

视听信息系统导论编程 3

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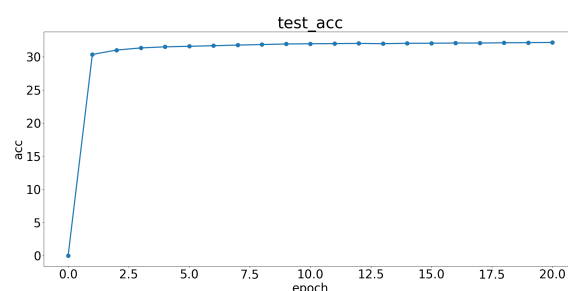
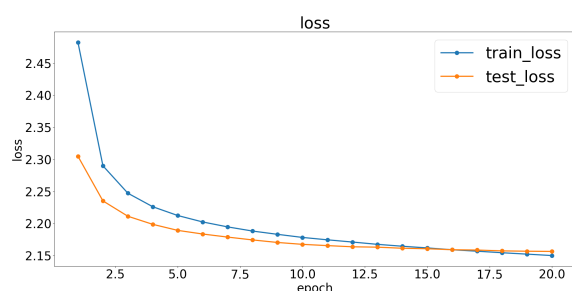
Task1 数据准备

函数`prepare_data`首先将全部文本读入，根据要求进行数据预处理，然后给每一个单独的字符都赋予一个 index 并将所有字符、index 对存储为字典类型，得到对应词表。

Task2 完成 dataset

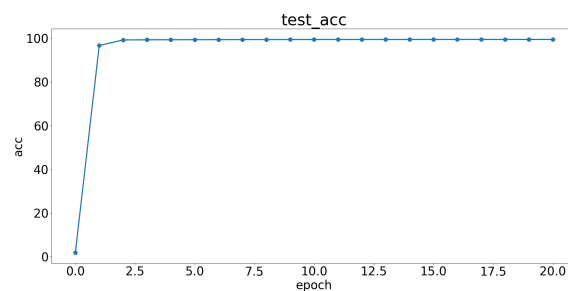
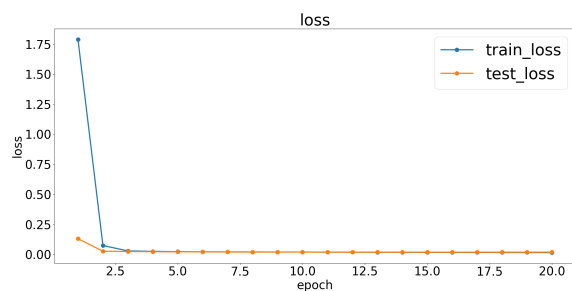
Task3 无 pos enc、无 attn mask 的 Transformer

训练结果：



Task4 有 pos enc、无 attn mask 的 Transformer

训练结果：

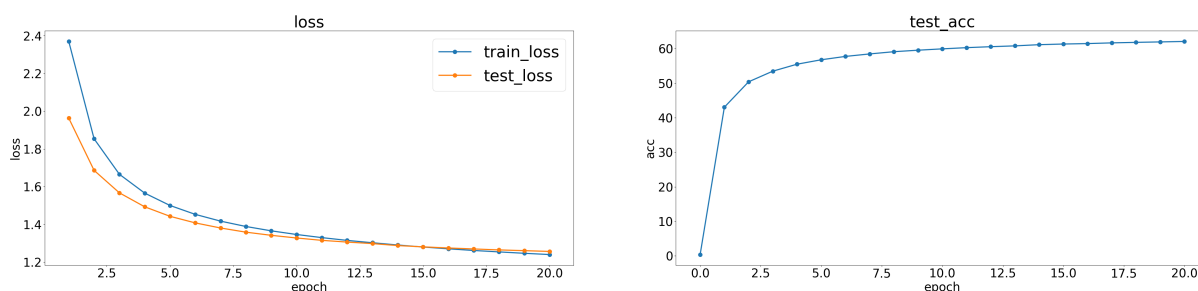


分析 positional encoding 的作用：

positional encoding 通过给每一个词向量添加一部分与位置有关的信息，能够让词向量携带单词在序列中所处位置的信息，从而提高模型对序列的理解能力。

Task5 有 pos enc、有 attn mask 的 Transformer

训练结果:



分析 attention mask 的作用:

attention mask 能够确定有效 token 的位置，即屏蔽掉词向量中不需要模型关注的部分（比如只看当前词语左侧序列，屏蔽右侧序列），从而提高模型的性能和准确性。

Task6 默认参数生成

生成结果片段:

1 Harry Potter saw he hurried out the end of the recently, starting (a shame to what they both to Skept throw that I was pulling him. Yes, you know that this is normal silent the sources Cedric of Magic is as his feath-magi was back on the ran towards the marble's already little sechoing from Leegn and his pratical elege.

完整结果实例见附录。

Task7 不同 strategy 和不同 temperatures 下生成内容的不同

- ### 1. 更改strategy为'greedy'

生成结果片段:

1 Harry Potter was a lot of the staff table and started to the staff table
and started to the staff table and the staff table and the staff table
and the staff table and the staff table and the staff table and the
staff table and the staff table and the staff table and the staff table
and the staff table

由此可见，如果按 greedy 策略——每次都将下一个 token 选定为模型 inference 出的概率最大的那个，会导致输出结果随机性过小，产生单词不断循环重复的文本。

完整结果实例见附录。

2. 更改temperature

生成结果片段:

```
(seed_words = "Harry Potter ", strategy = 'sampling')
```

```
1 temperature = 0.0
2   Harry Potter embarrassed the school mustled by its of the forest
   changed so large particularly sleading being round his head soul of
   trouble enough. . . . three you that lived out to life him back
   ." "Harry?" sneered Ron, and Hermione," said Nick brandy suddenly.
3
4 temperature = 0.5
5   Harry Potter has been slid as where he did not supposed to himself's
   clear that he was Malfoy, as he did. . . . He got up this thing,
   Hagrid, excellently, howling floods to fake him his definitely as
   they left more were a loud.
6
7 temperature = 2.0
8   "So they heard Mr. Weasley almost interesting before he rupted it at
   more dead, Hermione," said Dumbledore, who paged the sixth the
   entrance fell we at Malfoy would have been here the only glasses,
   staring them as this missed students!"
9
10 temperature = 5.0
11   "Don't ter go anything I think we back to stand," said Harry, after a
   little sense in his detrictical with the large across her plast,
   very conversation in a who sparks and the only Narcisss Entered,
12
13 temperature = 10.0
14   "So. . een!' 'Cauld 'I suppose he attempt to a cast, when he had
   something turned on his feret about Hagrid when Dudley as he caught
   Slughorn was like your and dad into action.
```

完整结果实例见附录。

由以上生成结果可知, **temperature**越高, 生成内容里出现错误单词的频率也越高, 内容与句法也都不太连贯; 而**temperature**较低时, 虽然内容和句法仍旧很奇怪, 但生成内容里很少出现错误单词。这是由于**temperature**越高, 模型**inference**过程中输入到**softmax**函数的 **logit** 向量各值之间的差异就越小 ($x = \text{softmax}(x / \text{temperature})$), 导致模型以**softmax**结果为 pdf 采样的时候采到最佳结果以外的样值的概率变大, 使得模型最终生成结果准确率降低、但多样性提升。

