# Cross-lingual Transfer learning for Causal Commonsense Reasoning

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# Background

*Causal Commonsense Reasoning*

- "Bridge between premises and possible hypotheses with world knowledge that is not explicit in text"

| | Premise | Hypothesis |
|---|---|---|
| √ | I poured water on my sleeping friend. | My friend awoke. |
| × | Teddy is my son. | Teddy is a male. |

# Background

*Cross-lingual Transfer Learning*

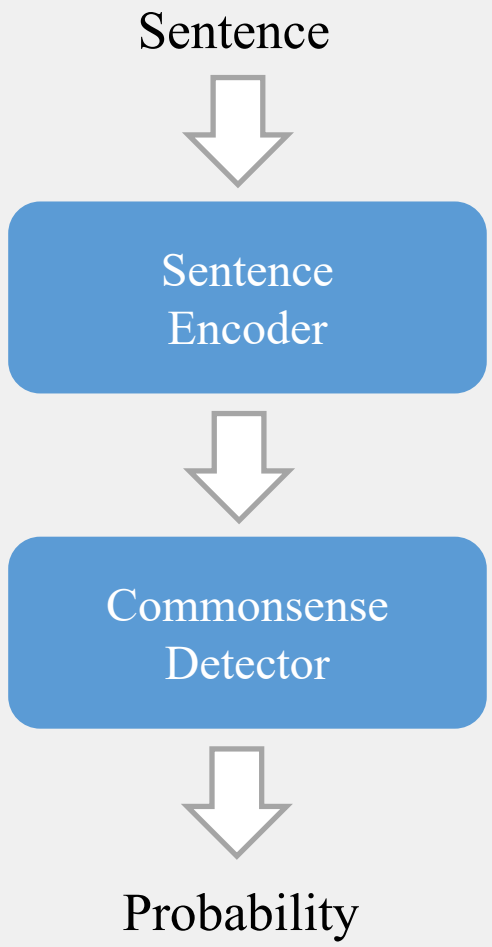
- Solve one problem and apply it to a different but related problem (Transfer Learning)
- Leverage large datasets available in one language—typically English—to build multilingual models that can generalize to other languages
- ZERO-SHOT / FEW-SHOT

# Overview

## PROCEDURE

- Data preprocessing
- Pretraining
- Fine-tuning
- Test

## MODEL



# Datasets

- Datasets for Pretraining
  - **SocialIQA**
    - "context": "Tracy protected her teammates from injury when she saw an accident about to happen prevented it."
    - "question": "Why did Tracy do this?“
    - "answerA": "make a play", "answerB": "prevent injuries", "answerC": "injure them"
  - **WinoGrande**
    - "sentence": "The GPS and map helped me navigate home.  I got lost when the _ got turned off. "
    - "option1": "GPS", "option2": "map"
- Datasets for Fine-tuning
  - **COPA**
    - "premise“: "I poured water on my sleeping friend. "
    - "choice1": "My friend awoke. ", "choice2": "My friend snored. "
- Datasets for Test
  - **COPA**
  - **XCOPA**

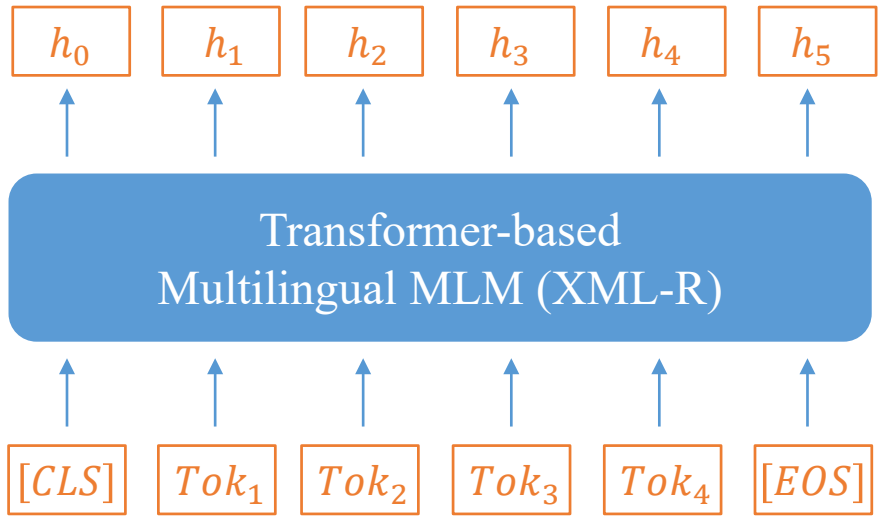
# Methodology

*Sentence Encoder*

- Input sentence
  $S = \{[CLS], Tok_1, Tok_2, \dots, Tok_n, [EOS]\}$

- Hidden states
  $H = \{h_0, h_1, h_2, \dots, h_n, h_{n+1}\}$

- Take the hidden state of $[CLS]$ $(h\_0)$ as the representation of the sentence



