Contributions

- An embedding hallucination method for data augmentation for few-shot learning, based on cWGAN [1].
- Evaluate Embedding Hallucination on 15 tasks and show that it generally improves over recent fine-tuning methods.
- Show the overall superiority of EmbedHalluc when comparing to regularization methods proposed to address the problem of over-fitting during fine-tuning of LMs and outperforms a common augmentation method.

Overview

Algorithm

1. Max Step = 1000.
2. LM: Language model.
3. Embedding hallucinator (pre-trained).
4. Train Set; Training set.
5. Sample; Randomly sampling function.
6. CE; Cross Entropy loss.
7. KL; KL-Divergence loss.
8. for i in Max Step do:
   9. sent, y = sample(Train Set)
   10. output = LM(sent)
   11. L = CE(output, y)
   12. optimizer.step()
9. end for
10. for i in Max Step do:
   11. sent, y = sample(Train Set)
   12. embed = H(N(0,1))
   13. learning from real text
   14. output = LM(sent)
   15. L = CE(output, y)
   16. L.backward()
   17. optimizer.step()
18. learning from hallucination
   19. prob = LM(embed)
   20. output = LM(embed)
   21. L = H(L) prob, output)
   22. L.backward()
   23. optimizer.step()
24. end for
25. return LM

Conventional fine-tuning

<table>
<thead>
<tr>
<th>Task</th>
<th>Fine-tuning</th>
<th>w/Label/CL</th>
<th>SST-2 (acc)</th>
<th>SST-5 (acc)</th>
<th>SNLI (acc)</th>
<th>MNLI-M (acc)</th>
<th>MNLI (acc)</th>
<th>VQA (top-1)</th>
<th>VQA (top-5)</th>
<th>ANL (top-1)</th>
<th>OSM (top-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPM</td>
<td></td>
<td></td>
<td>78.6 (3.5)</td>
<td>82.6 (3.6)</td>
<td>85.2 (4.7)</td>
<td>83.6 (4.9)</td>
<td>84.6 (5.0)</td>
<td>84.6 (5.0)</td>
<td>85.2 (4.7)</td>
<td>84.6 (5.0)</td>
<td>84.6 (5.0)</td>
</tr>
</tbody>
</table>

Prompt-based fine-tuning

| Task   | Prompt-based | w/Label/CL | SPM    |            |             |             |             |             |             |             |             |
|--------|--------------|-------------|--------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| SPM    |              |             | 92.7 (0.4) | 92.8 (0.7) | 90.1 (0.7) |             |             |             |             |             |

Comparison of conventional fine-tuning and our EmbedHalluc

Comparison of prompt-based fine-tuning and our EmbedHalluc

Hallucinator

Training of Hallucinator

Hallucinated Embedding

Training with pseudo-labeled "hallucinated" embeddings.