

Effective Use of Graph Convolution Network and Contextual Sub-tree for Commodity

News Event Extraction

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BACKGROUND

Event extraction task as defined in ACE2005:

1. Event **Trigger** extraction - identifying and classifying event triggers.
2. Event **Arguments** extraction - identifying arguments of event triggers and labeling their roles.



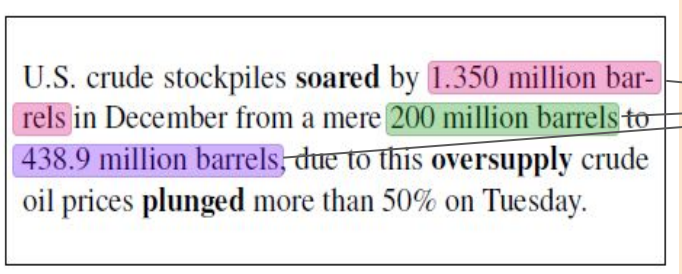
Event	Entity Mention	Argument Role
Trigger: soared	U.S.	Supplier
	crude	Item
	stockpiles	Attribute
	1.350 million barrels	Difference
Event type: movement	December	Reference point
	200 million barrels	Initial Value
	438.9 million barrels	Final Value
	more than 50%	NONE

Useful for:

1. Event sequences & narrative progression
2. Commodity Price Prediction

CHALLENGES:

- (1) sentences containing **lots of numerical information** such as price, percentage of change and dates,
- (2) **entities of similar type** playing distinctly different argument roles,
- (3) the need for accurate arguments extraction to **disambiguate events**.



