北京大學
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AUTOPROMPT: Eliciting Knowledge from Language Models with Automatically Generated Prompts

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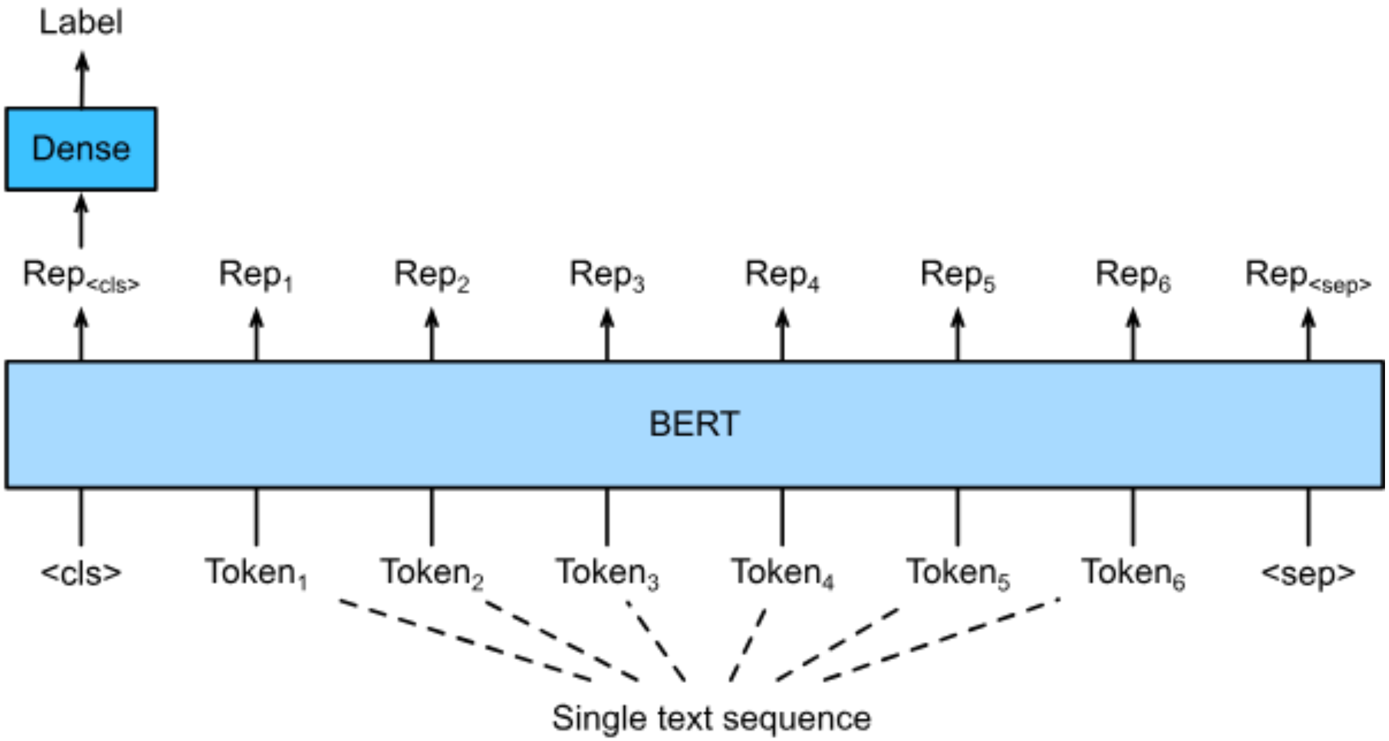
Motivation

