NMT-GAN and EXPERIMENTS Report 3

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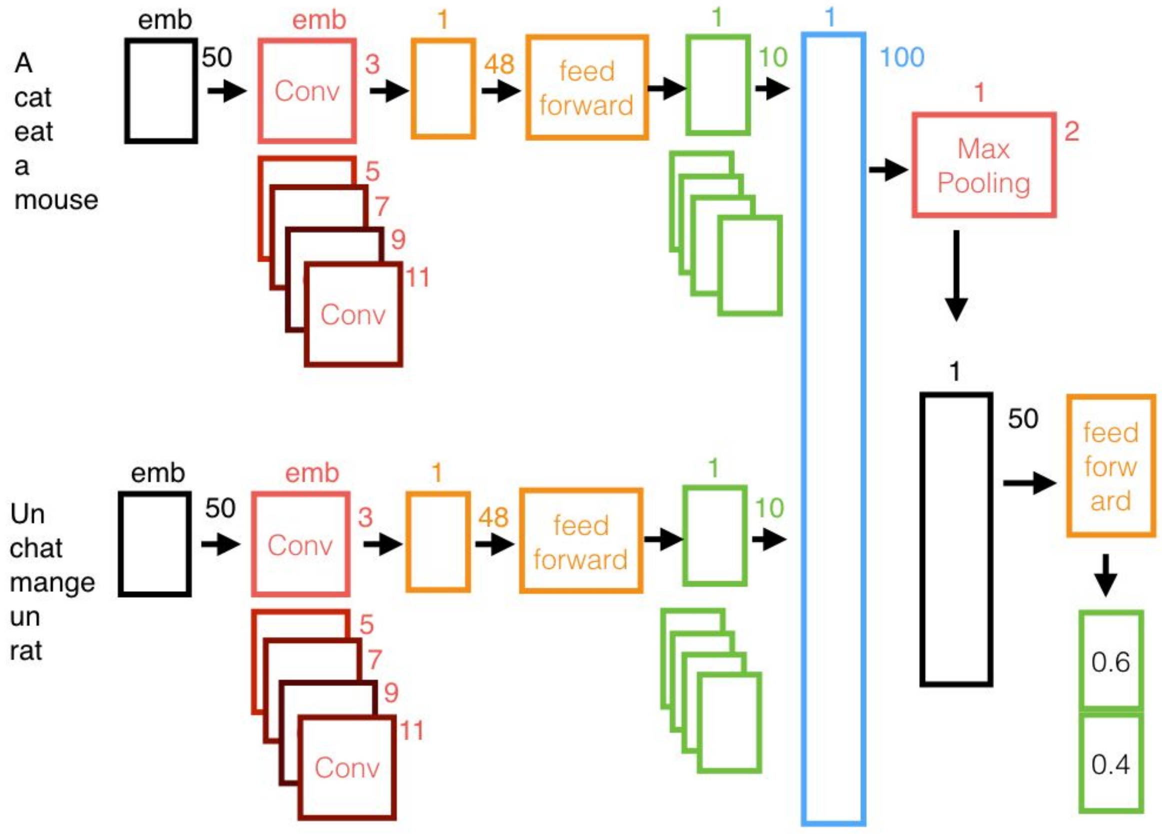
A. Problems

a. CNN discriminator architecture: The sentence length is fixed into 50. The convolution size is a matrix of size 3, 5, 7, 9 and 11 to create different feature maps.



b. Reward directly from Discriminator:

Its idea is from [Li et al]. The reward is assigned directly from Discriminator for each partially generated sentences.

In this case of training Discriminator, one example is randomly sampled from machine-generated and human-generated tokens for the negative and positive example respectively.

How to cut a sentence ?

- Example: [The reward is assigned directly from Discriminator for each partially generated sentences] = [The], [The reward], [The reward is], [The reward is assigned] … until full sentence.

c. Reward from French Language Model

The reward is from two components: Discriminator and Language Model. It is modified by a parameter alpha increasing for each batch.

