Choice of Plausible Alternatives

SuperGLUE

Li, Yansong; Qu, Shuzheng; Su, Xuanyu;
Yang, Siyuan; Linkletter, Maurice

uOttawa

SUMMARY

- We chose to do one of the SuperGLUE tasks
- Task: Choice of Plausible Alternatives (COPA)
- Our approach is based on the BERT language model
- BERT is an open source language model created by Google
- We have improved our model's accuracy from 60.4% to 74.7% using an Agile development process.
- By pre-training our model on a large set of MultiNLI data we have been able to improve our model's accuracy by 2%
- For future work we would like to use RoBERTa rather than BERT.

SuperGLUE

https://super.gluebenchmark.com/

COPA

Choice of Plausible Alternatives (COPA)

- The COPA task provides researchers with a tool for assessing progress in open-domain common-sense causal reasoning.
- COPA consists of 1000 questions, split equally into development and test sets of 500 questions each.
- Each question is composed of a premise and two alternatives, where the task is to select the alternative that more plausibly has a causal relation with the premise.
- The correct alternative is randomized so that the expected performance of randomly guessing is 50%.

COPA example:

Premise: The man broke his toe. **Type:** Cause
Alternative 1: He got a hole in his sock.
Alternative 2: He dropped a hammer on his foot.

Premise: I tipped the bottle. **Type:** Effect
Alternative 1: The liquid in the bottle froze.
Alternative 2: The liquid in the bottle poured out.

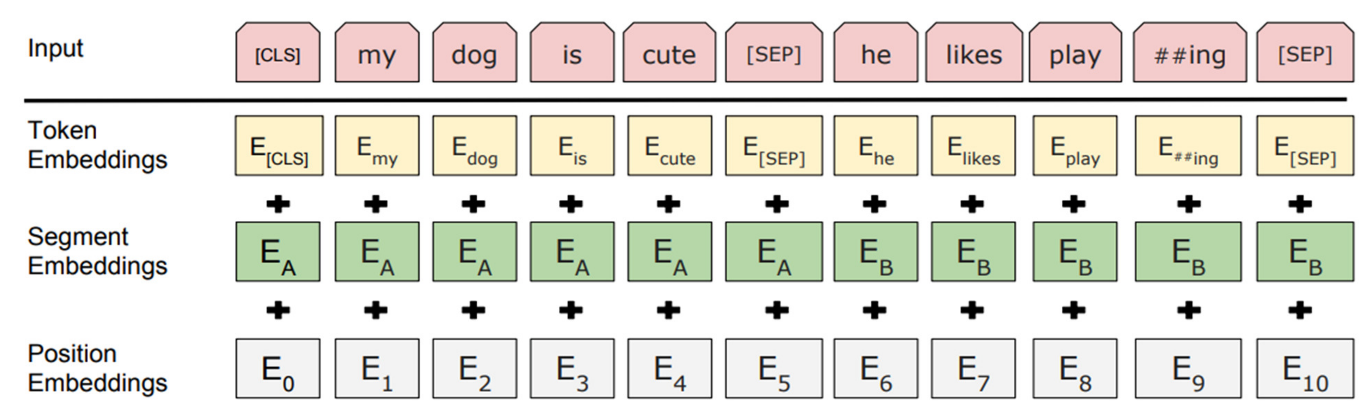
Premise: I knocked on my neighbor's door. **Type:** Effect
Alternative 1: My neighbor invited me in.
Alternative 2: My neighbor left his house.