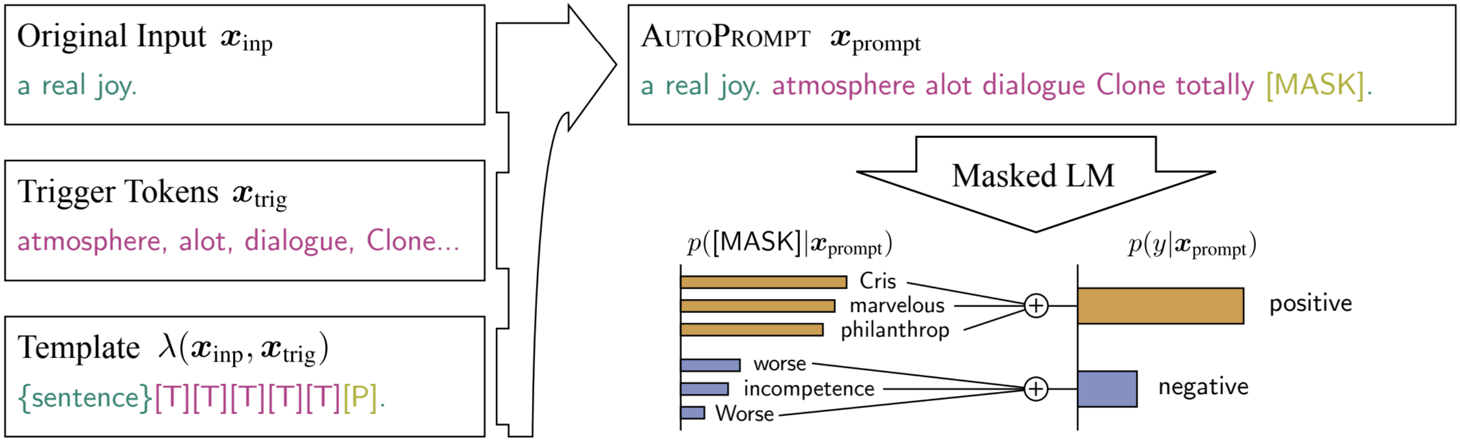
Determine whether knowledge are learned during language model training process

PROMPTING TO ELICIT KNOWLEDGE FROM LM

Method


Label
Dense
Rep<cls>
Rep1
Rep2
Rep3
Rep4
Rep5
Rep6
Rep<sep>
BERT
<cls>
Token1
Token2
Token3
Token4
Token5
Token6
<sep>
Single text sequence

Method


Original Input $\boldsymbol{x}_{\text{inp}}$
a real joy.
Trigger Tokens $\boldsymbol{x}_{\text{trig}}$
atmosphere, alot, dialogue, Clone...
Template $\lambda(\boldsymbol{x}_{\text{inp}}, \boldsymbol{x}_{\text{trig}})$
{sentence}[T][T][T][T][T][P].
AUTOPROMPT $\boldsymbol{x}_{\text{prompt}}$
a real joy. atmosphere alot dialogue Clone totally [MASK].
Masked LM
$p([\text{MASK}]|\boldsymbol{x}_{\text{prompt}})$
Cris
marvelous
philanthrop
worse
incompetence
Worse
$p(y|\boldsymbol{x}_{\text{prompt}})$
positive
negative

- Find Trigger Prompt
- Find Label Token Set

Method

$$p(y|\boldsymbol{x}_{\text{prompt}}) = \sum_{w \in \mathcal{V}_y} p(\text{[MASK]} = w|\boldsymbol{x}_{\text{prompt}})$$

$$\mathcal{V}_{\text{cand}} = \underset{w \in \mathcal{V}}{\text{top-}k} \left[\boldsymbol{w}_{\text{in}}^T \nabla \log p(y|\boldsymbol{x}_{\text{prompt}}) \right]$$

