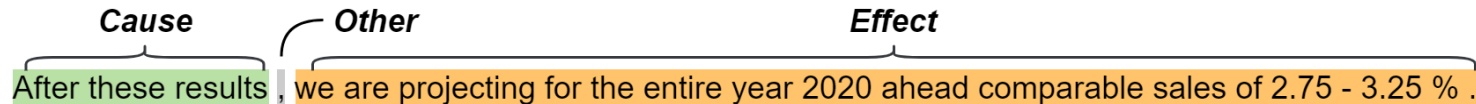


# NUS-IDS at FinCausal 2021: Dependency Tree in Graph Neural Network for Better Cause-Effect Span Detection

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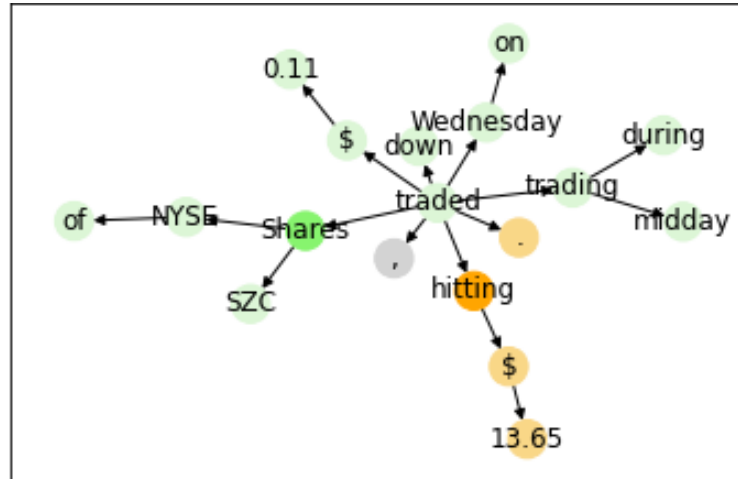
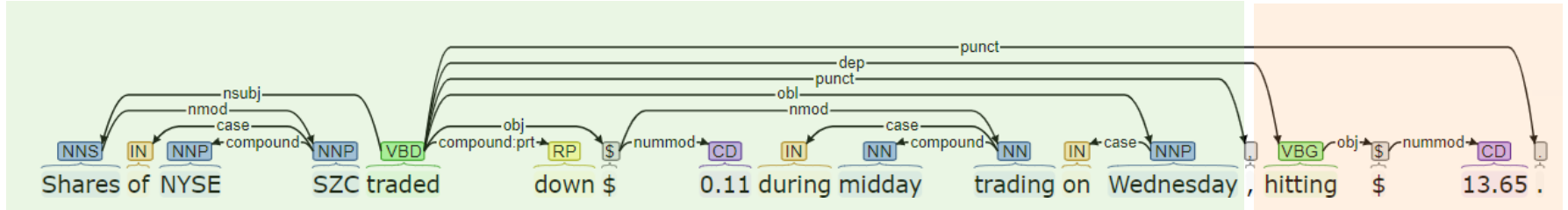
# Cause-Effect Span Detection aims to identify the *Cause* and *Effect* spans in text.



# MOTIVATION

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## Dependency parsing can help identify arguments in a sentence.

