Natural Language Inference

By Jack Pay & Dennis Kiselev

Introduction

- **Two models** were developed to solve Natural Language Inference (**NLI**), the task of assessing whether a premise semantically supports a hypothesis
- Method B focused on using RNNs whilst C finetuned pretrained Transformer architectures

Methods

- Method B:
  - Trained a **Bi-LSTM** with frozen **XLNET** embeddings
  - Utilised **learning rate scheduling** to approach a global optimum
    - LR was reduced on metric plateau
  - Employed **subtractive & multiplicative sentence fusion**, & **attention** to enhance sentence representations
- Method C:
  - Finetuned the base **ROBERTA** Transformer model
  - Employed **data augmentation** to bolster the training data:
    - Synonym replacements & insertions
    - Word deletions & swaps
  - Used **early stopping** and LR scheduling to reduce overfitting
    - LR warmup and then decreasing was used

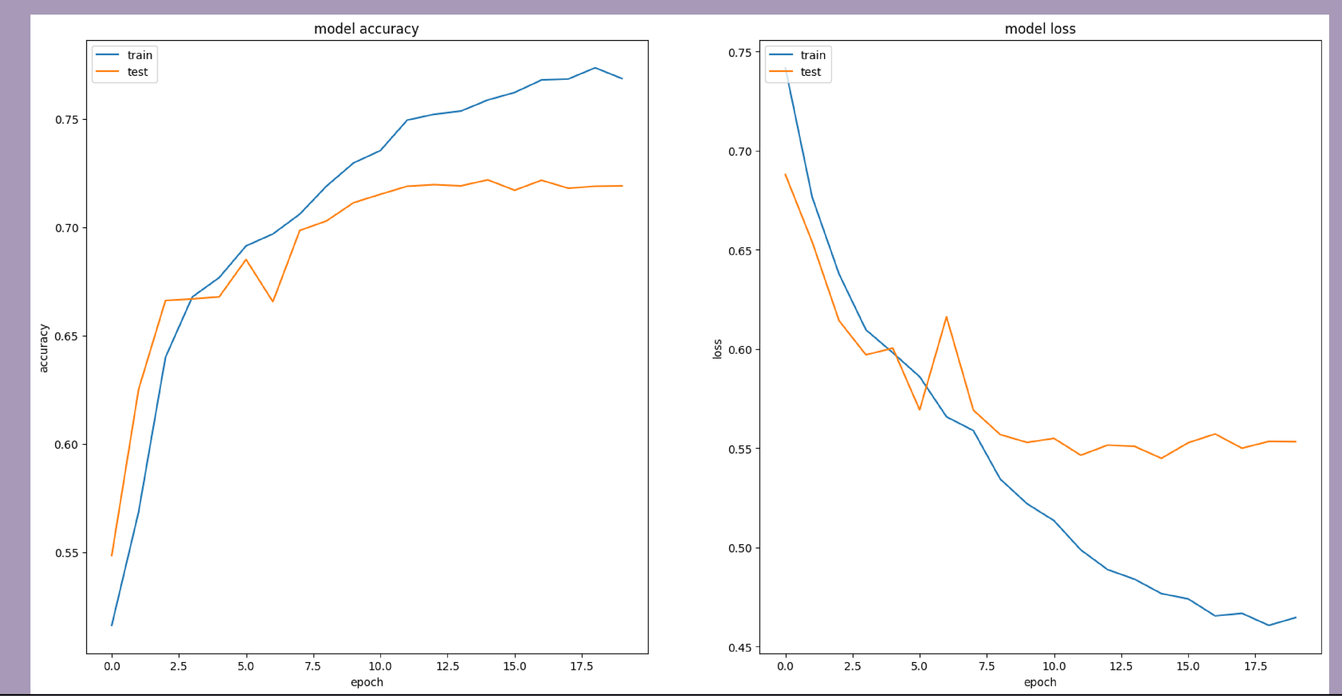
Conclusions

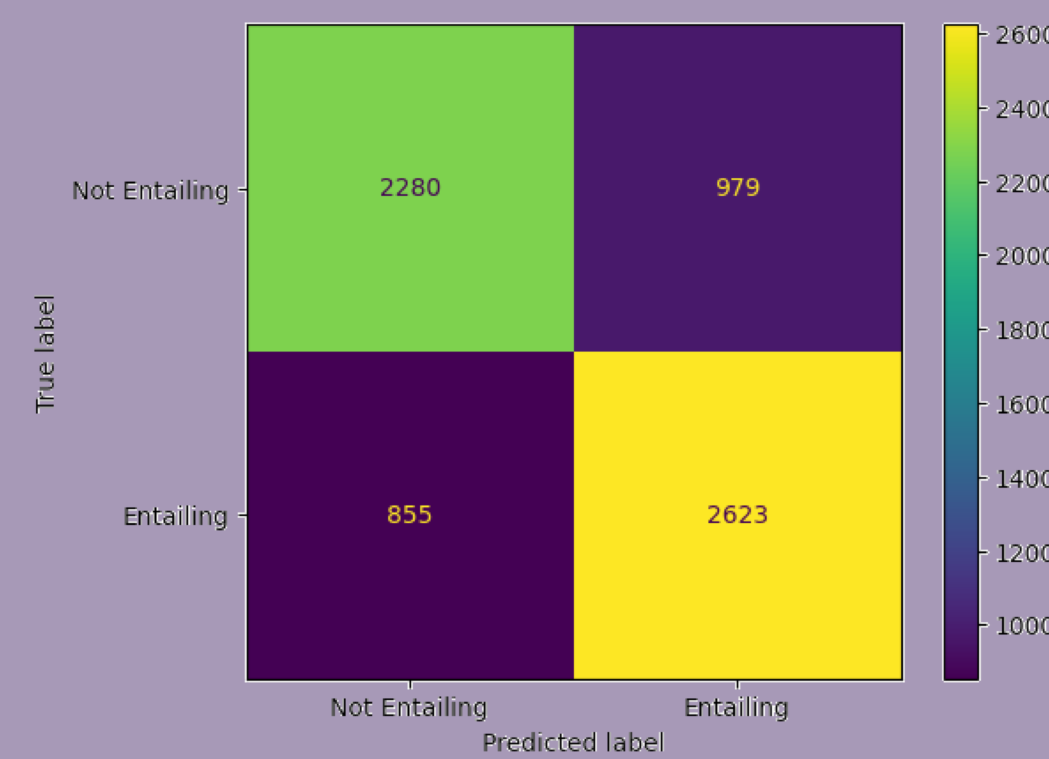
- **Pretrained word embeddings** are key to higher performance
- **Transformers** achieve a **higher performance** but also loss, compared with RNNs
  - Likely due to low output scores from RNNs
- Basic textual augmentations do not significantly improve performance

References

- S. Zhang, S. Liu and M. Liu, "Natural language inference using LSTM model with sentence fusion," 2017 36th Chinese Control Conference (CCC), Dalian, China, 2017, pp. 11081-11085, doi: 10.23919/ChiCC.2017.8029126
- Tarunesh, Ishan, Somak Aditya, and Monojit Choudhury. "Trusting roberta over bert: Insights from checklisting the natural language inference task." arXiv preprint arXiv:2107.07229 (2021).
- Sadat, Mobashir, and Cornelia Caragea. "Scinli: A corpus for natural language inference on scientific text." arXiv preprint arXiv:2203.06728 (2022).