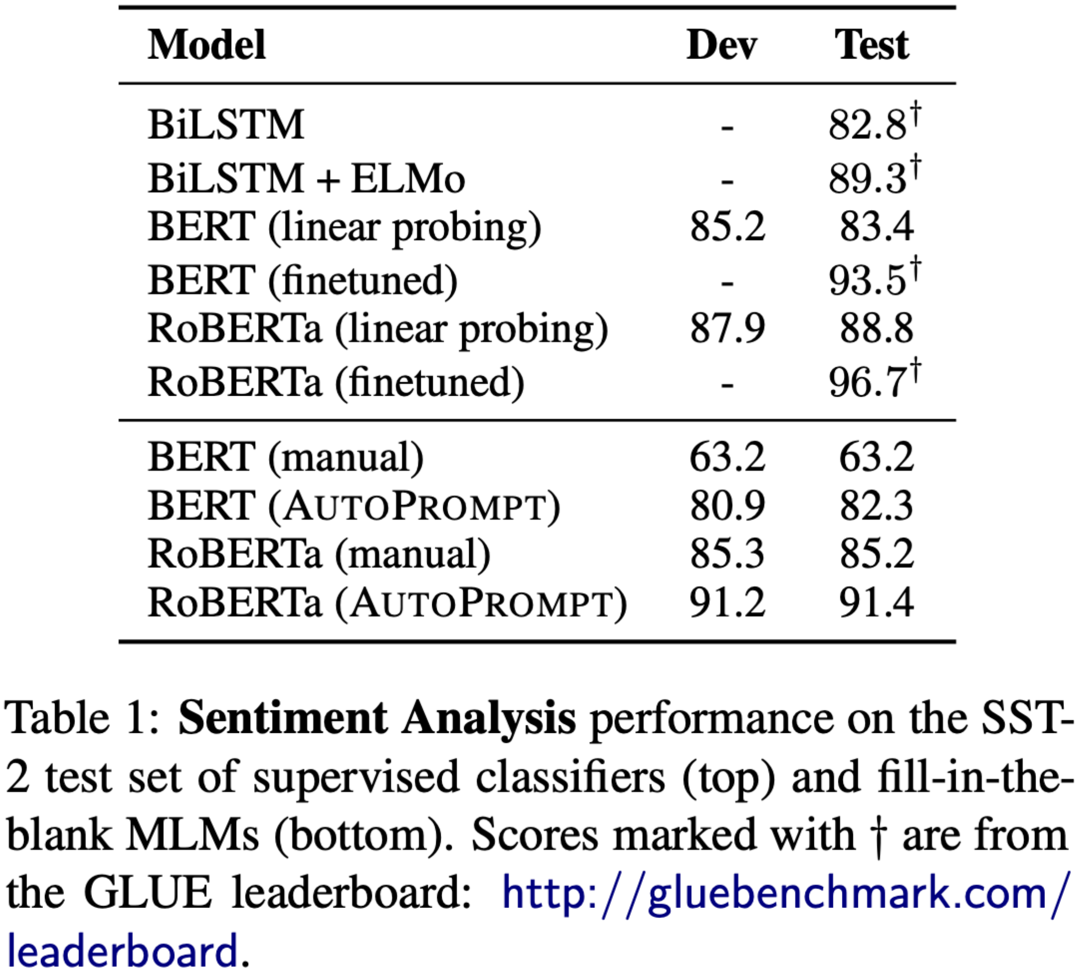
Label Projection

Replace $\boldsymbol{y}$ with $\boldsymbol{w}_{out}$ (token output embedding)

$$s(y, w) \;=\; p(y|\boldsymbol{w}_{\text{out}}).$$

$$\mathcal{V}_y = \underset{w \in \mathcal{V}}{\text{top-}k} \left[s(y, w) \right]$$

Experiment



Model	Dev	Test
BiLSTM	-	82.8†
BiLSTM + ELMo	-	89.3†
BERT (linear probing)	85.2	83.4
BERT (finetuned)	-	93.5†
RoBERTa (linear probing)	87.9	88.8
RoBERTa (finetuned)	-	96.7†
BERT (manual)	63.2	63.2
BERT (AUTOPROMPT)	80.9	82.3
RoBERTa (manual)	85.3	85.2
RoBERTa (AUTOPROMPT)	91.2	91.4

Table 1: **Sentiment Analysis** performance on the SST-2 test set of supervised classifiers (top) and fill-in-the-blank MLMs (bottom). Scores marked with † are from the GLUE leaderboard: http://gluebenchmark.com/leaderboard.

Discussion

- LLM Evaluation
    - Conventional Evaluation
    - Co-evaluation
- Prompt Guidence

Thanks