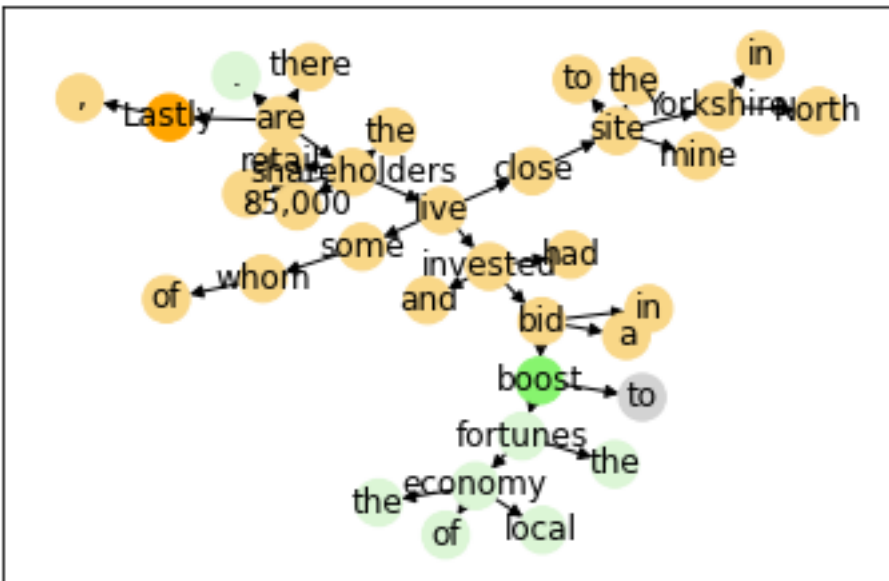
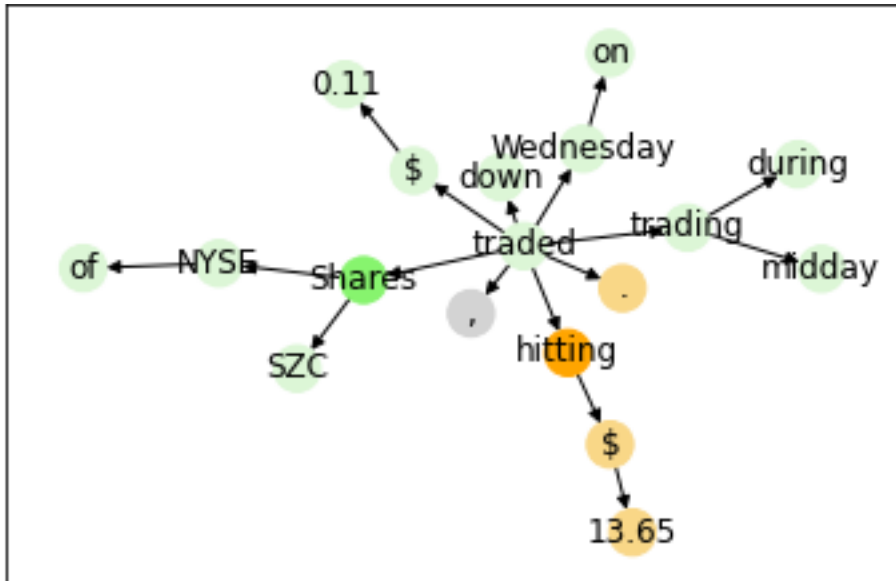


Cause Effect Other

## We include dependency tree features into our model via graph neural network.

Shares of NYSE SZC traded down \$0.11 during midday trading on Wednesday, hitting \$13.65.

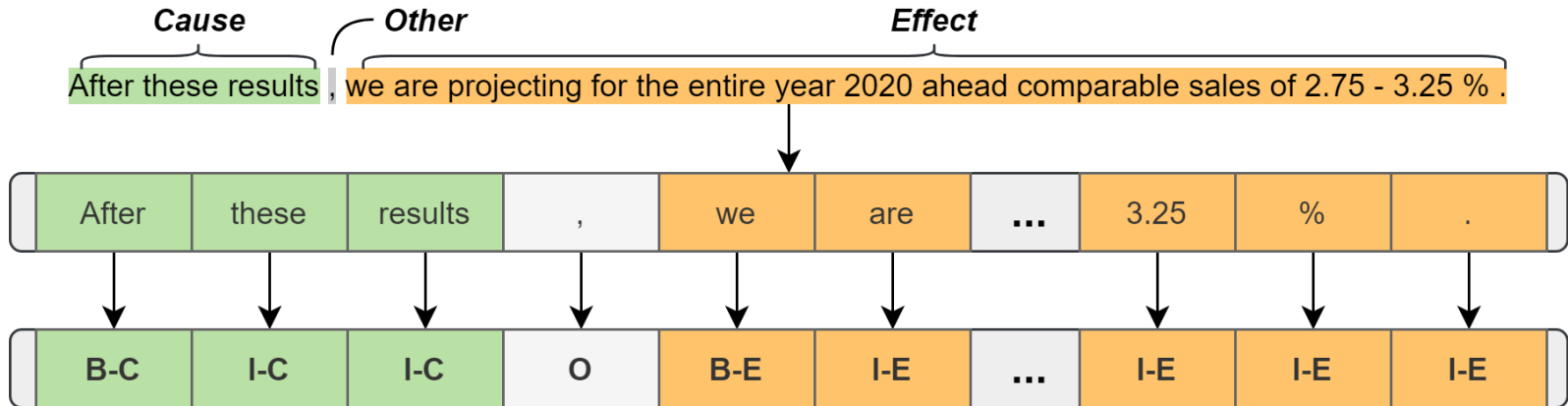
Lastly, there are the 85,000 retail shareholders, some of whom live close to the mine site in North Yorkshire and had invested in a bid to boost the fortunes of the local economy.



