Norm Conflict Identification using Vector Space Offsets

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Introduction

- Contracts formalise agreements between two or more people and state what each party must comply with.
- Contractual norms use deontic meanings to describe prohibitions, obligations, and permissions.
- However, conflicts may arise when the configurations of two or more norms involve conflicting elements, such as parties, deontic meanings, norm actions, and conditions.
    - Company X shall buy products only on business days.
    - Company X must not buy products on Fridays.

Introduction

- **In this work, we introduce an approach to identify norm conflicts by manipulating sentence embeddings.**

- As result, we aim to output a set of conflicting norms from a contract.

Background

Norms

- Norms are mechanisms that regulate expected behaviours from individuals in a specific society or group.
- Norms can be either mandatory or permissive:
  - **Mandatory (Prohibitive):** “Agent X **shall not** use product Y.”
  - **Mandatory (Obligatory):** “Agent X **must** use product Y.”
  - **Permissive:** “Agent X **may** use product Y in case of Z.”

Background

Contracts

- A contract is the formalization of a voluntary agreement between two or more parties.
- Contracts have three main components, which define the content and the contract's purpose: **promise**, **payment**, and **acceptance**.

Background

Norm Conflicts

- Norm conflicts are the result of two or more norms with opposite specifications about what ought to be done.
  - Agent X must buy product Y.
  - Agent X shall not buy product Y.

Background

Norm Conflicts

- Agent X must buy product Y in location Z.
- Agent X may buy product Y in location W.

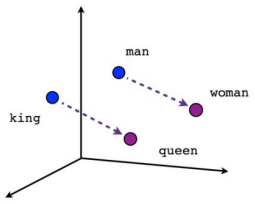
- Agent X must buy product Y in location Z.
- Agent X shall not enter location Z.

Background

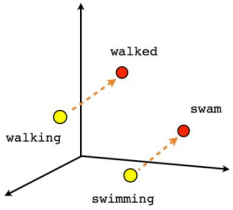
Text Representation

Text representations convert natural language text into dense vectors preserving the semantic meaning.

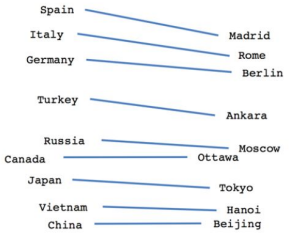
- Word2Vec
- Sent2Vec
- Doc2Vec



Male-Female



Verb tense



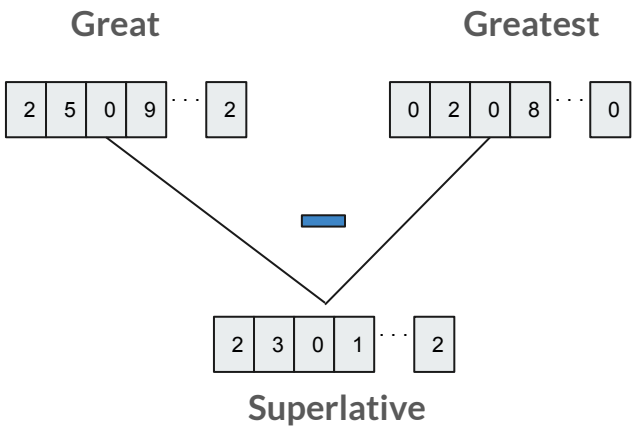
Country-Capital

Source: https://towardsdatascience.com/deep-learning-4-embedding-layers-f9a02d55ac12

Background

Vector Space Offset

- The result of a subtraction between two embedding preserves the main concept between them.



