semantic recognition of text pieces from legal documents is a valuable task
- Our task consists of assigning rhetorical roles (**sentence classification**) to text sentences
- Pre-trained deep learning models like BERT and GPT has boosted general-domain NLP applications but legal applications can benefit from them too

Sentence	**Role**
The University had granted conditional approval, as stated earlier	Argument
S.11 of the Act deals with inspection	Statute
At that time in 1984,the AICTE Act was not on the statute book	Precedent

State of the Art

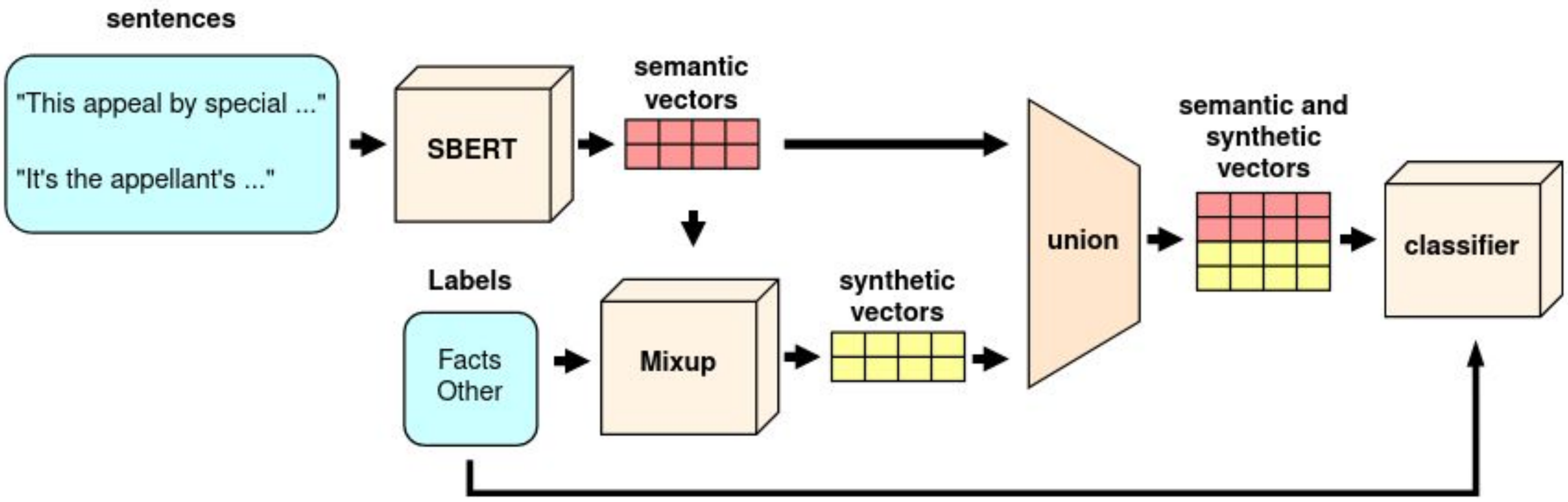
- Sentence BERT (SBERT): a model capable to generate semantically meaningful sentence embeddings from BERT hidden states in a computationally efficient way (Reimers and Gurevych, 2019).





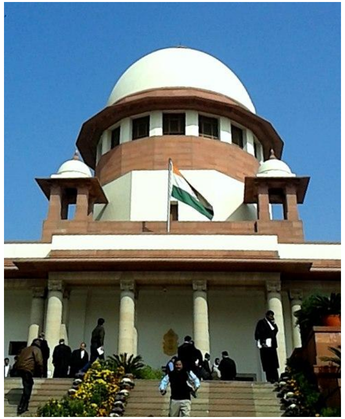
Proposed solution: exploit SBERT and MixUp

- Mixup: a data augmentation method agnostic to the nature of data or application. It also works as a regularization method (Zhang et al, 2018).


sentences
"This appeal by special ..."
"It's the appellant's ..."
SBERT
semantic vectors
Labels
Facts
Other
Mixup
synthetic vectors
union
semantic and synthetic vectors
classifier