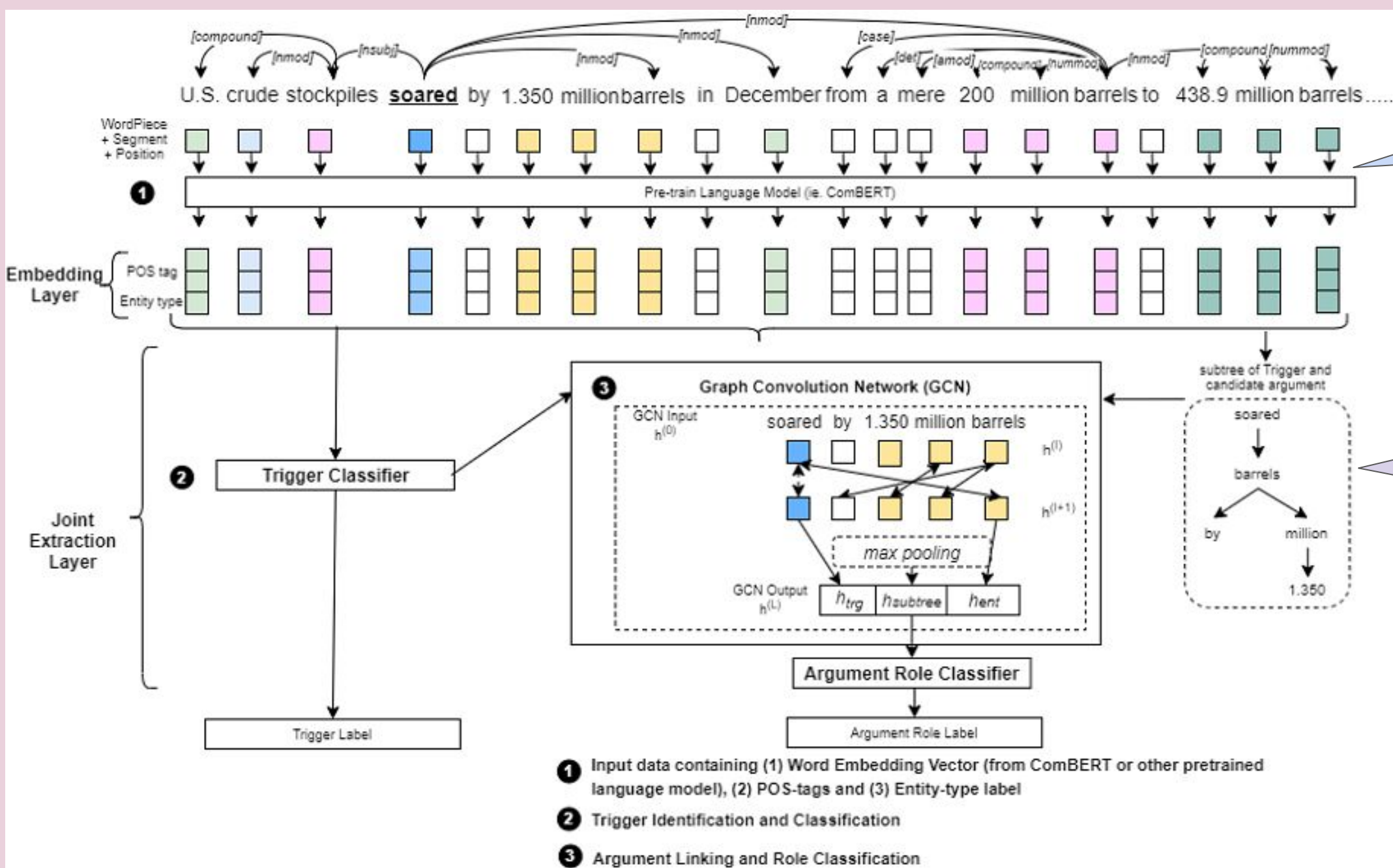
Quantity

Question:

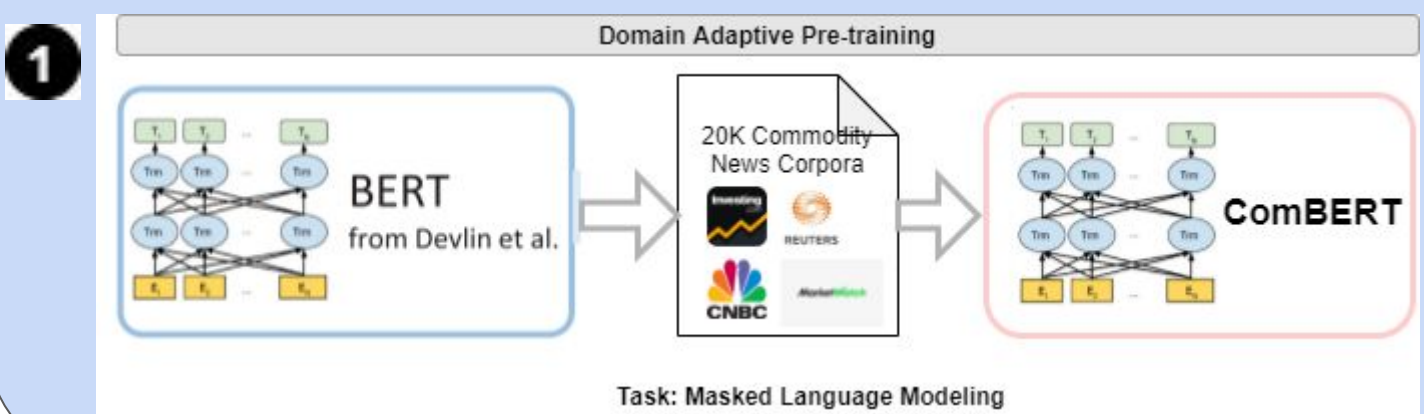
How to we label each 'Quantity' to the right argument role?

PROPOSED SOLUTION - MODEL ARCHITECTURE

Graph Convolutional Network (GCN) with dependency sub-tree- leverage on syntactic information of dependency parse tree to overcome the challenges highlighted above.