OUR APPROACH

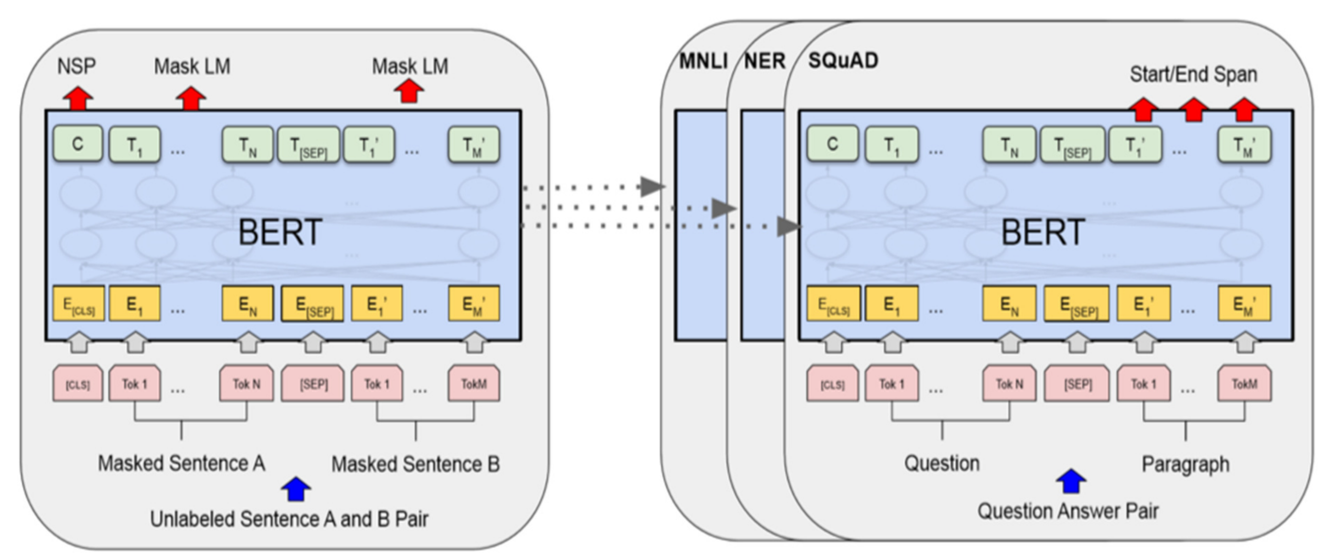
- We researched current state-of-the-art approaches for the COPA task.
- We chose to base our implementation on BERT $_{base}$ pre-trained Language model [3].
- We performed data pre-processing to add additional categorization to our training and evaluation data.
- Our model is comprised of 4 major components.
  - Data pre-processing
  - Linear Transformation layer
  - BERT language model layer(s).
  - A classification layer (learned matrices of weights and biases) with a Softmax output.
- Used an Agile Development process to iterate on our model's implementation.
- Using this Agile process we have been able to increase our model's accuracy from **60.40%** to **74.70%.**
- Generated an additional 10,000 pieces of training data from the MultiNLI dataset [4][2]
- Using the MultiNLI training data we were able to improve our model's accuracy from **72.7%** to **74.7%.**
- We are also attempting to improve our model's accuracy by use WordNet as a in-memory model in data pre-processing. ***This is a work-in-progress and a stretch goal for the project.***

BERT

- BERT (Bidirectional Encoder Representations from Transformers) is an open source language model created by Google.
- Input representation can be composed of three-part Embedding summation [3].

