Portuguese Language Models and Word Embeddings

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March 2, 2020

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Agenda

Introduction

- ASSIN datasets : Semantic Textual Similarity Task
  - ASSIN 1 (Fonseca et al. [2016])
  - ASSIN 2 (Real et al. [2020])

Text	Hypothesis	Similarity Score
Em comparação com o ano anterior, registaram-se menos 29 acidentes e menos duas vítimas mortais.	Feita a comparação com igual período do ano passado, registaram-se menos 29 acidentes e menos dois mortos.	5.0
O FC Porto renovou o contrato com o avançado colombiano Juan Quintero, até 2021.	O FC Porto confirmou nesta terça-feira a renovação com Juan Quintero.	4.0
A agência desceu a perspectiva do rating de Portugal, de "positiva" para "estável".	A agência elevou ainda a perspectiva do país de negativa para estável.	2.5
Este acessório prepara-se para dar um grande salto na nova versão do Surface Pro.	A Microsoft prepara-se para recolher os Surface Pro para a substituição dos respetivos cabos.	1.25

Related Work

- Portuguese word embeddings: Evaluating on word analogies and natural language tasks
  (Hartmann et al. [2017])
- Contextual Representations and Semi-Supervised Named Entity Recognition for Portuguese Language
  (de Castro et al. [2019])

Human error

- Conflicting replacement strategies for OOV words.
- Not applying the same preprocessing steps during evaluation and training.

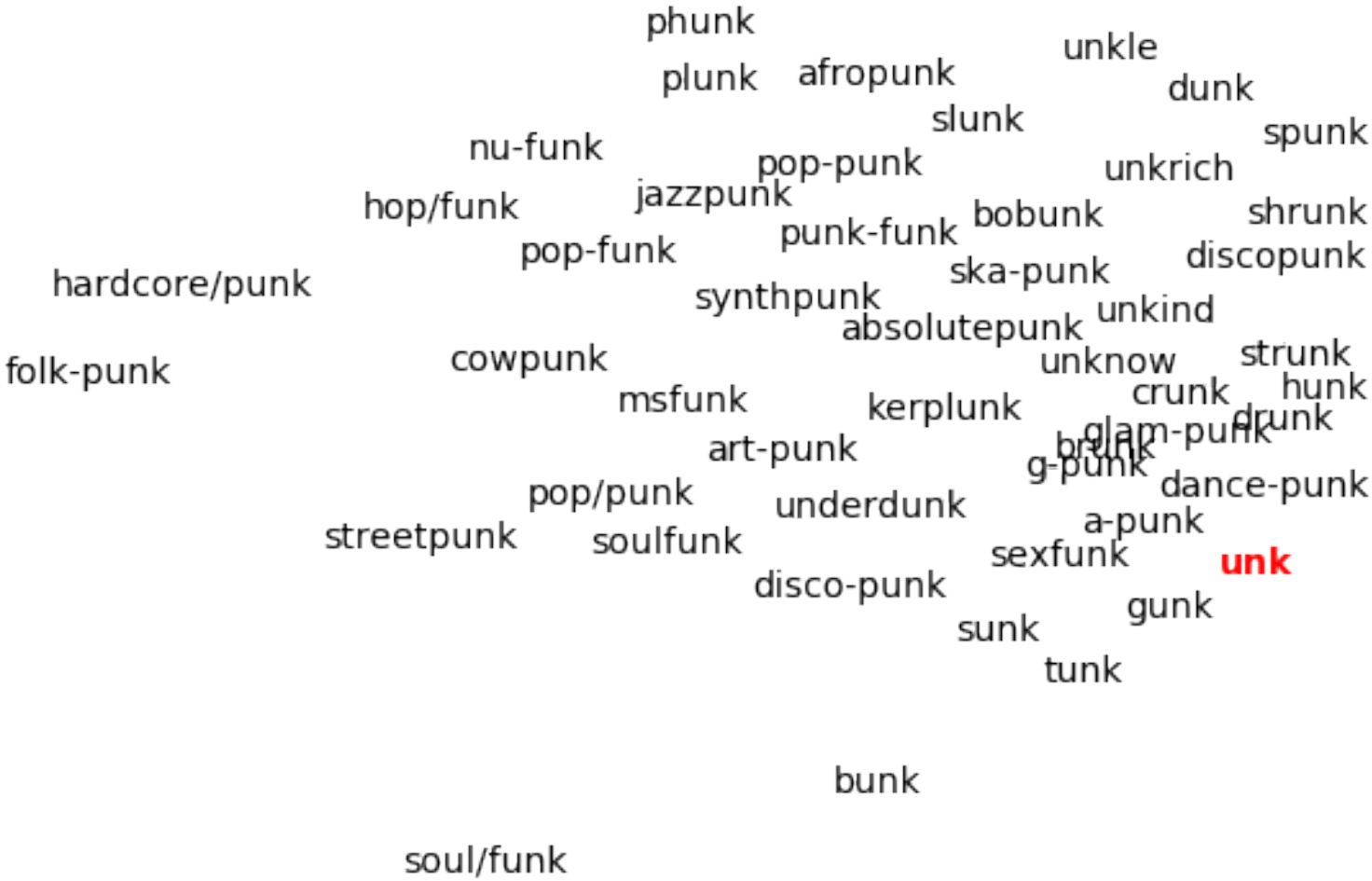
Example: FastText - OOV words replaced by "unk"

