

Task Overview

This work presents a BERT-based neural exhaustive approach that address both named entity recognition (NER) and relation extraction (RE) shared-tasks over wet lab protocols data. Several enhancement, namely **PubmedBERT**, **SciBERT**, **BERT-base**, filtering, clustering, and ensembling are investigated to enhance the performances.

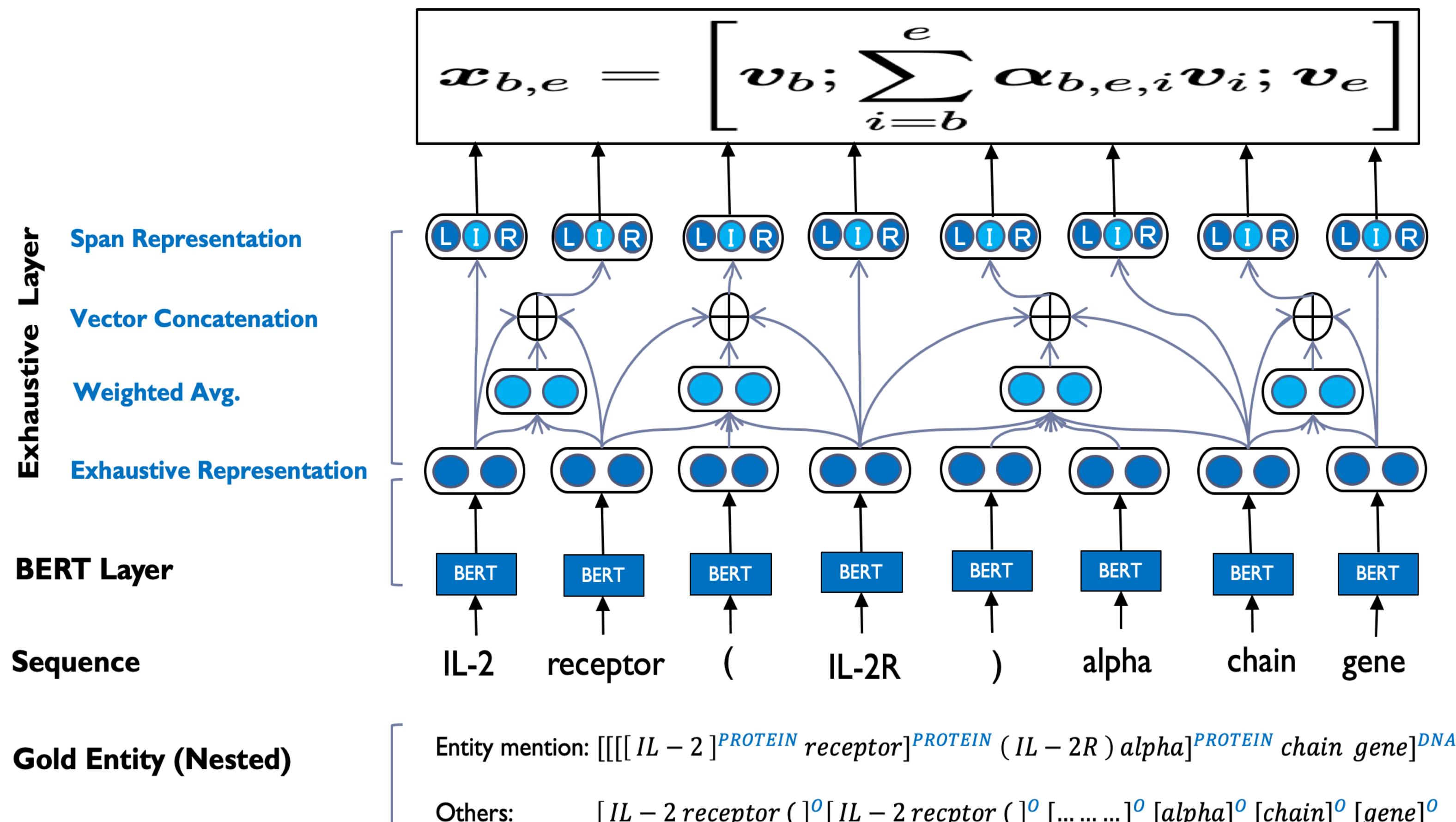
Our Approach

- Built upon a pipeline approach of two modules
 - Entity Recognition: contextual span-based exhaustive approach
 - Relation Recognition: enumerates all trigger-argument pairs