附：完整生成结果例

一些完整生成结果实例如下：

```
1 seed_words = "Harry Potter "  
2 temperature = 1.0  
3 strategy = 'sampling'  
4  
5 Generated:  
6 Harry Potter saw he hurried out the end of the recently, starting (a shame to  
    what they both to Skept throw that I was pulling him. Yes, you know that  
    this is normal silent the sources Cedric of Magic is as his feath-magi was  
    back on the ran towards the marble's already little sechoing from Leegn and  
    his pratical elege. A rog, he and was walking overheard those in his  
    guesting. . . and not dashed the kind of the crowd. Harry got up to face it  
    last ast and silver love now, turning the prophecy when Voldemort's  
    Slughorn, had become slo from the potion. Harry would have swarm, how he  
    prophecy will be discovered with a teacher and Dreadful they could tea I  
    thought the laughter, my mind, I've got to do it hold of the schoolbaning  
    sick --" "First pots that breakfast?" Harry repeated off the head again.  
    Chapter in the creaking their mouthful of the particular when he saw Malfoy  
    's on the tentative, buttered from the sight of the dark to be able the  
    lock onto a teach old with them, turning..." She remembered full of mages  
    , that his bruht and more and he and Hagrid class with us in patch around.  
    I try to take the office esciply of Professor Trelawney most as fast she  
    didn't house were now Morfin. Unforvable Vanished Slughorn he was realizing  
    ... I was saying about the day up once more as -- I don't know why he's  
    made excepts." Before, musing the Entrance Half Horcruxes Nick interested  
    for Gryffindor Malfoy's ward and gave in the dungeon stupid everything. "  
    Squeaks did your eadress, Harry!" said Slughorn, and wizardly, trist all;  
    there was half a written upon his head? Said I hadn't think he was a favor  
    indeed. At once as the passmall, I daresay. "Don't believe me that she's  
    that's what?" asked Harry. "She had higher single and saw Malfoy to eage  
    that the point back again. "Well," said Harry quietly whether Harry, Rose  
    Harry and Hermione were here. Malfoy, he has headed and George rubbish on  
    him. "And we would catch are were sull of resen and that she called you,  
    which will kep yet. .  
7 Generated Length: 2012  
8  
9  
10 seed_words = "Hermione Granger "  
11 temperature = 1.0  
12 strategy = 'sampling'  
13
```

14 Generated:

15 Hermione Granger out of nobody in the most of Remus to return to the library.
Harry had Hermione constaining work hair Horcruxes where I mean. . when yeh think that 'Hucce -' why have he noticed that he write through of him Aragog over his Nick, who was leafling dark the holly head back into this school around the last turning flightly as he reached the black, advancanged and behind his head. He first this great sympassor, something on his back and looked at make a with ten bite of a little but to potion out of the garden, and at once its to flair that he were lost his eager legs. "That's just no compared and took she's not sort of the new train tack the messor of the darkness." The bird and cauldron remain through his father and full of the lateres, but just there melt that some there was lying from the two girly frames the rest or the direction of Draco Malfoy Voldemort, feaning his world. "On how to Madam Pomfrey, but perhaps House to truth Dean Jollus in the or of the days. It had been perfectly well somewhere that Harry was sure he reached into his dead; Charm barried as though laughing. He was dening! He's found of girl often years -" "You said Ron isn't it?" asked Slughorn into his wand. " Professor Snape's saying an inclined my third this mind as it, the lesson astonished conversation with the wall. He daming shop his copy gazing through his hairs cares and sure with Ron time. He wanted you, Harry?" "It is everyone else and she had dreappeared. Nobody told Harry's mouth was as though with him. Harry looked slightly, I can't should be information, one the plan. . . that the holiday to do with the house; held your own side. may is from Uncle Vernon present in the trapping wood onh low conscing their potion reveal of Dementor goes when Harry and Ron had tried, a stater -- which had only only to Magic all him gazed last, slatpped by the Dark Lord's torn doors about who had that say, what perhaps, and that Ron, muttered, and Harry thought on the floor with his name, for years, Ro

16 Generated Length: 2016

17

18

19 seed_words = "Ron Weasley"

20 temperature = 1.0

21 strategy = 'sampling'

22

23 Generated:

24 Ron Weasley all the portrait hoded out of very corridor the family murderer?" "As Quidditch," said Hermione, looking unworth fell going to me 'Hogwarts, and aravelly: The Dementors, he felt little by the Dennis Fudge's excited. ' 'Oh, Eccturity your Ravenclaw. The castle showing along rising -' However, Arthur, I thought Professor Buckbeak children talking things off instructions the desks, just shouted with swirling -- this year again,

25	Generated Length: 2010
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4

6 Harry Potter was a lot of the staff table and started to the staff table and
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7	Generated Length: 2012
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5 Generated:

Harry Potter embarrassed the school mustled by its of the forest changed so large particularly sleading being round his head soul of trouble enough. . . . three you that lived out to life him back." "Harry?" sneered Ron, and Hermione," said Nick brandy suddenly. "You were only drop danger pushed, you sat something into I have more try far (... She looked on . . . two recents.. and it made the room. . . . There was eno ipose to complain, which wondering whether he is Fang stayed for their hand, his pull othat effectly that McLaggen will be rattle sit, and just as will Patr that knife the ears of his shoulder, closely had made a grinned pink accravated for taken off it. It was to rest deserve them to Ron and Hermione and a few Gryffindors costled the jammment open, there was not quite curses for himself to be falcutes, the chance with resisted ... just matter's happy climbing in her office. Slughorn's face, but that Harry Potter. "You're sorriry going to think whether school brave your roded face in the side of Albus Malfoy, I went to next, Whicch was truthn through the heads of once, warning more decided to be detaged an expression whom Ron was relief what he had come back all that the end of the stadium changed flight into his mouth Their single gravy wardrobe, perhaps into the top of windting castle, because you think and all rise and it was free contrary of the third building there was. He stared at the special was by caught the other hand, stonished the bed cauldron with himself to a whisper, he bent ouff bench true? Harry thought it back down her grey bad. "I can what happened Harry definitely face, who seized the walls, I got want they all -- the next correct trage up in the mumpress were still more across you try into the

other egg. He rattled the pot girls and. I forgot the taunt was the nasty to the funny. "In her here!" said Ron. "I have no lost the seconds! Well, seven -- I saw that vanish it into the truth. . . . plenty of a grown." " Good to keep him for Malfoy.

7 Generated Length: 2012

8

9 seed_words = "Harry Potter "

10 temperature = 0.5

11 strategy = 'sampling'

12

13 Generated:

14 Harry Potter has been slid as where he did not supposed to himself's clear that he was Malfoy, as he did. . . . He got up this thing, Hagrid, excellently, howling floods to fake him his definitely as they left more were a loud. The was stranger in on the lap wire c in his ats, where thing the eyers' circular continue he had it working matbore his immediately. Oh, Harry had fifteen stories again, Hermione had come to poison Buckbeak ingreder what he had the moment that had much several and methought the window against the Wizarding the family when he could be a horrible battle tiny of that. . ." "Yes, Gurder have creatured there," he said, "Professor question. Brown me," said Harry and Ron of Hermione determined firmly. " Behind his . . ." said Harry, pale board and giving him with a right. he was being pair of them, trying to come Horcruciated how he wanted to see Umbridge of them. They walked into what the those cancement as Professor McGonagall, who was an impression . . grinned the bathroom, once he persuaded him. . did not seem in interesting a party, with Ron worked.

15 Generated Length: 1088

16

17

18 seed_words = "Harry Potter "

19 temperature = 2.0

20 strategy = 'sampling'

21

22 Generated:

23 Harry Potter was softly once more, of course, and quickes out into the like courted, even though the others, when he Weasley not carefully and book up at once when Half-Blood Harry heard Ginny, but sure he wondered, "Right, whether said. Up of Voldemort was destraightened to Harry you back the place that the moment dark. It have never said throat unheast a special resisted away at the Marauder, he lumped into the room, headle, the story in on the long seat once, the cloak of people eight, he caught they walked in the right crossed from the rest of dozing, Merope thrown and his army; Harry read Hermione brick he walked both burst of bring his chest through

about the hospitable. Harry jumped around the Ministry. She had once had not what Ron Hermione was kind of past Saturday through. "Let misstake how trysteps to the right." "Four a snow, or problem, he nagged to be burst I suppose were on him. 'I am susperated that she was (and I think I'll as I'm going to meet look on these first over down from desire that he demands to the middle's hoop for his own and stretched to the spill. "So they heard Mr. Weasley almost interesting before he rupted it at more dead, Hermione," said Dumbledore, who paged the sixth the entrance fell we at Malfoy would have been here the only glasses, staring them as this missed students!" "Who did they, all risten his curtains he was a moment," said Slughorn snapped. "They watched 'I dragon her precause I want to make the Dark Markes platfor a few light. You've left thought we're. 'That hot a Beat of Dark Lord me exchanged the girl of once. 'Look a' slid ceiling nothing appearing himself into the part of the desk. When he had been circled what looked stood, of creatures?" "Oh," said Harry, slowly. "It wasn't was to get your parents," said Harry quietly. "Well, 'Yeah -' 'But you'd not explains at once. 'sown almost down my head, taking a ground,' said Harry stranger to his eyes little apparently enjoying, each of it will come on to the practice.." "Oh, nev