# Methodology

## *Commonsense Detector*

- Obtain the representation of the $i$- sentence : $r_i$

- Compute the possibility of having a causal relation

$$P_i = sigmoid(W_b\sigma(W_a r_i + b_a) + b_b)$$

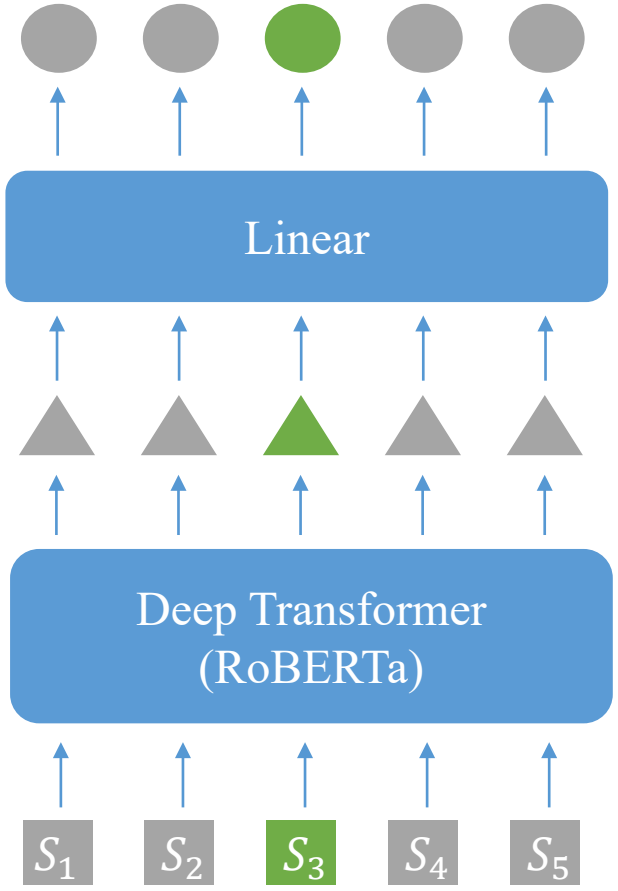
- Use binary cross entropy (BCE) as the detection loss

$$\mathcal{L} = -\frac{1}{N}\sum_{i=1}^{N} \mathbb{I}(label_i = 1)\log P_i + \mathbb{I}(label_i = 0)\log(1 - P_i)$$

# Methodology

*Denoising Module*

- Background
  - Noncausal relation with positive label
- Target
  - Denoise low-quality input data
- Method
  - Train a rank model for monolingual (English) causal commensense reasoning detection
  - Compute positive scores for $N$ sentences
  - Keep top $k$ sentences



# Methodology

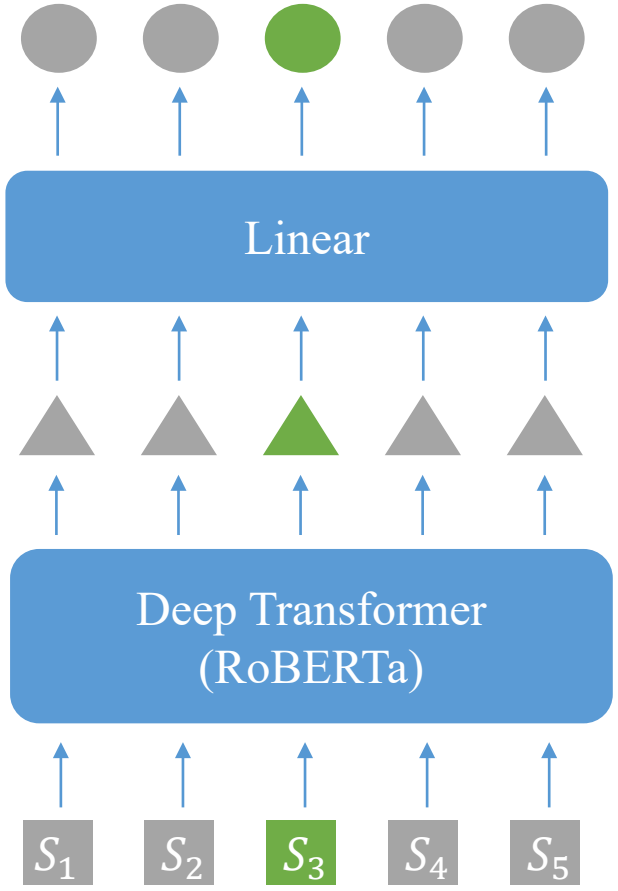
*Denoising Module*

## How to train?

- Input $m$ instances $\{S_i\}_{i=1}^{m}$ where only one is positive
- Compute their positive scores using Roberta and MLP