ComBERT - DOMAIN-ADAPTIVE PRE-TRAINING

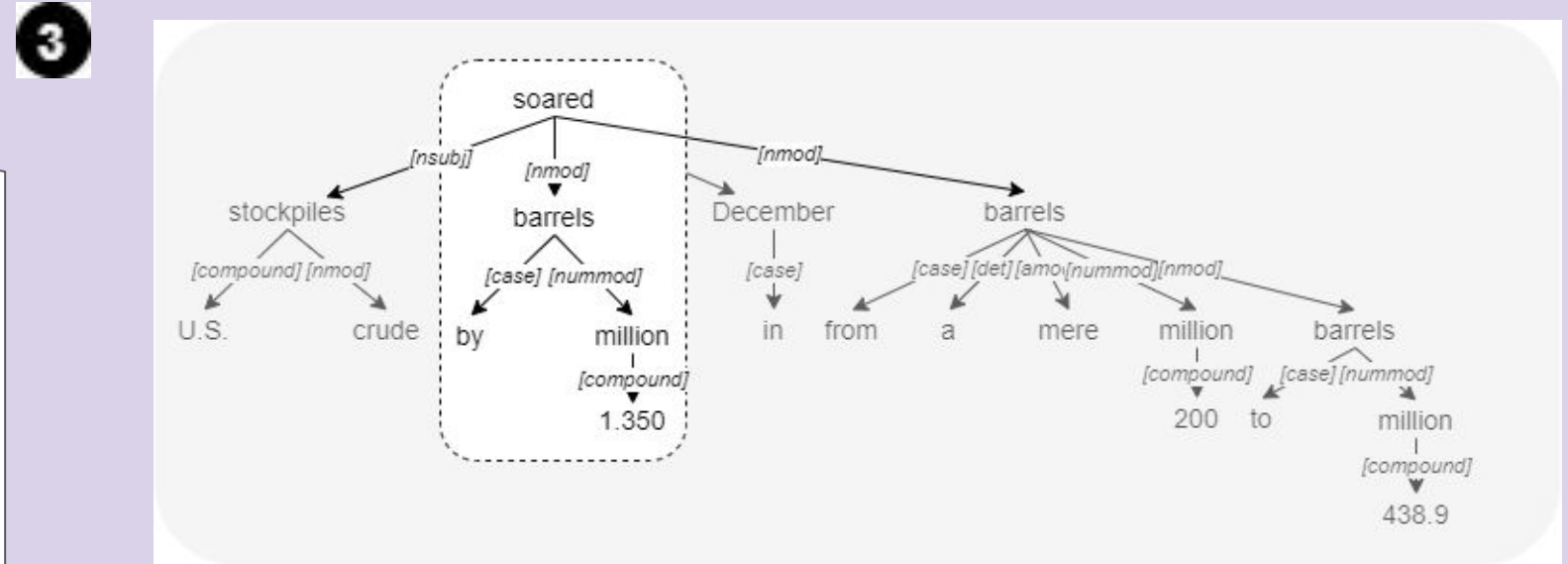


ComBERT further differentiates polysemous words within commodity news:

- **stocks**: (1) inventory and (2) shares
- **tank**: (1) storage vessel (noun) and (2) market/price drop (verb)
- **appreciates**: (1) recognize the full worth of and (2) increase in value.