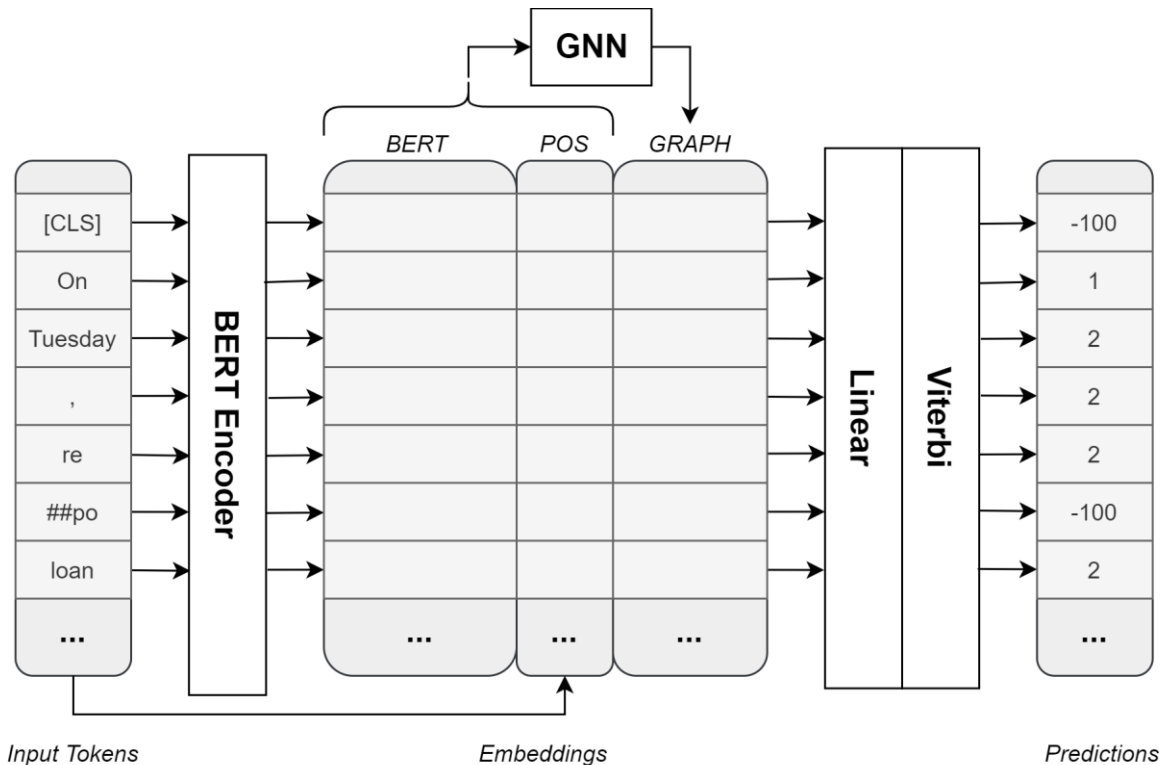
## OUR APPROACH

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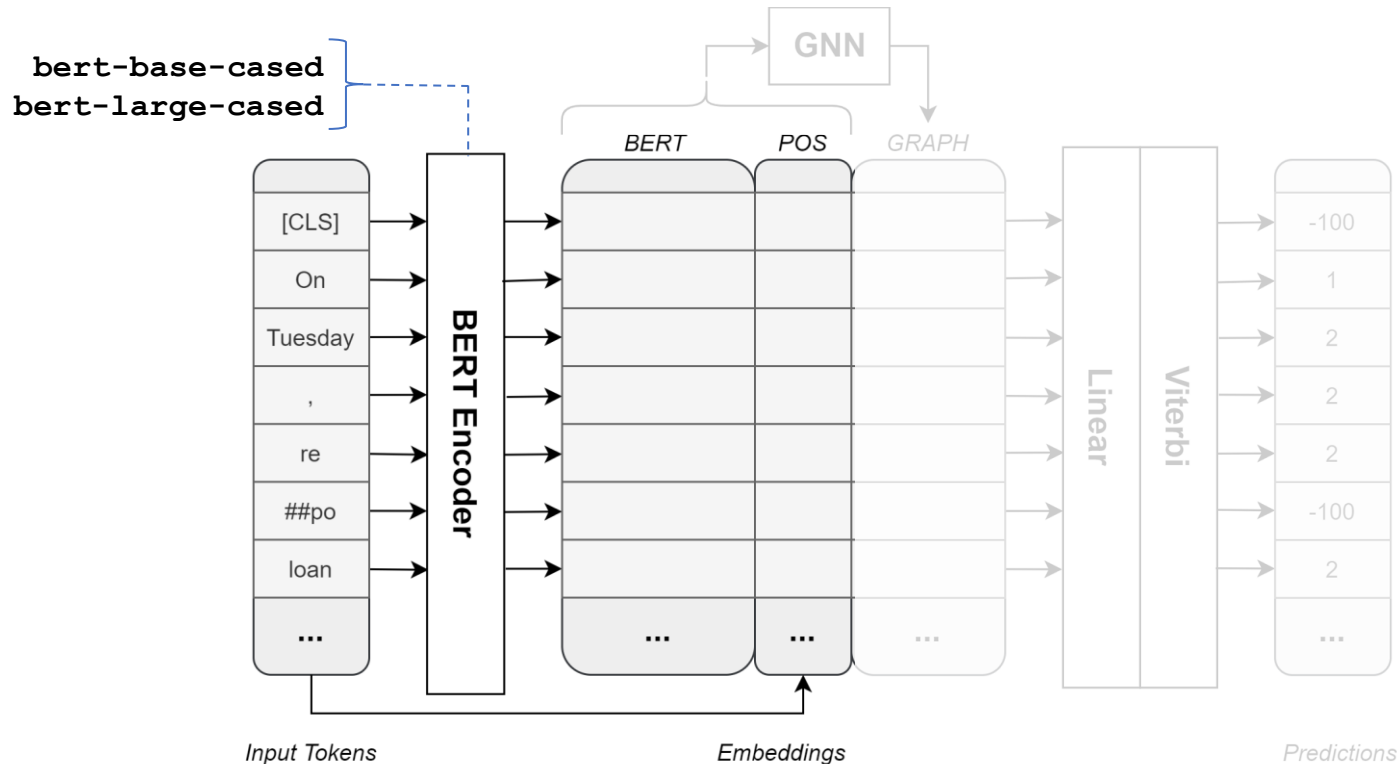
