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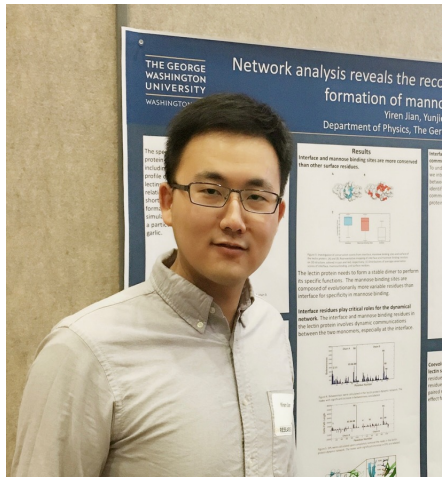
Computer Science

Embedding Hallucination for Few-shot Language Fine-tuning



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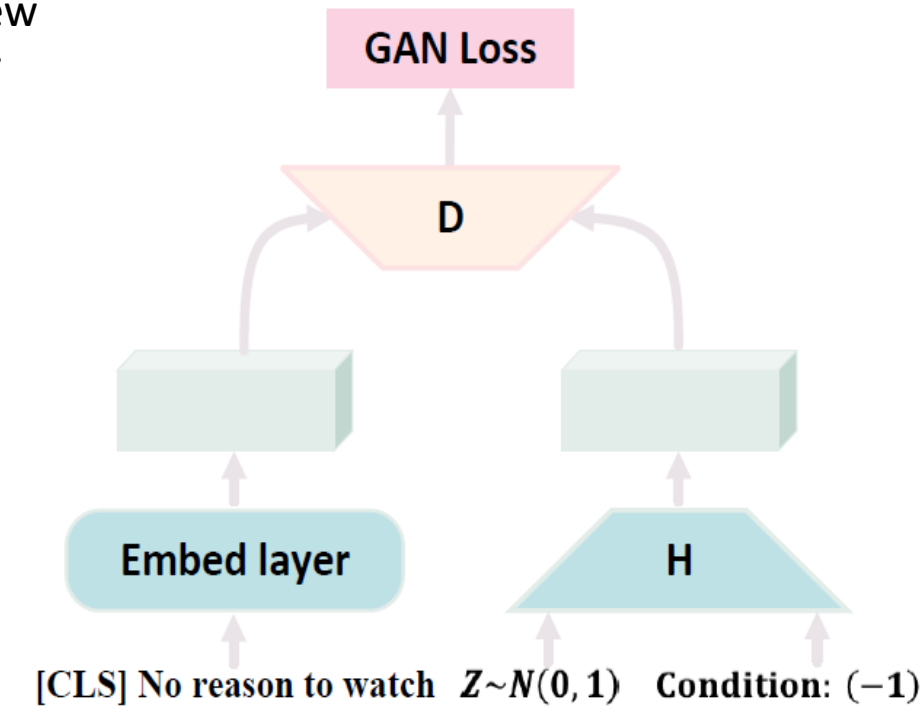
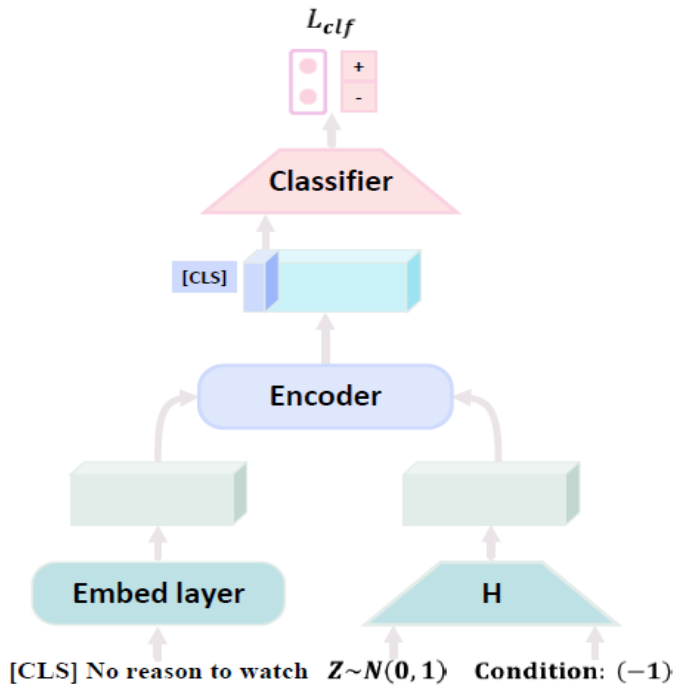
EmbedHalluc: Training of Hallucinator as conditional GAN

When learning from a few examples, models suffer from over-fitting.