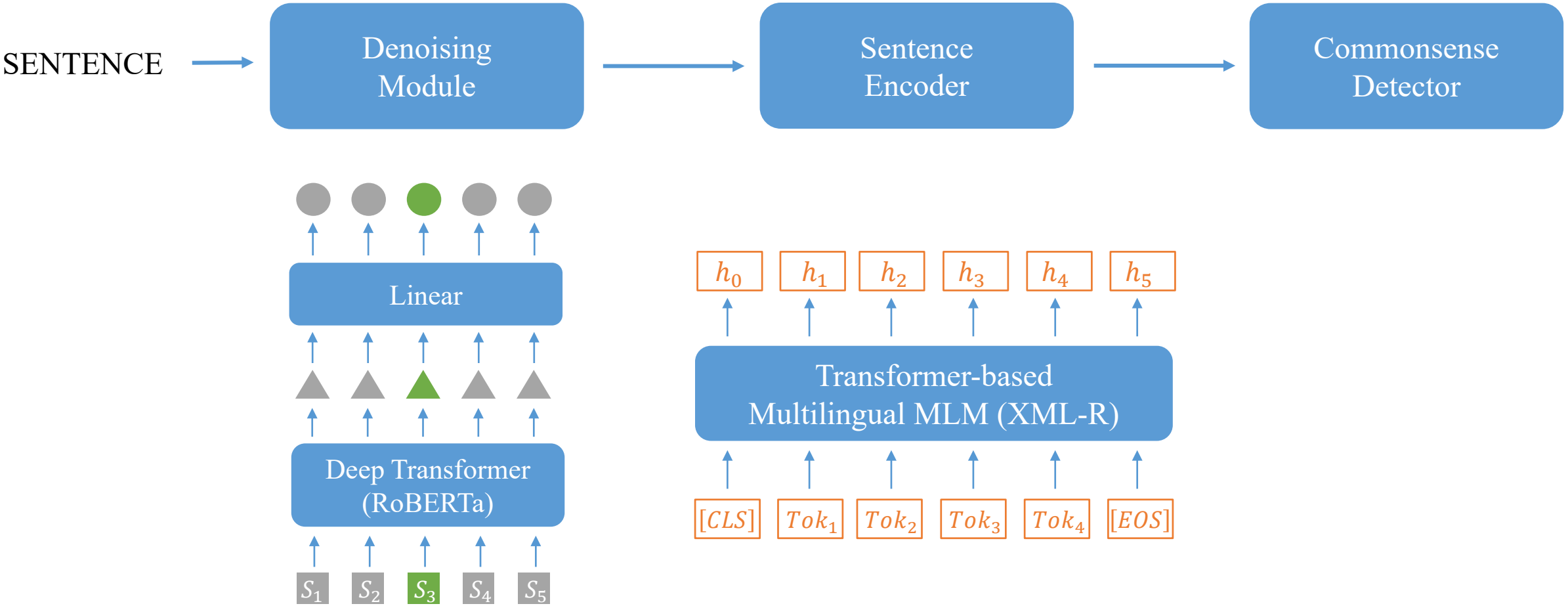
$$r_i = Encoder(S_i)$$
$$score_i = w_m r_i + b_m$$

- Apply a softmax function to compute the probability of $i$-th instance to be positive