- Original approach by Hartmann et al. [2017]:
  - **Original phrase**:
    "Votaram contra a proposta 267 deputados, e 210 votaram a favor"
  - **Preprocessing**:
    "votaram", "contra", "proposta", "267", "deputados", "210", "votara", "favor"
  - **Replace unknown words by unk**:
    "votaram", "contra", "proposta", **"unk"**, "deputados", **"unk"**, "votara", "favor"

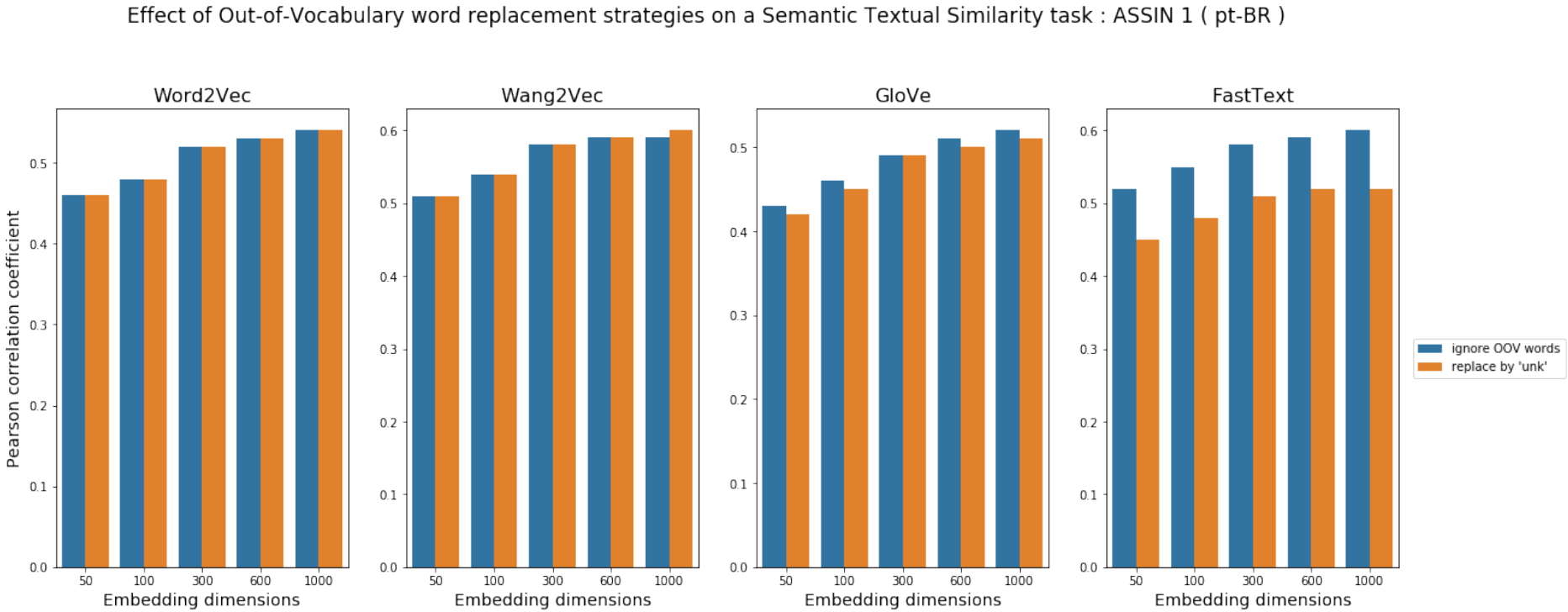
Example: FastText - OOV words replaced by "unk"

- Our approach:
  - **Original phrase**:
    "Votaram contra a proposta 267 deputados, e 210 votaram a favor"
  - **Preprocessing**:
    "votaram", "contra", "proposta", "000", "deputados", "000", "votara", "favor"
  - **Remove unknown words from the phrase**:
    "votaram", "contra", "proposta", "000", "deputados", "000", "votara", "favor"