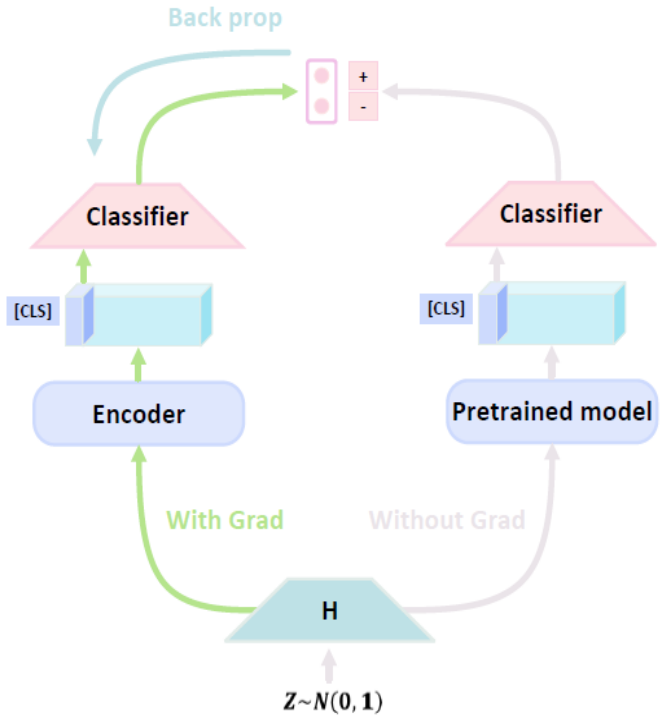
We train a Hallucinator (based on conditional GAN), which generates hallucinated-embeddings that are indistinguishable from real ones.

EmbedHalluc: Training of the few-shot learner with the augmented pseudo-embeddings



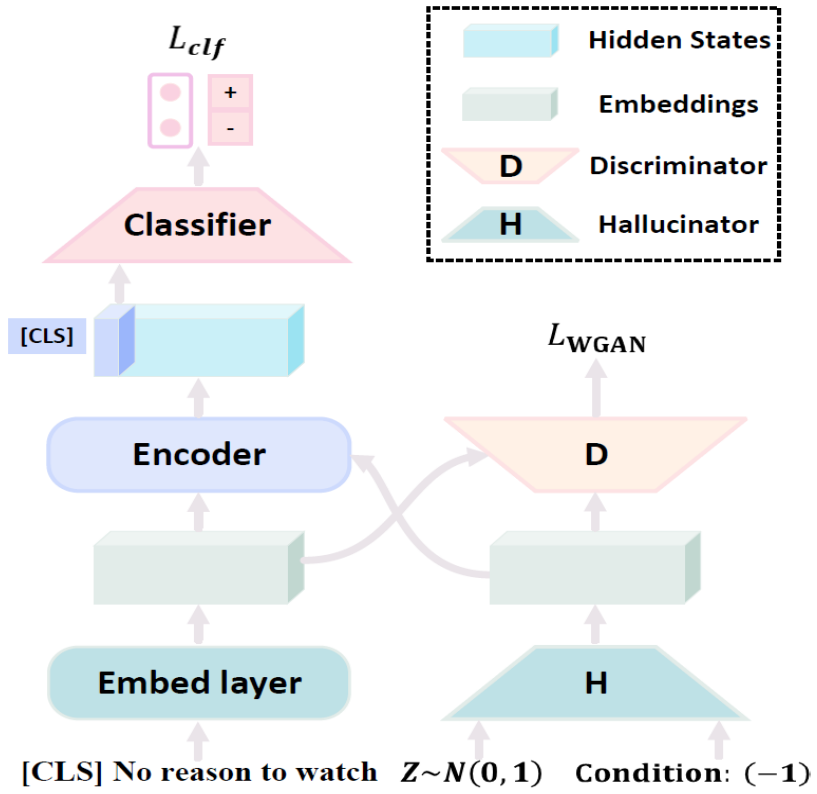
Once we have trained the Hallucinator, the few-shot language model learns from both real example-label pairs, as well as the hallucinated embeddings and condition pairs.