Experimental setup

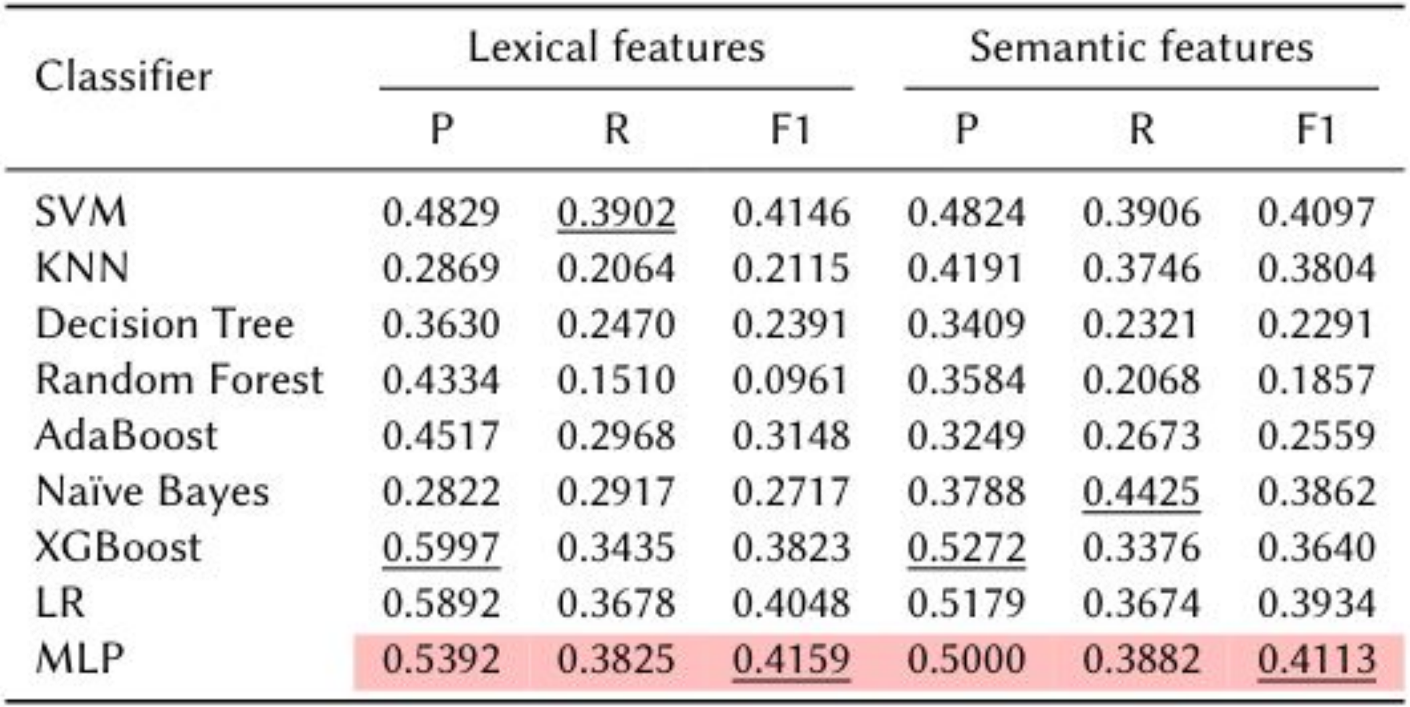
- Dataset published by Parikh et al (2021):
  - 60 judgments from Indian Supreme Court
  - 10,024 sentences
  - 7 rhetorical labels: facts, ruling by lower court, argument, statute, precedent, ratio of the decision, ruling by present court
- Baselines:
  - TF-IDF vectors (lexical feature set)
  - SBERT dense vectors (semantic feature set)
- 8 classic classifiers (knn, SVM,...) + 1 NN
- 26 models in total