Example: FastText - nearest neighbors of "unk"

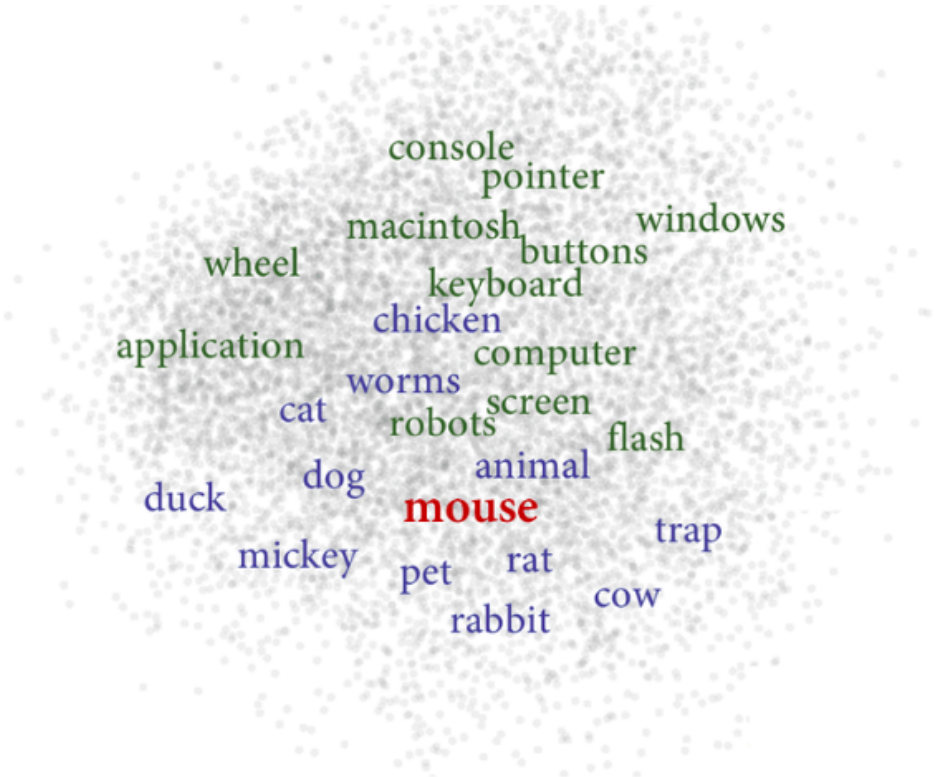


Example


Effect of Out-of-Vocabulary word replacement strategies on a Semantic Textual Similarity task : ASSIN 1 (pt-BR)
Word2Vec
Wang2Vec
GloVe
FastText
Pearson correlation coefficient
Embedding dimensions
50
100
300
600
1000
ignore OOV words
replace by 'unk'

Model-specific issues

- Out-of-vocabulary (OOV) words (Hu et al. [2019])
- Meaning conflation deficiency (Camacho-Collados and Pilehvar [2018])



ELMo (Peters et al. [2018])

- ~~Out-of-vocabulary (OOV) words~~
  - A convolutional neural network generates character-level embeddings.
- ~~Meaning conflation deficiency~~
  - A bidirectional language model generates contextualized word embeddings.

Results: ASSIN

Dataset	Model	Embedding	Architecture	Dimensions	PCC	MSE
ASSIN 1 (pt-BR)	ELMo - wiki (reduced)				**0.62**	**0.47**
	ELMo - wiki (reduced)	word2vec	CBOW	1000	0.62	0.47
	portuguese-BERT				0.53	0.55
	BERT-multilingual				0.51	1.94
ASSIN 1 (pt-PT)	ELMo - wiki (reduced)				0.63	0.73
	ELMo - wiki (reduced)	word2vec	CBOW	1000	**0.64**	**0.73**
	portuguese-BERT				0.53	0.88
	BERT-multilingual				0.52	0.90
ASSIN 2	ELMo - wiki (reduced)				0.57	1.94
	ELMo - wiki (reduced)	word2vec	CBOW	1000	0.59	1.88
	portuguese-BERT				**0.64**	**1.69**
	BERT-multilingual				0.51	1.94

Conclusions

- Our ELMo models have achieved acceptable performance both on named-entity recognition and semantic textual similarity tasks.
- Out-of-vocabulary word replacement strategies should be carefully considered during semantic textual similarity evaluation. (Hu et al. [2019])

- **Source code:**
  - `https://github.com/ruanchaves/elmo`

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Acknowledgements