EmbedHalluc: Improved results by pseudo-labeled hallucinations (label calibration)



Instead of using hallucination and condition pairs as augmented training examples, we use a pre-finetuned model to pseudo-label hallucinated embeddings. The language learner then learns from hallucination and pseudo-label pairs.

EmbedHalluc: Overview of our method and learning objective



$$\mathcal{L}_{\text{halluc}} = \text{KL}(\mathcal{M}(s_{\text{halluc}}(c_i)), c_{\text{pseudo},i})$$

$$\mathcal{L}_{\text{total}} = \mathcal{L}_{\text{real}} + \mathcal{L}_{\text{halluc}}$$

EmbedHalluc: Results on conventional finetuning and prompt-based finetuning

Conventional fine-tuning

Task	Fine-tuning	EmbedHalluc	w/LabelCalib
SST-2 (acc)	76.8 (4.2)	**82.6** (5.6)	82.0 (4.7)
Subj (acc)	90.3 (1.5)	**91.3** (0.8)	**91.3** (0.9)
SST-5 (acc)	40.6 (2.2)	40.3 (1.5)	**41.6** (2.6)
CoLA (Matt.)	36.0 (9.9)	**39.7** (10.8)	38.1 (11.8)
TREC (acc)	83.0 (4.9)	**88.1** (2.5	87.9 (1.0)
MNLI (acc)	41.6 (5.2)	48.0 (9.5)	**49.6** (5.8)
MNLI-mm (acc)	42.7 (5.9)	49.7 (10.5)	**51.8** (6.1)
SNLI (acc)	52.9 (6.7)	**54.4** (3.4)	52.3 (5.3)
QNLI (acc)	55.3 (2.7)	60.2 (5.3)	**64.9** (5.1)
QQP (acc)	59.2 (8.6)	64.6 (5.0)	**66.7** (5.3)
RTE (acc)	52.9 (1.4)	53.4 (1.7)	**55.9** (4.3)
MRPC (F1)	76.3 (5.2)	**78.7** (1.9)	78.1 (3.0)
MR (acc)	74.5 (5.9)	79.4 (5.5)	**80.8** (3.2)
MPQA (acc)	65.0 (1.5)	70.1 (7.0)	**70.5** (4.6)
CR (acc)	71.7 (7.5)	75.1 (5.6)	**78.0** (3.8)

Prompt-based method

Task	Prompt-based	EmbedHalluc	w/LabelCalib
SST-2 (acc).	92.7 (0.4)	92.8 (0.7)	**93.1** (0.7)
Subj (acc)	91.3 (1.0)	**92.0** (0.4)	91.7 (1.3)
SST-5 (acc)	48.8 (1.0)	49.0 (2.2)	**49.4** (1.4)
CoLA (Matt.)	7.3 (5.8)	12.3 (7.6)	**22.1** (15.6)
TREC (acc)	83.8 (5.3)	85.5 (3.3)	**87.1** (2.9)
MNLI (acc)	**69.7** (2.0)	68.0 (2.8)	68.5 (1.7)
MNLI-mm (acc)	**71.5** (1.9)	69.9 (3.0)	70.6 (1.7)
SNLI (acc)	78.0 (3.0)	**78.8** (2.3)	78.4 (2.3)
QNLI (acc)	68.6 (2.8)	69.6 (0.3)	**71.6** (2.0)
QQP (acc)	70.2 (4.3)	71.9 (5.2)	**74.2** (0.9)
RTE (acc)	**70.9** (3.3)	69.9 (3.3)	66.9 (3.4)
MRPC (F1)	74.6 (6.8)	78.0 (4.9)	**80.3** (3.5)
MR (acc)	86.8 (0.9)	87.2 (0.9)	**87.5** (0.9)
MPQA (acc)	85.4 (1.8)	84.2 (1.9)	**85.4** (1.9)
CR (acc)	91.1 (1.0)	91.1 (0.9)	**91.3** (0.3)

Our method can improve conventional finetuning and prompt-based finetuning in 15 few-shot language tasks.

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Thank you!