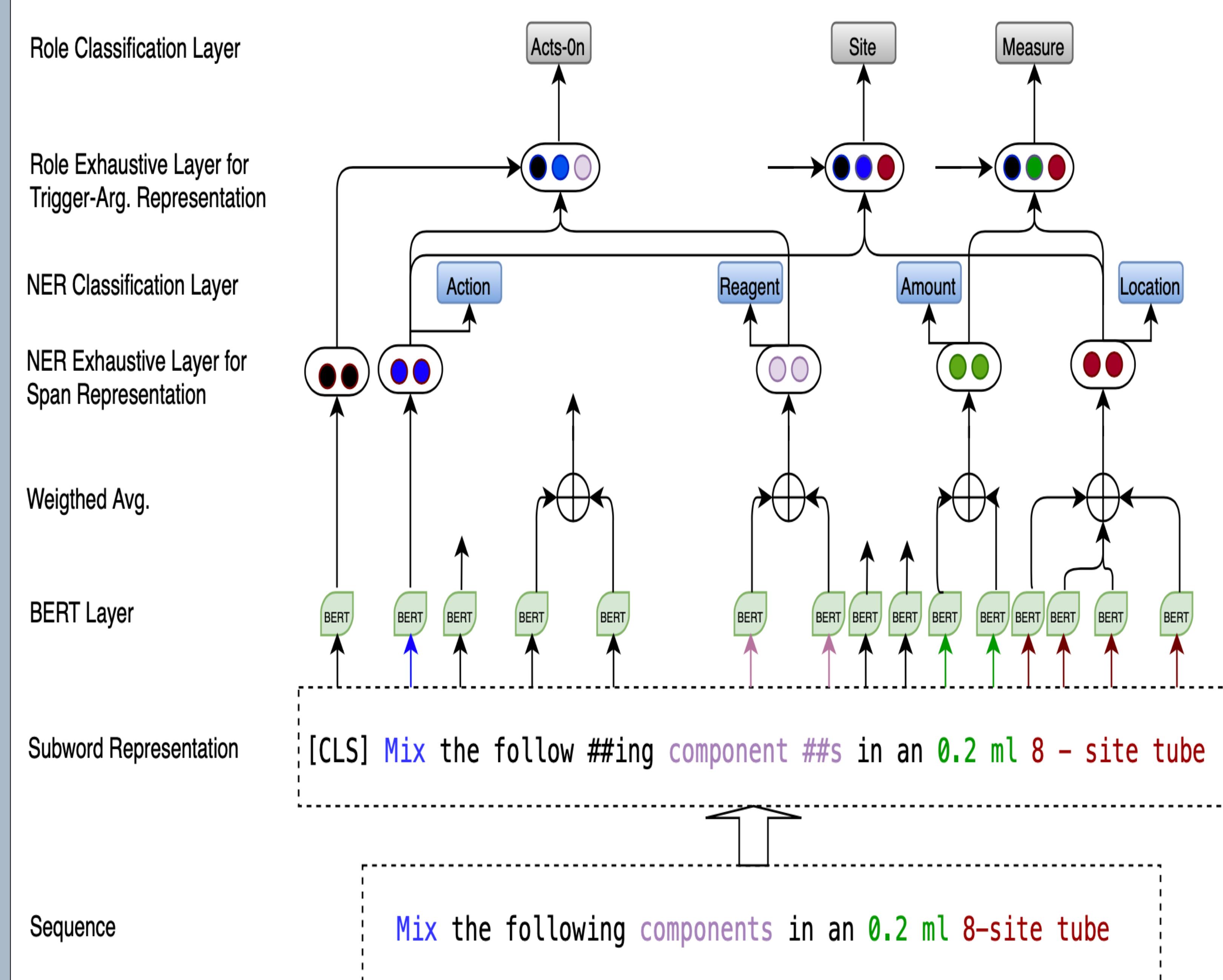
Contribution

- Flat and Nested Entities: by reasoning over all the span within a specified maximum length.
- BERT-based neural approach: to solve entity and relation recognition
- 3rd Rank NER Approach: We achieved the F-score of 76.60%.
- Top System in Relation Recognition System: We achieved the F-score of 80.46%.