# We converted the span detection task into a token classification task.



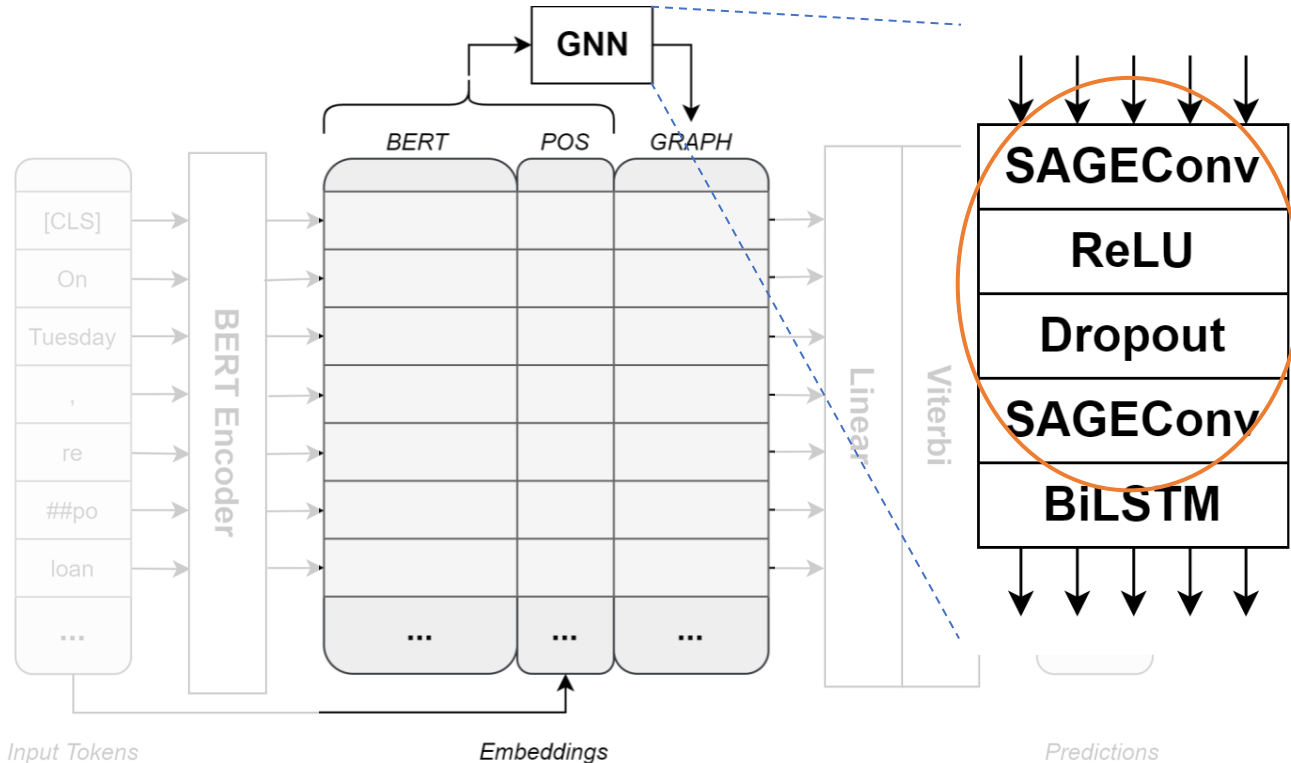
# Our model builds on a baseline BERT token classifier with Viterbi decoding.