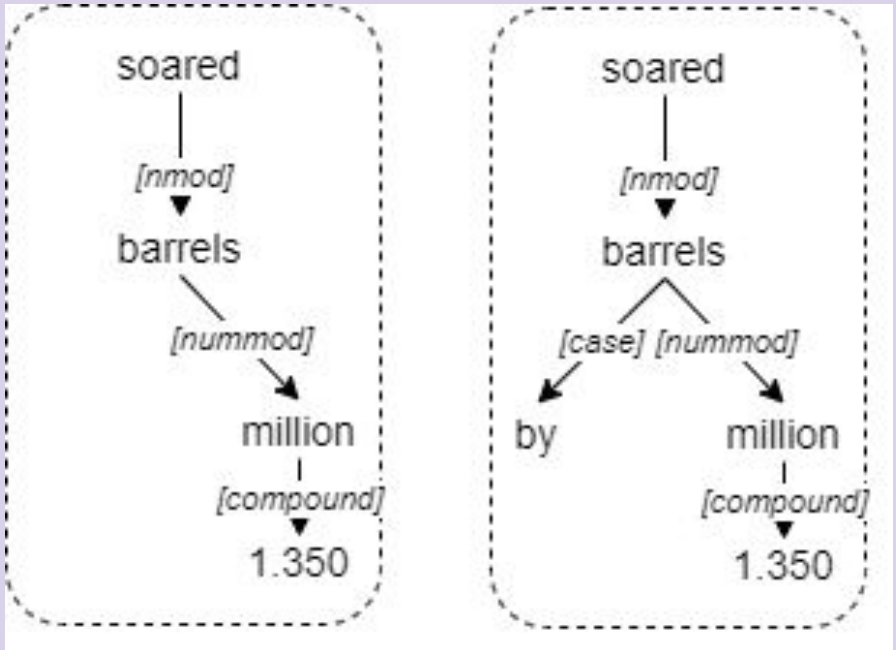
CONTEXTUAL SUB-TREE

Contextual Sub-tree is pruned dependency parse tree of **shortest path** between **candidate trigger** and **candidate argument** but also contains **off-path information** of distance DIST away from the shortest path.



The dependency parse tree of the given example

pruned



Left: Sub-tree with shortest path

Right: Sub-tree with off-path information DIST =1

RESULTS

Argument Roles	Entity Type	Argument Role Classification F1 Score				
		Model A	Model B	Model C	Model D	Model E
NONE	-	0.84	0.84	0.90	0.91	0.94
Attribute	Financial Attribute	0.40	0.65	0.79	0.75	0.83
Item	Economic Item	0.64	0.85	0.88	0.85	0.88
Final_value ♣	Money / Production unit / Price unit / Percentage / Quantity	0.43	0.39	0.71	0.75	0.79
Initial_value ♣	Money / Production unit / Price unit / Percentage / Quantity	0.56	0.56	0.73	0.69	0.77
Difference ♣	Money / Production unit / Price unit / Percentage / Quantity	0.58	0.69	0.84	0.89	0.89
Reference_point ◇	Date	0.54	0.69	0.80	0.71	0.80
Initial_reference_point ◇	Date	0.40	0.63	0.63	0.60	0.66
Contract_date ◇	Date	0.52	0.54	0.70	0.66	0.80

Duration	Duration	0.55	0.55	0.75	0.82	0.84
Type	Location	0.52	0.59	0.70	0.68	0.76
Imposer ♠	Country / State or province	0.71	0.69	0.81	0.79	0.81
Imposee ♠	Country / State or province	0.50	0.49	0.60	0.68	0.68
Place ♠	Country / State or province	0.58	0.69	0.74	0.60	0.74
Supplier_consumer ♠	Country / State or province / Nationality / Group	0.49	0.71	0.73	0.73	0.79
Impacted_countries ♠	Country	0.42	0.69	0.72	0.70	0.76
Participating_countries ♠	Country	0.65	0.75	0.78	0.83	0.89
Forecaster	Organization / Group	0.62	0.75	0.78	0.80	0.82
Forecast	Forecast_Target	0.61	0.61	0.83	0.67	0.91
Situation	Phenomenon / Other activities	0.57	0.69	0.73	0.67	0.66

F1-scores Argument role classification (Model E is proposed solution).

ANALYSIS

- Contextual sub-tree produced better results both overall and also at argument role classification subtask.
- Higher F1 scores in classifying entities of the same type to the right argument role.

Group of Entities with same Entity type but plays different argument roles:

- ♣ Money / Price unit, production unit
- ◇ Date
- ♠ Country

CONCLUSIONS

Proposed solution, which out-performs existing methods with F1 scores as high as 0.90. ComBERT outperforms GloVe by 23%, and BERT and RoBERTa by 7% in argument roles classification.