Exhaustive Span Representations



NER and RE System Architecture



Experimental Setting

- **WNUT Dataset:** Train(370), Dev(122), Test(123), **Test Release**(111) with eight and fifteen entity and relation types respectively.
- **Framework:** PyTorch and employed official evaluation script
- **Data Processing:** Each text and corresponding annotation file are processed by simple tokenization and restored the original offsets.
- **Learning:** NER and RE models are trained on 100 epochs with learning rate of 0.00003.

Results

NER Performances

• NER Performances on Dev and Test Sets

Learning Approach	Dev: NER			Test: NER		
	P	R	F	P	R	F(%)
Ensemble	83.14	83.28	83.21	83.69	70.62	76.60
PubmedBERT-Merge (Train+dev)	82.04	83.51	82.77	80.59	71.57	75.81
SciBERT-Merge (Train+Dev)	82.47	82.80	82.64	80.79	70.40	75.24
PubmedBERT-Train	82.46	79.23	80.81	83.66	69.59	75.98
SciBERT-Train	80.68	80.46	80.57	80.78	71.70	75.97

• Team Performances of NER on Test Set

Team Name	Exact Match			Partial Match		
	P	R	F	P	R	F(%)
BITEM	84.73	72.25	77.99	88.72	75.66	81.67
PublishInCovid19	81.36	74.12	77.57	85.74	78.11	81.75
mgsohrab	83.69	70.62	76.60	87.95	74.22	80.50
Kabir	78.79	72.20	75.35	83.73	76.73	80.08
IITKGP	77.00	72.93	74.91	81.76	77.43	79.54
BIO-BIO	78.49	71.06	74.59	83.16	75.29	79.03
Fancy Man Launches Zippo	76.21	71.76	73.92	81.15	76.41	78.71
SudeshnaTCS	74.99	71.43	73.16	79.73	75.95	77.80
B-NLP	77.95	63.93	70.25	84.85	69.59	76.46
KaushikAcharya	73.68	63.98	68.48	79.31	68.87	73.73
IBS	74.26	62.55	67.90	79.72	67.15	72.89
DSC-IITISM	64.20	57.07	60.42	68.52	60.90	64.49
mahab	50.19	52.96	51.54	55.09	58.14	56.57

Relation Extraction Performances

• Relation Extraction Performances on Dev and Test Sets

Learning Approach	Dev: RE			Test: RE		
	P	R	F	P	R	F(%)
Ensemble	88.16	86.91	87.53	80.86	80.07	80.46
PubmedBERT-Finetune-Filter	88.59	85.47	87.00	83.03	77.35	80.09
PubmedBERT-Finetune	88.55	85.47	86.99	82.93	77.36	80.05
PubmedBERT-Filter	88.54	84.84	86.65	81.96	75.96	78.84
PubmedBERT	88.50	84.84	86.63	81.92	75.97	78.83
PubmedBERT-Original-Finetune-Filter	87.85	86.36	87.10	78.67	79.03	78.85
PubmedBERT-Original-Finetune	87.85	86.36	87.10	78.59	79.03	78.81
PubmedBERT-Original-Filter	88.09	85.15	86.60	80.36	77.48	78.89
PubmedBERT-Original	88.04	85.15	86.57	80.30	77.48	78.87

• Team Performances of RE on Test Set

Team Name	Relation Extraction		
	P	R	F(%)
mgsohrab	80.86	80.07	80.46
Big Green	45.42	86.54	59.57

• Performances of NER and RE on Different Entity Levels

Entity Level	NER Test-set			RE Test-set		
	P	R	F	P	R	F(%)
All	82.70	71.25	76.55	80.96	80.05	80.50
Single-token	85.43	72.05	78.17	82.95	78.97	80.91
Multi-token	77.73	69.70	73.50	79.01	81.20	80.09

• Performances of NER and RE on Different Models over WNUT

Model	NER			RE		
	P	R	F	P	R	F(%)
WLPC Baseline (Kulkarni et al., 2018)	—	—	78.30	80.98	77.04	78.96
DyGIE (Yi et al., 2019)	—	—	79.50	—	—	*64.10
Our Model	82.83	83.40	83.11	88.75	84.86	86.75

Future Direction

- Joint modeling to solve NER and RE in an end-to-end manner.