# We experimented with two pretrained BERT language models to encode texts.



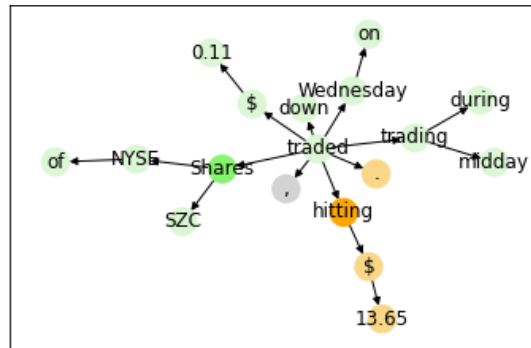
# We incorporate dependency relations via a graph neural network (GNN) to obtain graph embeddings.



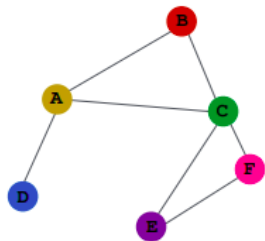


# GCN utilizes node attributes to construct representations.

- **Nodes:** BERT+POS embeddings
- **Edges:** Dependency relations



$$h_v^{(l+1)} = \sigma(W_l \sum_{u \in N(v)} \frac{h_u^{(l)}}{|N(v)|} + B_l h_v^{(l)})$$