Background

Vector Space Offset

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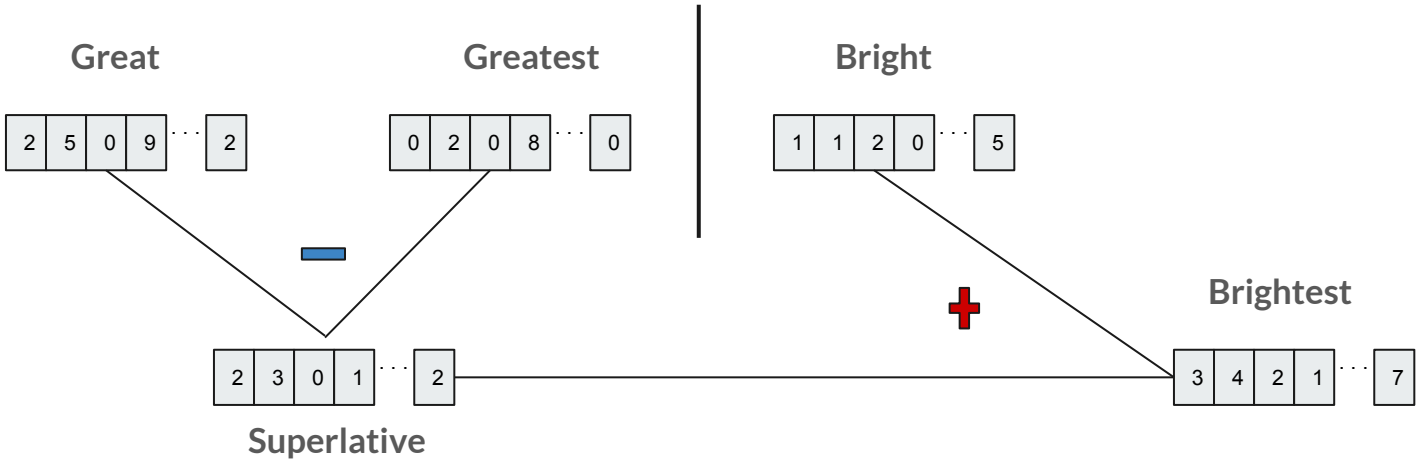
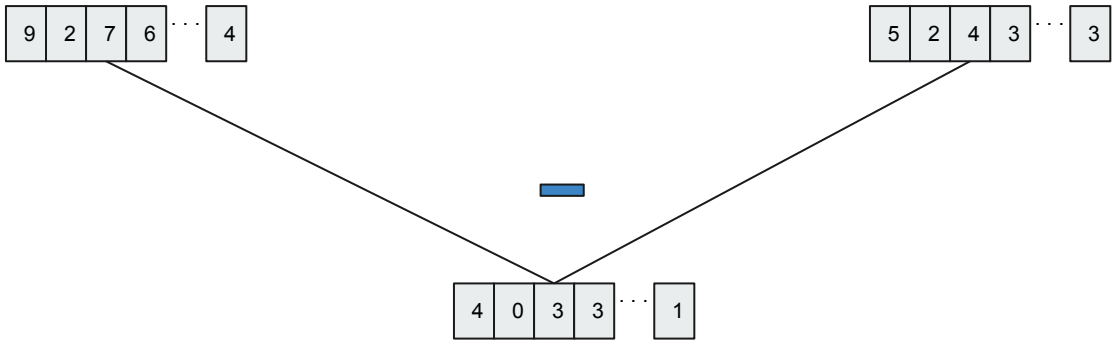


Approach

Conflict Offset

Agent X must buy product Y in location Z.

Agent X may buy product Y in location W.



Conflict

Approach

- In this work, we use the sent2vec algorithm created by Pagliardini et al., 2017

- The authors provide a series of sent2vec pre-trained models, which we use as basis to our application of sentence embedding generation