Research Questions

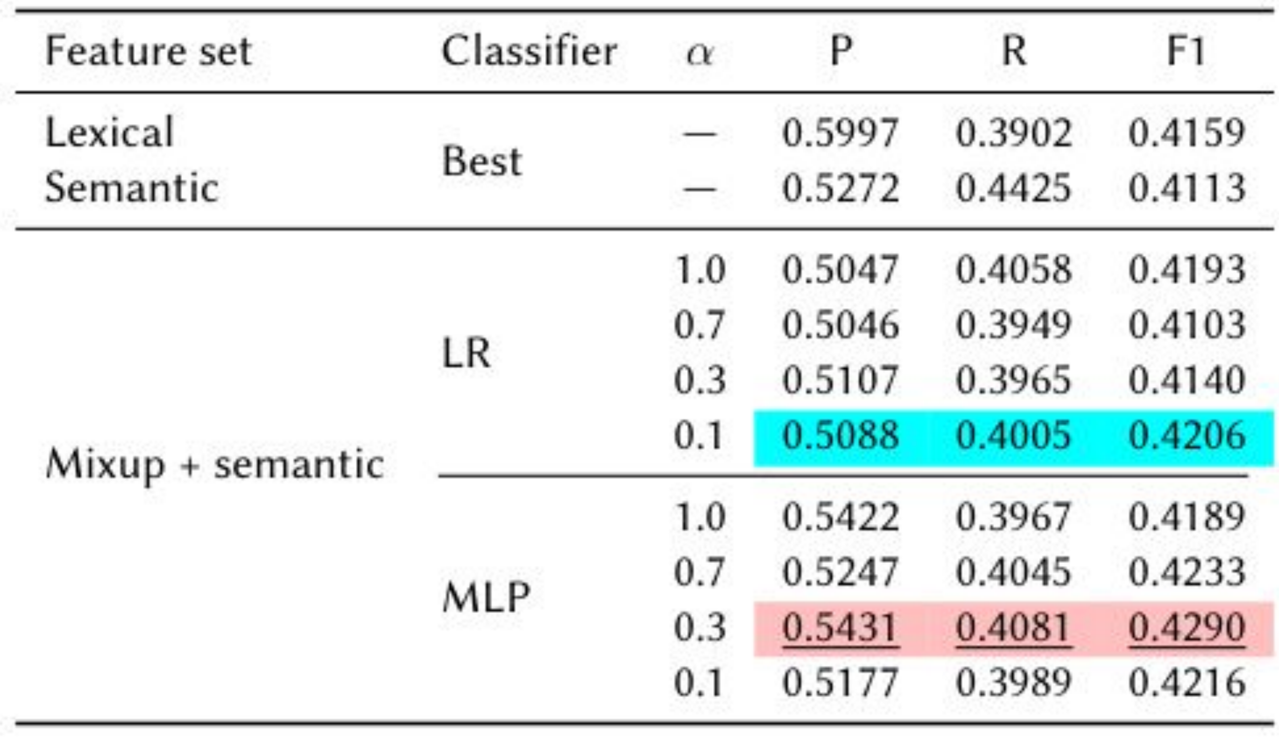
- Are SOTA models pre-trained with general-domain corpus able to produce useful representations for the task of rhetorical role labeling from Indian legal documents?
- Is the augmented data generated by the Mixup method able to improve the performance of semantic models?

Baseline results



Classifier	Lexical features			Semantic features		
	P	R	F1	P	R	F1
SVM	0.4829	0.3902	0.4146	0.4824	0.3906	0.4097
KNN	0.2869	0.2064	0.2115	0.4191	0.3746	0.3804
Decision Tree	0.3630	0.2470	0.2391	0.3409	0.2321	0.2291
Random Forest	0.4334	0.1510	0.0961	0.3584	0.2068	0.1857
AdaBoost	0.4517	0.2968	0.3148	0.3249	0.2673	0.2559
Naïve Bayes	0.2822	0.2917	0.2717	0.3788	0.4425	0.3862
XGBoost	0.5997	0.3435	0.3823	0.5272	0.3376	0.3640
LR	0.5892	0.3678	0.4048	0.5179	0.3674	0.3934
MLP	0.5392	0.3825	0.4159	0.5000	0.3882	0.4113

Mixup results



Feature set	Classifier	α	P	R	F1
Lexical	Best	—	0.5997	0.3902	0.4159
Semantic		—	0.5272	0.4425	0.4113
Mixup + semantic	LR	1.0	0.5047	0.4058	0.4193
		0.7	0.5046	0.3949	0.4103
		0.3	0.5107	0.3965	0.4140
		0.1	0.5088	0.4005	0.4206
	MLP	1.0	0.5422	0.3967	0.4189
		0.7	0.5247	0.4045	0.4233
		0.3	0.5431	0.4081	0.4290
		0.1	0.5177	0.3989	0.4216

Conclusions

- In the task of role labelling in the legal domain, our results show a small difference between lexical and semantic features with a slightly better performance of the lexical model regarding F1
- Our proposal, the use of Mixup in the legal domain, is capable to boost the semantic features and allow the models to overcome the baselines
- For future work, we plan to exploit pre-trained models on legal documents

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