INPUT GRAPH

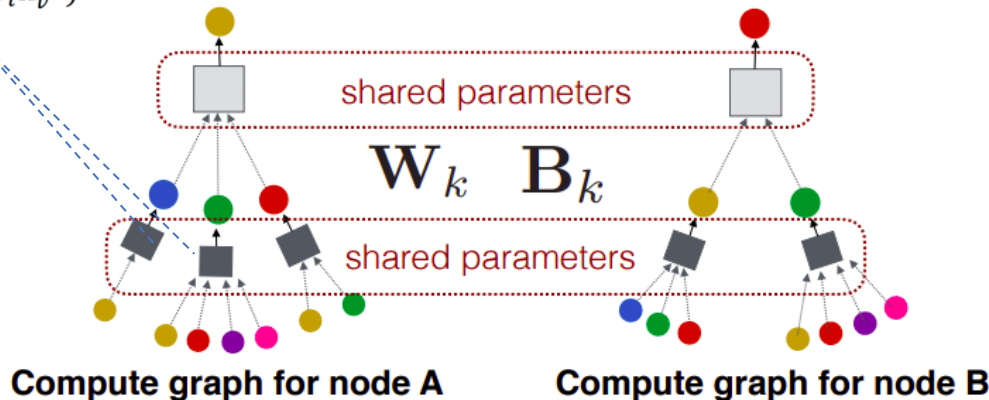