Approach

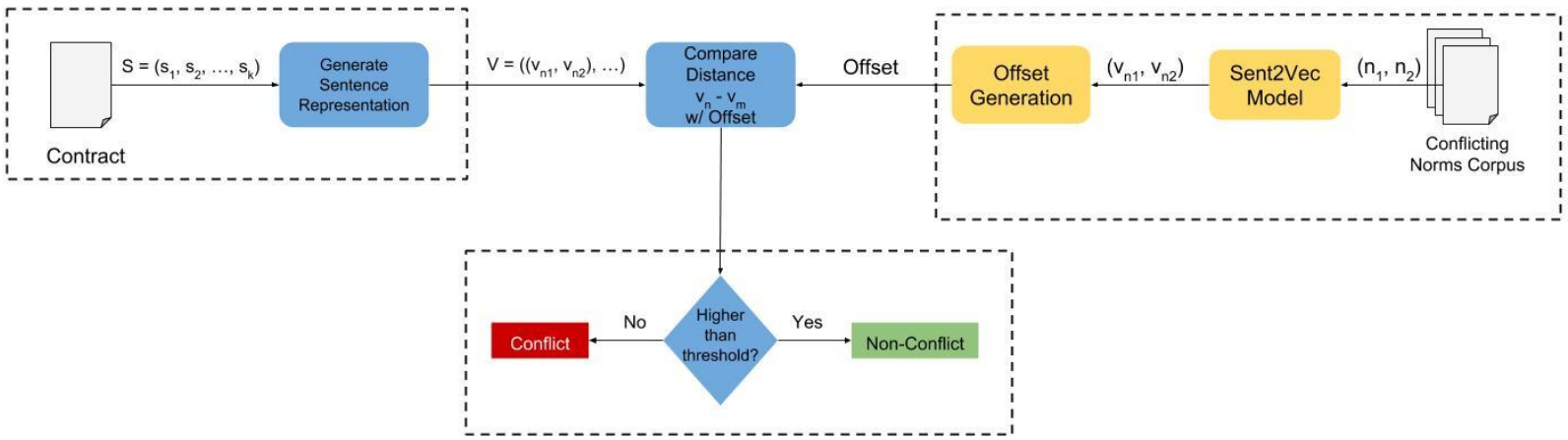
- Using a set of conflicting norm pairs[1], we generate a dataset to **create our conflict offset** and test the approach
- On the other hand, we process raw contracts by identifying their norm sentences and converting them into sentence embeddings

[1] Available at https://zenodo.org/record/345411#.WzFQP-FKjmE

Approach

- Finally, we subtract the pairs of sentence embeddings and compare to the offset
- Given a threshold, we select the conflicting pairs that have a similarity measure below the threshold