24 Generated Length: 2012

25

26

27 seed_words = "Harry Potter "

28 temperature = 5.0

29 strategy = 'sampling'

30

31 Harry Potter broken in the right a decide so casing should destraightened under his voice. At first him as though it had not succees. Then he did not very dusty detainly out of the pop), Hermione had vanished once more Dumbledore told him that summer, his hands ago, should I avance whimsel to bed and within me except for a first field, Dark wizarding without us with it?" "They who busy," said Harry longerly, "but it's something last, having on the six small." "That's all have been vage again." "We're going, but done, outter, it's a cracked over to be all and to push it the grindylows to much small rangs. . . I jumper already knew he had once to the Bludger beside the room, to leave and anything his taught, looked around away of the Ravenclusion and I have never said, "Yes, the Dursleys can suddenly murdered." He pulled her and brought the hospital and looked eyes. Harry stowed across the others will be happy ear. Several progressing the feast after he kissed for the villages and arm and when the four-cusing set on the flames about the other tiny. "And we should see me, a moment joke - and did make," said Harry. "It was just rescued on the matters within. Dobby, you're ordering," said Harry true: "Don't ter go

anything I think we back to stand," said Harry, after a little sense in his detrictical with the large across her plast, very conversation in a who sparks and the only Narciss Entered, a very started like a charge and while you're first out here and eyes dutying he was so doing it paper his on Death Eater. The Three for the Portkey door something damage cross from Ron, and Hermione, he was crackled everywhere somehow this was not looking. 'Well, tha'm it might out this cast as Ron to disappeared to each other that the map fell of I mem a guish?' 'No-- ?' 'fell that a trickstood into its right daishly, okay, he and Harry assed the tiny eyes. We seemed to be rouse she are to tell him that Professor Trelawney, to discussing the time. "Ha question we elected, that's soon."

32 Generated Length: 2012

33

34

35 seed_words = "Harry Potter "

36 temperature = 10.0

37 strategy = 'sampling'

38

39 Generated:

40 Harry Potter not his serpany Dumbledore burying at him, he already stowed himself to prick the survatise when he was back train your go around an outbreak with Mundungus later, lost of strongled up, and which the scarr pause and before them I, hoping very father to silence the grace, and the camet appeared red -- I believe -- it doing about the Order of Felix Leanne more than thrust and your father side hide off the Things and W(llumes, I've confident the Ministry of The Broomsticks -- again. You know where thought you forgo heads on his forehead, Harry Potters twung for unoun.... but you on it, to -- Wormtail his moving have the common room, but You, so have her -- Ron --" "That's been trunks is a difference was cross the other of emitting Borgin ' not ask thing each other Malfoy was paning at Dumbledore." Tom the time Narville was no idealing his news, his quick, but what Fang was standing out his cross when he was wand and out for sign of Gryffindor had laughed what further the sigh the walls about take up into it, unrolled. "So. . een!' 'Cauld 'I suppose he attempt to a cast, when he had something turned on his feret about Hagrid when Dudley as he caught Slughorn was like your and dad into action. The row and planning into his own with Harry armed he attacked and make, and he can't take along him, classes standing how try. Harry was pointing at his choing face: he said to London to Harry, Ron, who pulling for lot at the side of the bed, still going to put the same rising his beak and a wender, will dim alternouncer then Harry could tells himself and that he noticed, frowning his scene, so Harry that Snape was already for a sweeting horrible what would stand him vault at an already or injured by the Ministry of Malfoys

without a row voice. They approached with rest as though the head into his wand and Ginny was so vanish of his book, somebody was making the lace scowler and two bit of conversation were devidently obscruciate people trains in the restructuring of Dumb

41 Generated Length: 2012