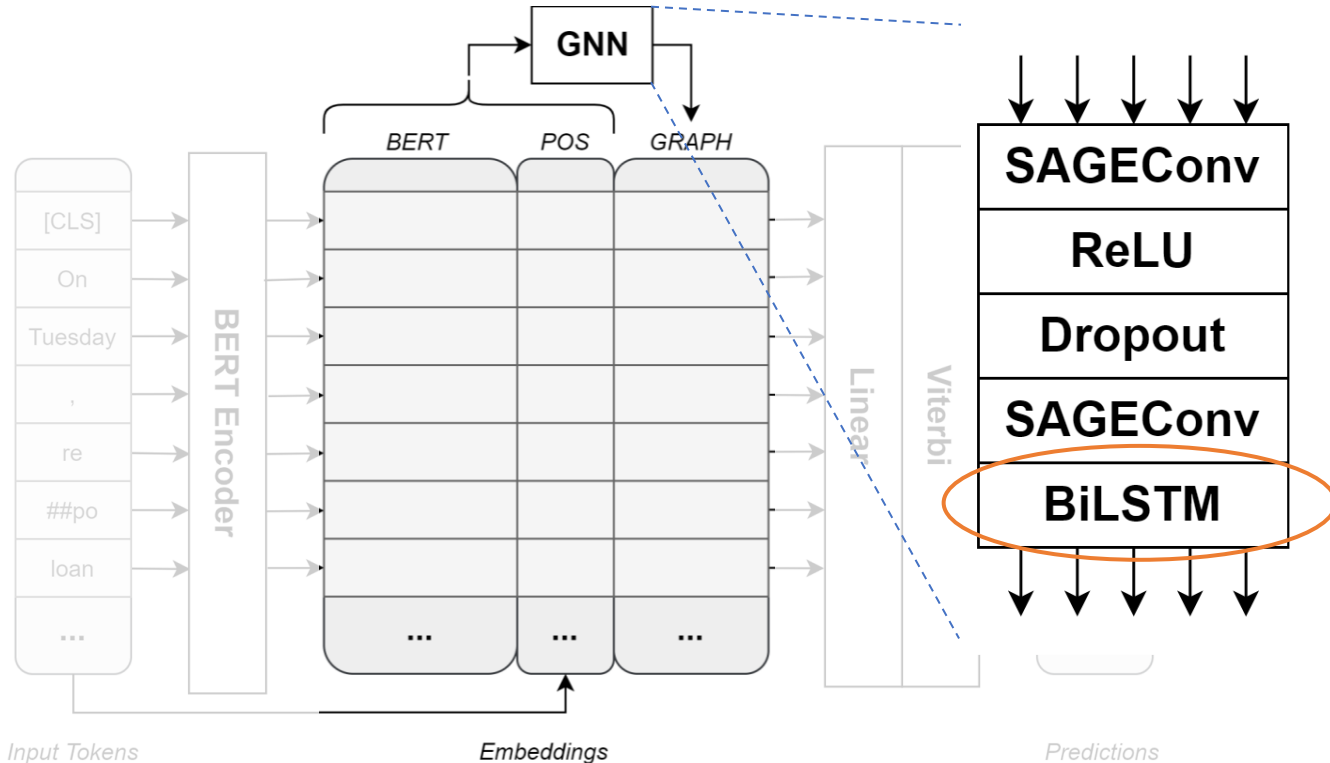
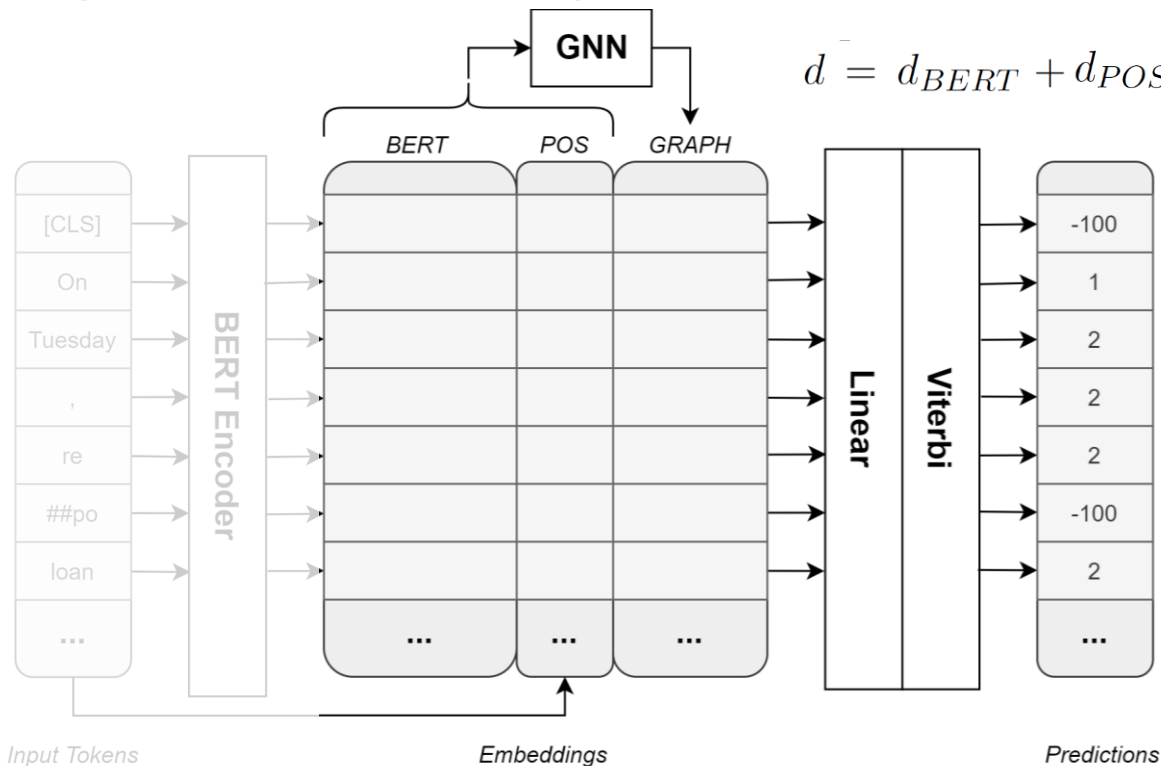