Approach

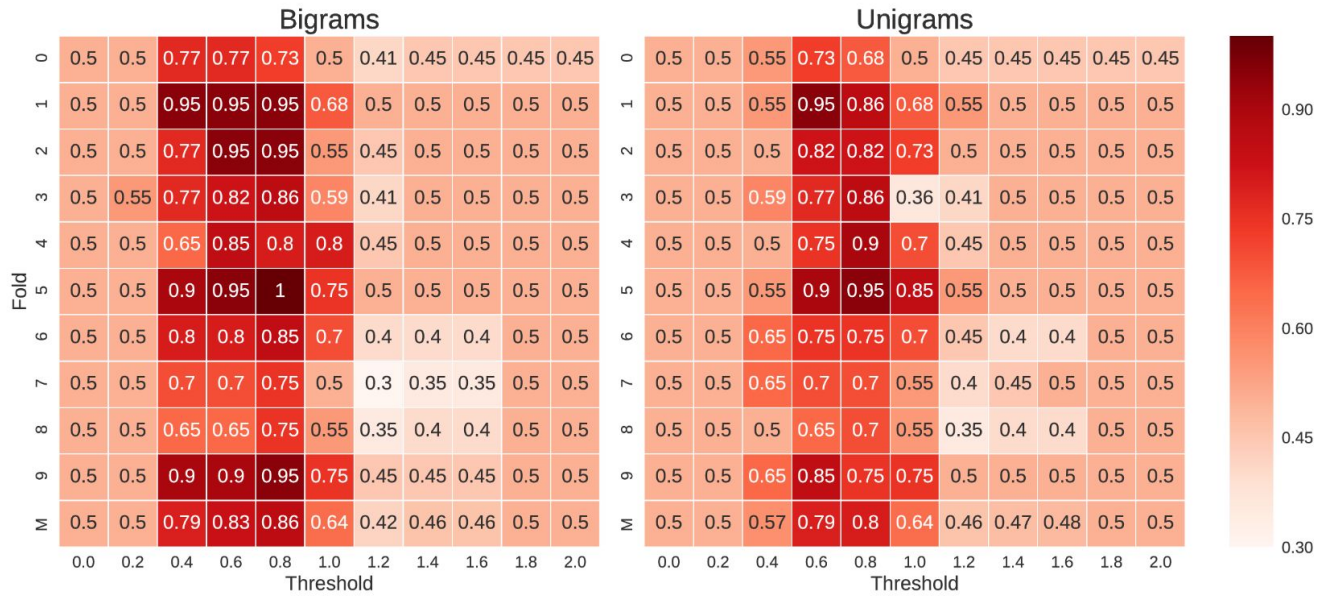

Contract
S = (s1, s2, …, sk)
Generate Sentence Representation
V = ((vn1, vn2), …)
Compare Distance vn - vm w/ Offset
Offset
Offset Generation
(vn1, vn2)
Sent2Vec Model
(n1, n2)
Conflicting Norms Corpus
Higher than threshold?
No
Conflict
Yes
Non-Conflict

Experiments

- We perform 10-fold cross validation over our conflict dataset
- We test two different distance metrics: euclidean and cosine
- We tested two sets of weights Unigram and Bigram

Results

Accuracy when using different pre-trained models with cosine distance



Results

We reach a mean accuracy of **95%** on the identification of conflicts

Compared to previous work, we surpass them by 11%

Approach	Accuracy
Aires et al., 2017	78%
Aires and Meneguzzi, 2017	84%
Our approach	**95%**

Conclusion

- In this work, we propose an approach to detect potential conflicts between norms in contracts
- As we can see, using sentence embeddings resulted in a better approach for norm conflict identification
- Semantic information plays an important role when identifying conflicts

Future Work

- We aim to gather more data to improve our results
- Classify norm conflicts according to their types
- Use the embeddings to generate new conflicts
- Detect what parts of the norm make the conflict to arise

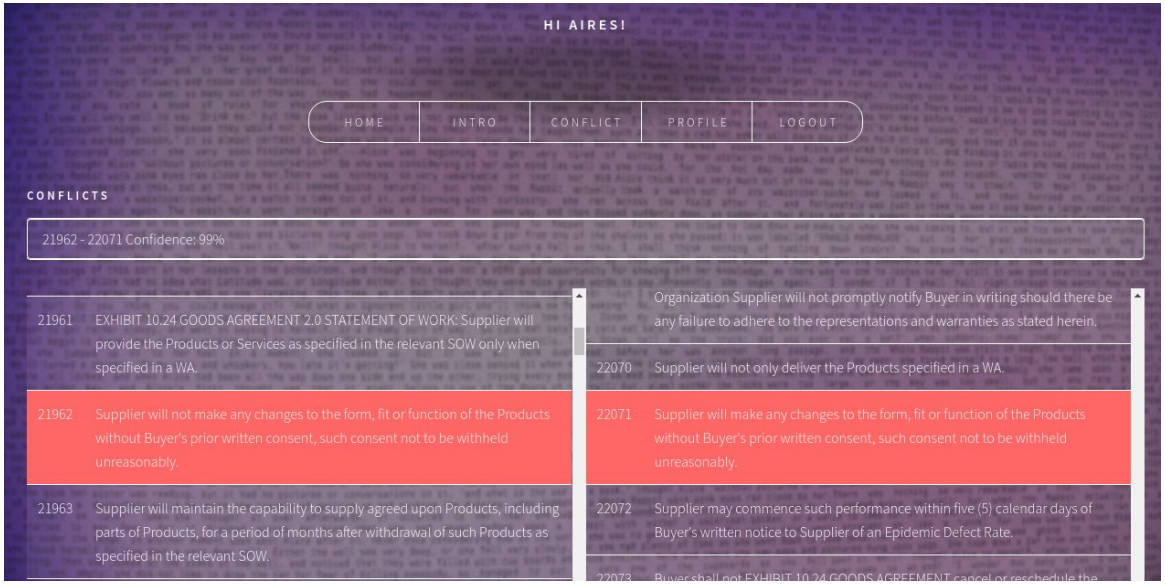
Future Work

Web Tool

- In order to obtain more data for train and test, we created a web tool.
- http://lsa.pucrs.br/concon

Future Work

You can help us!



Thank you!

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