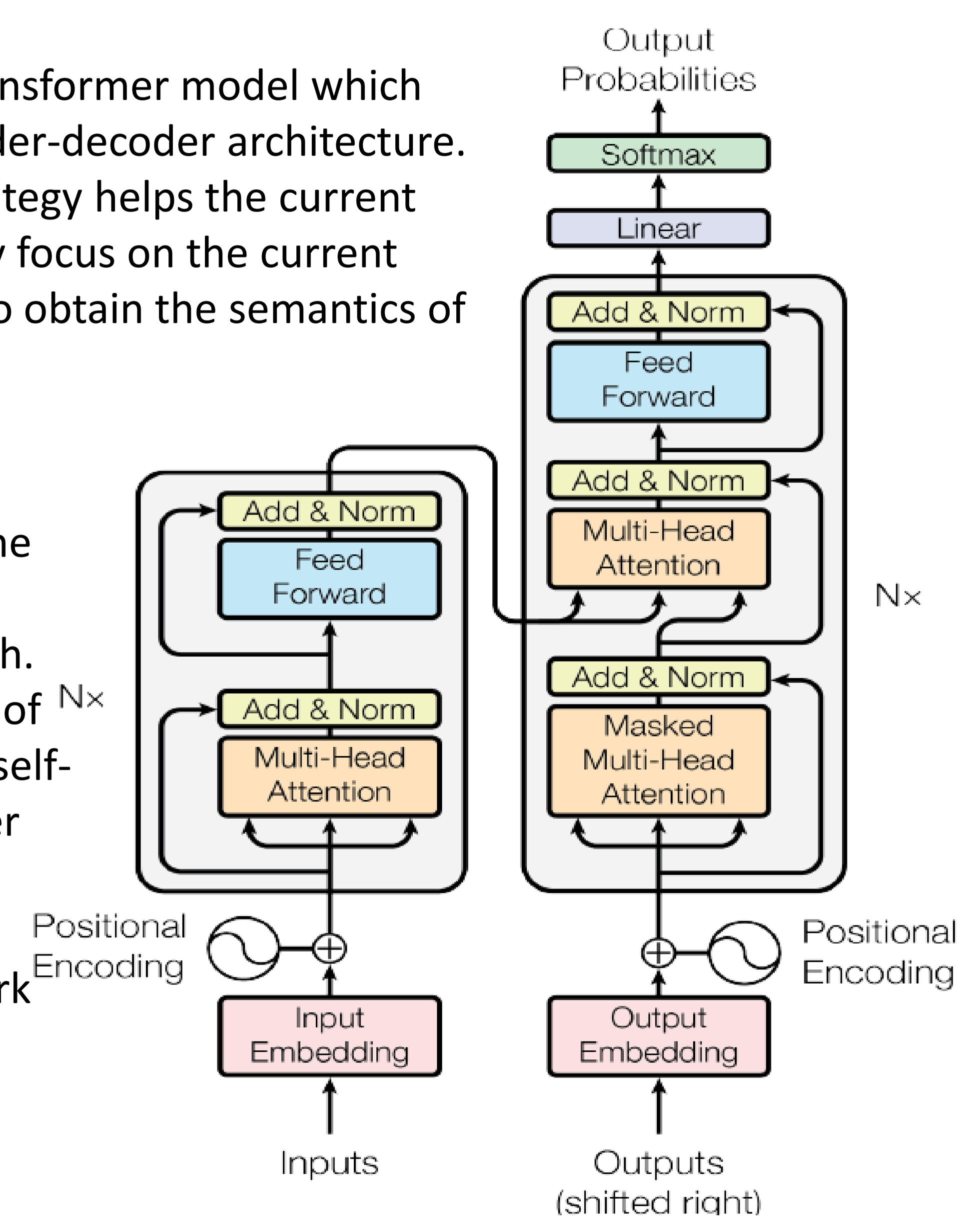


- Pre-training: trained on unlabeled data (unsupervised learning);
- Fine-Tuning: using labeled data from the downstream tasks (COPA).