Image Source: <https://dsgittr.com/blogs/graphsage/>

# We incorporate dependency relations via a graph neural network (GNN) to obtain graph embeddings.



# Graph representations are concatenated with other embeddings before feeding to a classifier.



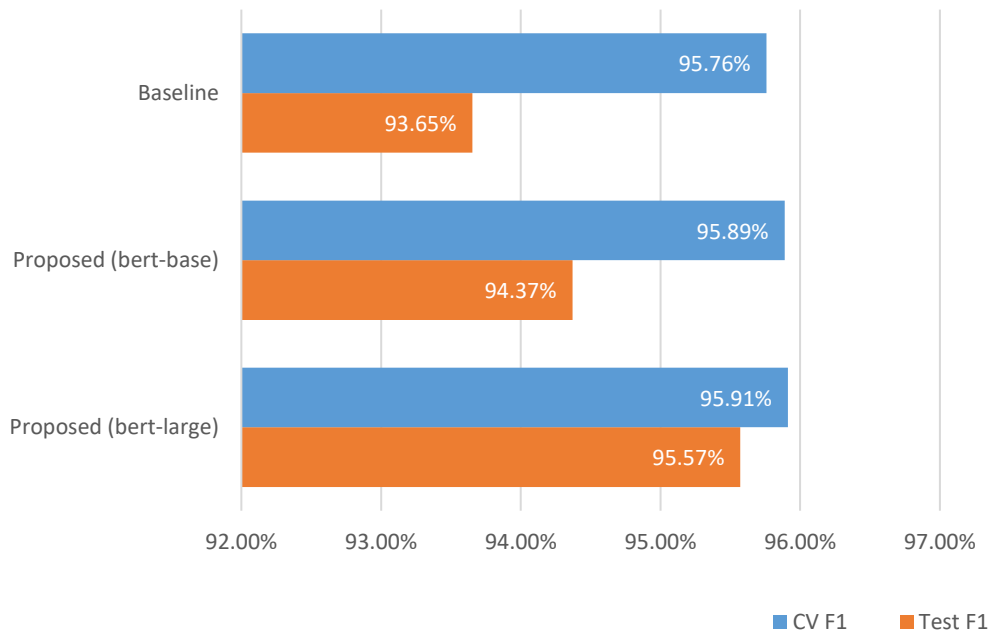
$$d = d_{BERT} + d_{POS} + d_{GNN}$$

## RESULTS

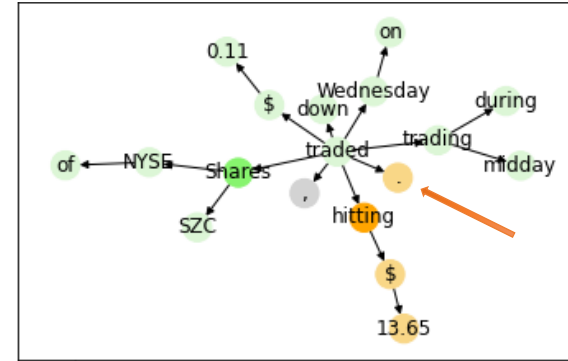
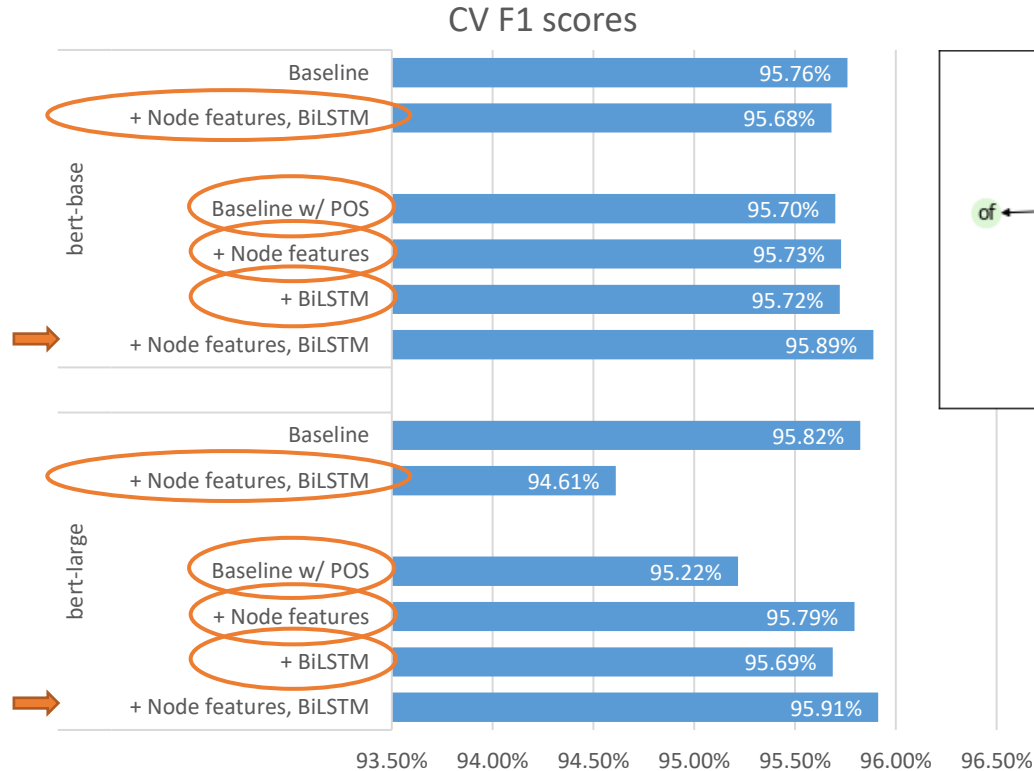
10

# Our model outperforms the baseline in cross-validation and during the competition.

Main results: F1 scores



# POS features, node features, and BiLSTM layer are all important components in our Proposed model.



Index	Baseline	Proposed	Right?
0036 .000 11	<E>Future sales agreements with suppliers increased during the period, and aggregate contracted sales volumes are now 11.7m tonnes per annum</E>, following <C>new European supply agreements.</C>	<C>Future sales agreements with suppliers increased during the period, and</C> <E>aggregate contracted sales volumes are now 11.7m tonnes per annum</E>, following new European supply agreements.	Baseline
0270 .000 09	<E> It comes with a £250 free overdraft and requires a £1,000 monthly deposit</E> to <C>avoid a £10 monthly fee.</C>	<C>It comes with a £250 free overdraft</C> and requires a £1,000 monthly deposit to <E>avoid a £10 monthly fee.</E>	Baseline
0209 .000 33	<C>Fiserv believes that this business combination makes sense from the complementary assets between the two companies, projecting higher revenue growth than</C> <E>it would achieve on its own and costs savings of about \$900 million over five years.</E>	<C>Fiserv believes that this business combination makes sense from the complementary assets between the two companies</C>, <E>projecting higher revenue growth than it would achieve on its own and costs savings of about \$900 million over five years.</E>	Proposed
0003 .000 19	<E>Additionally, the Congress provided \$125 million in the current fiscal year for sustainable landscapes programming</E> to <C>prevent forest loss.</C>	<E>Additionally, the Congress provided \$125 million in the current fiscal year</E> for <C>sustainable landscapes programming to prevent forest loss.</C>	Proposed

Table 3: Predicted Cause-Effect spans for CV set from  $seed = 916$  on first fold (i.e.  $K0$ ). *Notes.* Cause and Effect spans highlighted in green and orange respectively.



# Thank you.

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**<https://github.com/tanfiona/CauseEffectDetection>**