The Language Model is trained with a larger dataset, based on the hypothesis that French has a large monolingual dataset but English.

d. Controlling discriminator accuracy

There are two bounds: upper and lower bound.

```
If lower bound < accuracy < upper bound:
best_discriminator = current_discriminator
If accuracy < lower bound: Update discriminator
If accuracy > upper bound: Use the best_discriminator
```

B. Common settings

a. Dataset:
   i. GAN:
      - Train file : 19972 sentences
      - Valid file : 506 sentences
      - Test file : 469 sentences
   ii. Language model:
      - Train file: 62227 sentences
      - Valid file: 31111 sentences
      - Test file: 31112 sentences

b. Parameters:
   i. Batch_size: 80

c. Parameters for Generator:
   i. Optimizer: Adadelta
   ii. Loop of Generator: generator_loop_num: 1
   iii. Embedding vector dimension:
      - embedding_dim: 512
   iv. RNN's hidden layer dimension:
      - rnn_dim: 1024
   v. Vocabulary:
      - n_words_src: 30000/ 7751
      - n_words_trg: 30000/ 9067
   vi. Monte Carlo search:
      - maxlen: 50
      - Number of sentence rolled: rollnum: 20

d. Parameters for Discriminator:
   i. Optimizer: Adadelta
   ii. Loop of Discriminator: discriminator_loop_num: 1
   iii. Accuracy maximum: max_acc: 0.85
   iv. Accuracy minimum: min_acc: 0.75

e. Parameters for Language Model
   i. Embedding vector dimension
      - in_emb_dim: 512
      - out_emb_dim: 512
   ii. Vocabulary:
      - n_words: 30000/ 7751
   iii. Alpha * Reward of Discriminator + (1 - Alpha) * Reward of LM

- alpha_init = 0
- alpha_rate = 0.001

C. Algorithm

```
for each batch:
        alpha += alpha_rate
        for generator_loop_num:
                translated_sentences = translate_beam_search(batch)

                for sentence in translated_sentences:
                        if monte_carlo_search:
                                reward = get_reward_MC_sampling(sentence)
                        else:
                                reward = get_reward_not_MC(sentence)
                discriminator_rewards.append(reward)

                if language_model:
                        for sentence in translated_sentences:
                                reward = get_reward_LM(sentence)
                                language_model_rewards.append(reward)

                rewards = alpha * discriminator_rewards + (1-alpha) *
language_model_rewards

                update_generator(translated_sentences, rewards)
                update_discriminator(batch, professor_rewards)

        for discriminator_loop_num:
                if monte_carlo_search:
                        data = prepare_date_MC_sampling(batch)
                else:
                        data = prepare_date_not_MC(batch)
                update_discriminator(data)
```

D. Experiments:

a. NMT baseline

- Model type: Attention model with GRU
- BLEU score: (Beam_search, argmax, multinomial)
  - Train: 46.71, 42.17, 12.98
  - Valid: 38.85, 35.11, 14.45
  - Test: 38.39, 36.06, 15.20

b. NMT-GAN (MC search)

i. Pre-trained Generator:
- Model type: NMT baseline

ii. Pre-trained Discriminator:
- Model type: CNN discriminator
- Data: Machine-translated sentences of NMT baseline (Train 19972*2 sentences, Valid 506*2 sentences, Test 469*2 sentences) with maximum length of sentence 50
- Optimizer: Adadelta
- Cross-entropy: (Multinomial_1, Multinomial_2)
  - Train: 0.125, 0.178
  - Valid: 0.141, 0.218
  - Test: 0.124, 0.177

iii. GAN:
- BLEU score:

c. NMT with Reward directly from Discriminator

i. Pre-trained Discriminator: Same as NMT-GAN (MC search)
- Cross-entropy: (Multinomial)
  - Valid: 0.858, 0.835 (0.165)

ii. GAN:
- BLEU score:
  - Train: 46.71
  - Valid: 35.570
  - Test: 33.60

d. NMT with Reward of Language Model

i. Language model: RNN

ii. GAN:
- BLEU score:

E. Code: https://github.com/ngohoanhkhoa/GAN-NMT

F. Reference

a. [Li et al]: Adversarial Learning for Neural Dialogue Generation