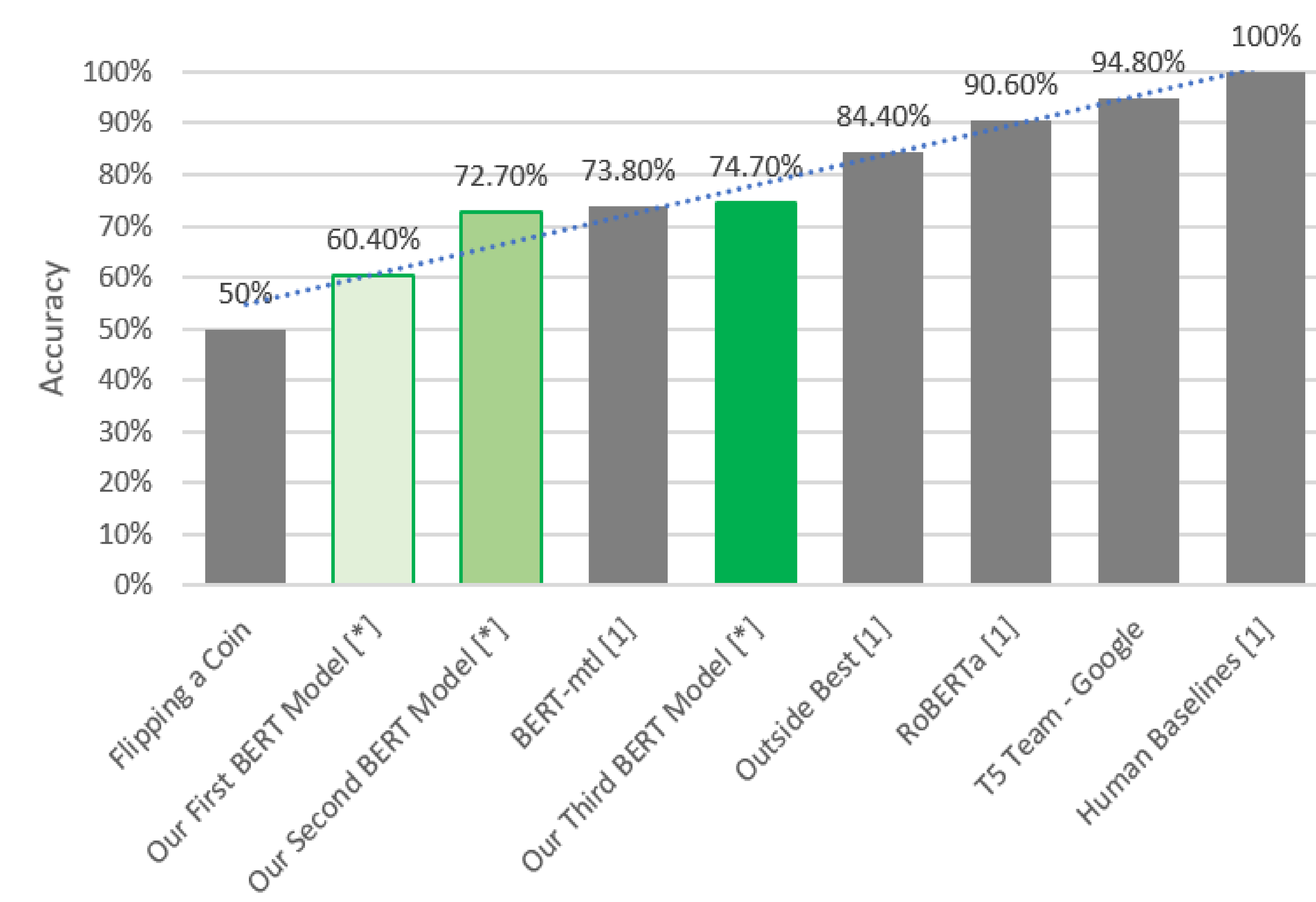


Pre-training Fine-Tuning

- BERT uses transformer model which has the encoder-decoder architecture.
- Attention strategy helps the current node not only focus on the current word, but also obtain the semantics of the context.
- Both encoder and decoder share the same number in network depth.
- Both consists of two layers, a self-attention layer and a feedforward neural network



RESULTS



** Our model's accuracy is based on the average accuracy of 10 consecutive experiments using the same hyper-parameter configuration.*

CONCLUSION

- By pre-training our model with MultiNLI[4][2] data and then fine-tuning on the COPA data our BERT model obtained an accuracy of 74.7% on the COPA task.
- By using an Agile Development process we have been able to rapidly improve our model's accuracy.
- For future work we would like to continue looking at ways to use WordNet, as an in-memory model, in our data pre-processing step.
- Can we uses WordNet's text similarity to enrich our COPA sentence and help our model learn/extract common-sense reasoning?
- For future work we would also consider using the RoBERTa pre-trained language model. RoBERTa is Facebook's open source version of the BERT model. A RoBERTa based model currently holds second place in the COPA task on the SuperGLUE leader board.

REFERENCES

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