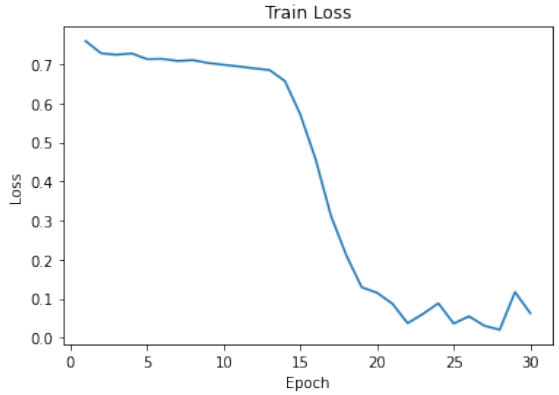
# Methodology

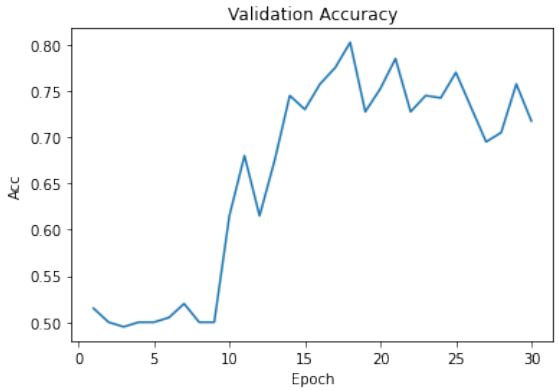
*Network Architecture*

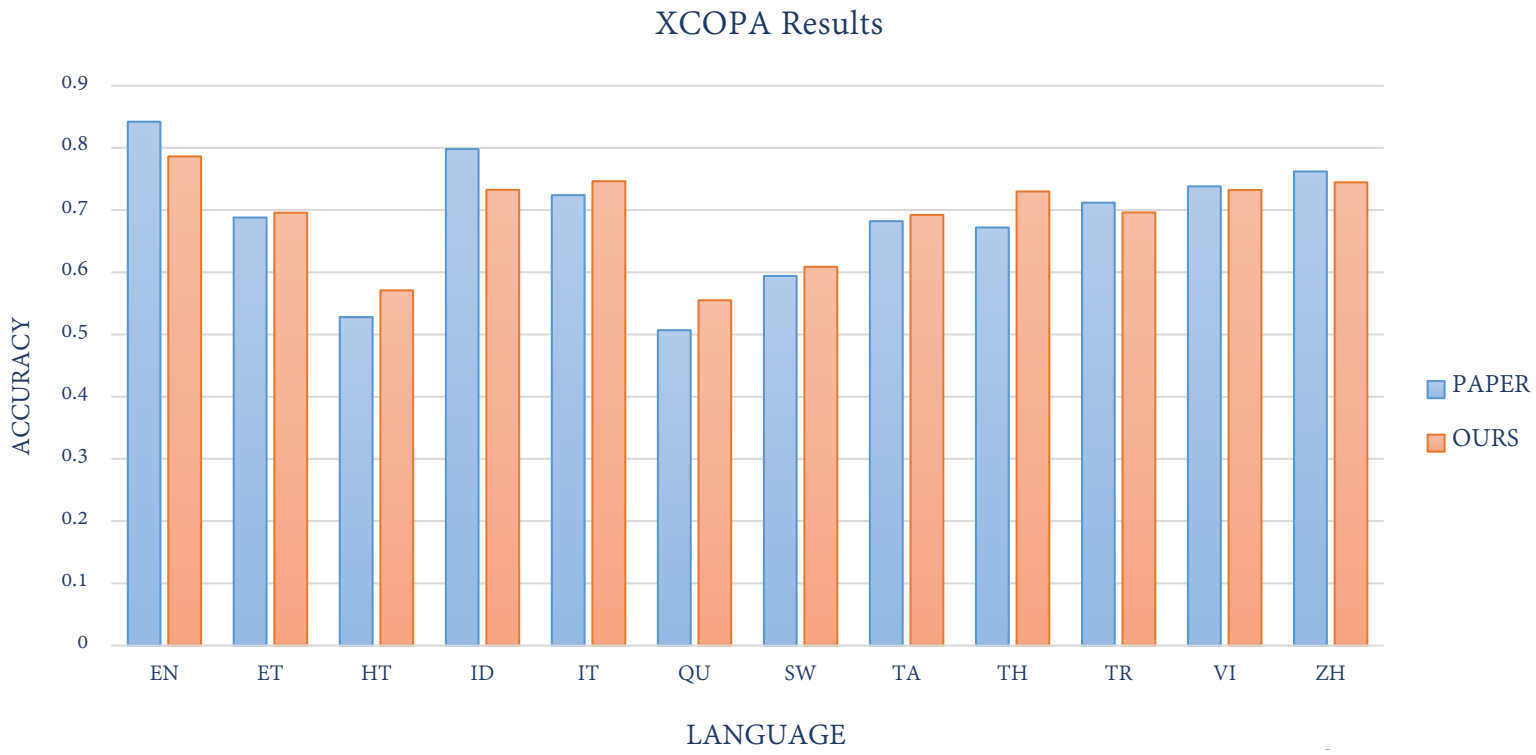


# Experiment

- Pretraining: batch_size=64 Adam with learning_rate=4e-4 and weight_decay=0.01
- Fine tuning: batch_size=16 Adam with learning_rate=1e-5 and weight_decay=0.1



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# Thanks for your attention