Task B: Figures

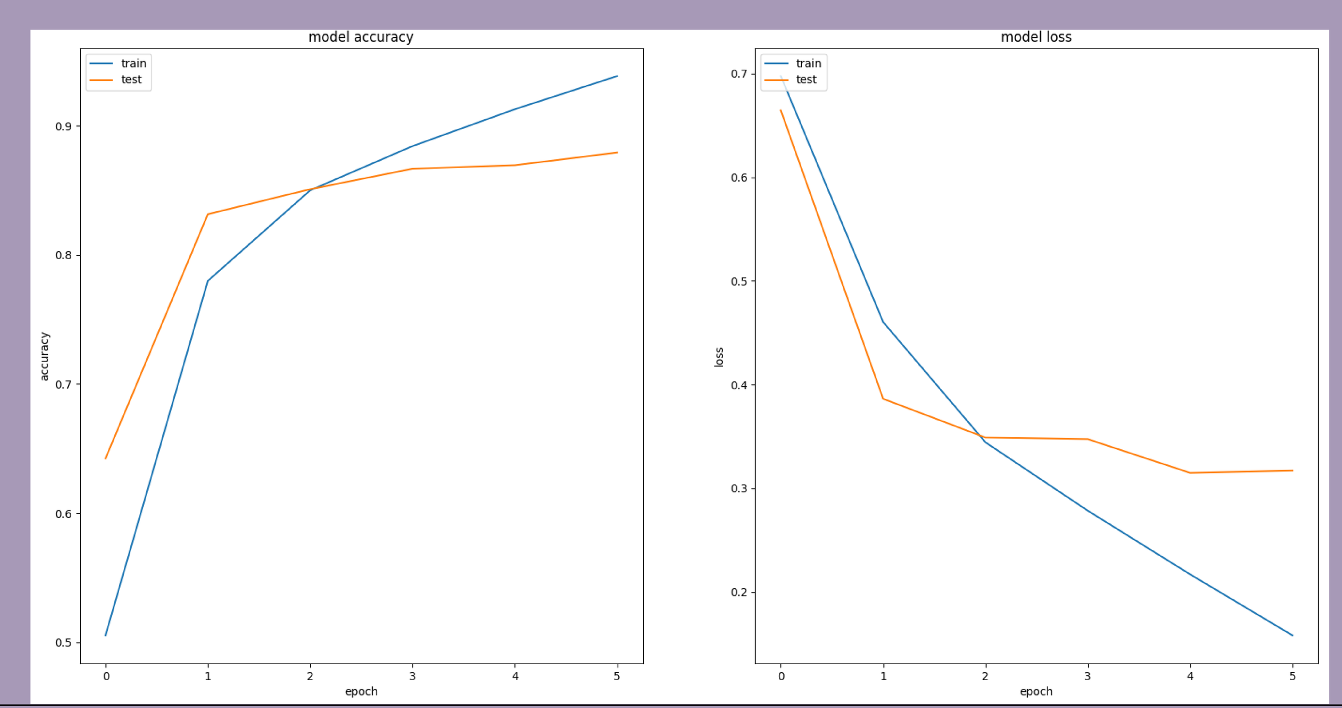


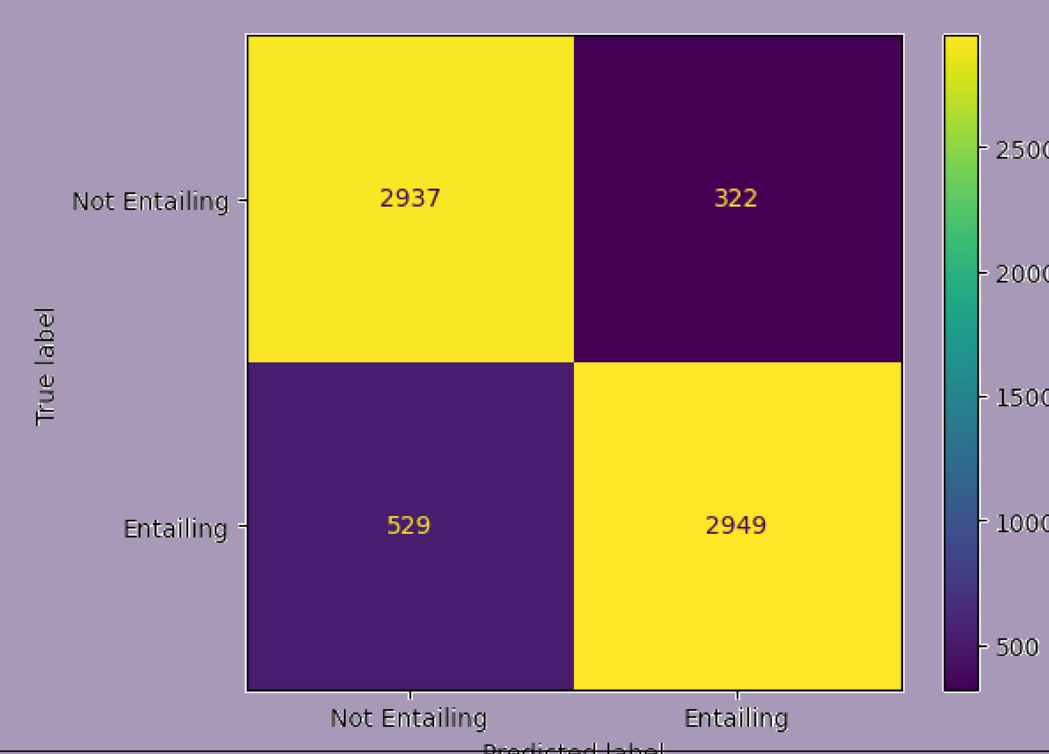


Predictions with the Highest Loss

Loss	Premise	Hypothesis
11.88	He was the first scholar to describe in detail.	He was the first scholar to describe in detail and document the long-term cyclical relationship between global population cycles and cycles of political rebellion and revolution.
6.59	La Barredora ("The Sweeper Truck") is a criminal gang based in the Mexican resort city of Acapulco, Guerrero and its surrounding territories.	La Barredora ("The Sweeper Truck") is a criminal gang based in the Mexican resort city of Acapulco, City and County of Denver and its surrounding territories.
5.58	Traditional examples of background music include music played at various social gatherings and music played in certain retail venues.	Traditional examples of background music include music played at same social gatherings and music played in certain retail venues.

Task C: Figures





Predictions with the Highest Loss

Loss	Premise	Hypothesis
16.12	The traditional word for the API is pharmacon from Greek : : Ï†Î¬ÏÎ¼Î±ÎºÎ¿Î½, adapted from pharmacos which originally denoted a magical substance or drug.	The traditional word for the API is pharmacon or pharmakon (from Greek: Ï†Î¬ÏÎ¼Î±ÎºÎ¿Î½ , adapted from pharmacos) which originally denoted a magical substance or drug.
16.12	She received basic training in music when her mother used to take her ' masterji ' for training.	She received basic training in music when her mother used to take her to a Hindustani music teacher or 'masterji' for training.
16.12	Mon Dieu!	This person is speaking English.

Optimal Results

Method	Accuracy	Precision	Macro Precision	Weighted Macro Precision	Recall	Macro Recall	Weighted Macro Recall	F1-Score	Macro F1-Score	Weighted Macro F1-Score	MCC	Loss
B	0.728	0.728	0.728	0.728	0.754	0.727	0.728	0.741	0.727	0.728	0.455	0.535
C	0.874	0.902	0.874	0.875	0.848	0.875	0.874	0.874	0.874	0.874	0.749	1.849