Text Classification for Identifying Eligibility Criteria in Clinical Trial Protocols using Pre-trained Deep Learning Models

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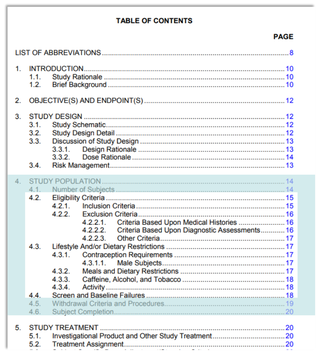
Background

Information extraction from clinical protocols



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Importance of protocols and downstream tasks of protocol analytics

- For understanding operational requirements
- For understanding systemic challenges
- Implying probability of success
- cost implications and business planning

Challenges

- Clinical protocols = semi-structured or unstructured document
- Lack of training and labeled

Methods

Pretrained on large corpus

- *optimized towards language model and next sentence prediction*

Bi-directional language representations

- *as opposed to unidirectional representation in other pre-trained models*

Context-sensitive deep neural networks

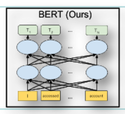
- *compared to context-insensitivity of non-pretrained neural networks*

End-to-end machine learning paradigm

- *Without classical NLP pipelines, e.g., tokenization -> feature engineering -> feature extraction -> machine learning…*

Vocabulary
- Base vocab
- Scibert vocab

Pretrained BERT model
- Bert
- BioBert
- SciBert



Text classification
- Softmax layer

Data & Methods

Eligibility criteria data from clinicaltrials.gov (ct.gov)

- A small subset of ct.gov XML documents
- A XML doc contains multiple fields about a protocol, e.g. eligibility criteria, intervention, condition, etc.
- Used the eligibility criteria (EC) section of the XML docs as positive samples, and other sections (non-EC) as negative samples

Eligibility criteria (EC)	Non-eligibility (non-EC)
Train – 14,000 Test – 6,000	Train - 14000 Test – 6,000

Binary text classification task using pretrained deep learning model

- Using Bidirectional Encoder Representations from Transformers (BERT) as the pretrained language model
- Fine tuning the binary text classification task based on the BERT pretrained model
- Experimented with variants of BERT pretrained models: Bert/BioBert/Scibert

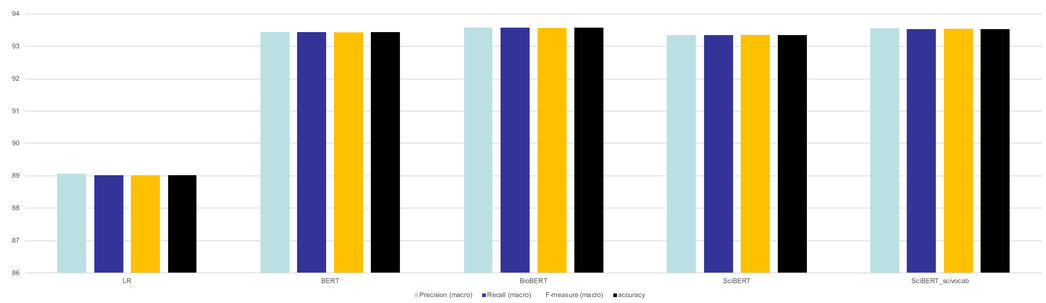
Positive sample

```
<eligibility>
  <criteria>Inclusion Criteria (patient): - Willingness to treat the target lesion according to the DCB only…</criteria>
</eligibility>
```

Negative sample

```
<Intervention_name>drug coated balloon angioplasty<Intervention_name>
</Intervention>
```

Results & Conclusions



- Overall the BERT family models outperform the logistic regression baseline due to the deeper language representation and fine tuning
- The BERT family models perform close to each other on our data set, likely due to the fact it was a small classification data set
- Ongoing NLP efforts in Covance – entity recognition, syntactic relations, multi-task learning

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poster url: https://www.ohdsi.org/2019-us-symposium-showcase-32/
BERT image from https://ai.googleblog.com/2018/11/open-sourcing-bert-state-of-art-pre.html

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Abstract

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Methods

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