

Adversarial Training on Pointer Generator

Introduction

The beginning of the introduction.

Table Of Contents:

- [Load Data & Initialize Model](#)
- [Example Generation](#)
- [Train Pointer Generator](#)
 - [Without Coverage](#)
 - [Generate Tokens](#)
 - [Rouge Evaluation](#)
 - [With Coverage](#)
 - [Generate Tokens](#)
 - [Rouge Evaluation](#)
- [Train Generative Adversarial Network](#)
 - [Pretrain Discriminator](#)
 - [Generate Tokens](#)
 - [Rouge Evaluation](#)
 - [Adversarial Training](#)
 - [Generate Tokens](#)
 - [Rouge Evaluation](#)
- [Analysis & Conclusion](#)
- [Limitations & Future Work](#)

Load Data & Initialize Model

```
In [1]: import numpy as np
from data import Data
from model import SummaryModel
import argparse

import tensorflow as tf

tf.compat.v1.disable_eager_execution()
tf.compat.v1.logging.set_verbosity('ERROR')

parser = argparse.ArgumentParser(description = 'Train/Test summarization model', formatter_class = argparse.ArgumentDefaultsHelpFormatter)

# Import Setting
parser.add_argument("--doc_file", type = str, default = './data/doc.p', help = 'path to document file')
parser.add_argument("--vocab_file", type = str, default = './data/vocab.p', help = 'path to vocabulary file')
parser.add_argument("--emb_file", type = str, default = './data/emb.p', help = 'path to embedding file')
parser.add_argument("--src_time", type = int, default = 200, help = 'maximal # of time steps in source text')
parser.add_argument("--sum_time", type = int, default = 50, help = 'maximal # of time steps in summary')
parser.add_argument("--max_oov_bucket", type = int, default = 280, help = 'maximal # of out-of-vocabulary word')
parser.add_argument("--train_ratio", type = float, default = 0.8, help = 'ratio of training data')
parser.add_argument("--seed", type = int, default = 888, help = 'seed for splitting data')

# Saving Setting
parser.add_argument("--log", type = str, default = './log/', help = 'logging directory')
parser.add_argument("--save", type = str, default = './model/', help = 'model saving directory')
parser.add_argument("--checkpoint", type = str, help = 'path to checkpoint point')
parser.add_argument("--autosearch", type = bool, default = False, help = "[NOT AVAILABLE] Set 'True' if searching for best hyperparameter")
parser.add_argument("--save_interval", type = int, default = 1900, help = "Save interval for training")

# Hyperparameter Setting
parser.add_argument("--batch_size", type = int, default = 16, help = 'number of samples in one batch')
parser.add_argument("--gen_lr", type = float, default = 1e-3, help = 'learning rate for generator')
parser.add_argument("--dis_lr", type = float, default = 1e-3, help = 'learning rate for discriminator')
parser.add_argument("--cov_weight", type = float, default = 1e-3, help = 'learning rate for coverage')

params = vars(parser.parse_args([]))

params['load_pretrain'] = True
# 1900 no coverage
#
params['checkpoint'] = './model/pointer_cov_supervised-1900' # Uncomment when requiring reloading model
```

```
model = SummaryModel(**params)
data = Data(**params)
```

```
A:\SHANE_STUFF\Text-Generation-GAN\SummaryGeneration\model.py:214: UserWarning: `tf.nn.rnn_cell.LSTMCell` is deprecated and will be removed in a future version. This class is equivalent as `tf.keras.layers.LSTMCell`, and will be replaced by that in Tensorflow 2.0.
    self.enc_fw_unit = tf.compat.v1.nn.rnn_cell.LSTMCell(self.num_unit, name='encoder_forward_cell')
A:\SHANE_STUFF\Text-Generation-GAN\SummaryGeneration\model.py:215: UserWarning: `tf.nn.rnn_cell.LSTMCell` is deprecated and will be removed in a future version. This class is equivalent as `tf.keras.layers.LSTMCell`, and will be replaced by that in Tensorflow 2.0.
    self.enc_bw_unit = tf.compat.v1.nn.rnn_cell.LSTMCell(self.num_unit, name='encoder_backward_cell')
A:\SHANE_STUFF\Text-Generation-GAN\SummaryGeneration\model.py:250: UserWarning: `tf.nn.rnn_cell.LSTMCell` is deprecated and will be removed in a future version. This class is equivalent as `tf.keras.layers.LSTMCell`, and will be replaced by that in Tensorflow 2.0.
    self.dec_unit = tf.compat.v1.nn.rnn_cell.LSTMCell(self.num_unit, state_is_tuple=False, name='decoder_cell')
A:\SHANE_STUFF\Text-Generation-GAN\SummaryGeneration\model.py:462: UserWarning: `tf.nn.rnn_cell.LSTMCell` is deprecated and will be removed in a future version. This class is equivalent as `tf.keras.layers.LSTMCell`, and will be replaced by that in Tensorflow 2.0.
    self.dis_enc_unit = tf.compat.v1.nn.rnn_cell.LSTMCell(self.num_unit, name='dis_enc_unit')
A:\SHANE_STUFF\Text-Generation-GAN\SummaryGeneration\model.py:464: UserWarning: `tf.nn.rnn_cell.LSTMCell` is deprecated and will be removed in a future version. This class is equivalent as `tf.keras.layers.LSTMCell`, and will be replaced by that in Tensorflow 2.0.
    self.dis_dec_unit = tf.compat.v1.nn.rnn_cell.LSTMCell(self.num_unit, name='dis_dec_unit')
A:\SHANE_STUFF\Text-Generation-GAN\SummaryGeneration\model.py:495: UserWarning: `tf.nn.rnn_cell.LSTMCell` is deprecated and will be removed in a future version. This class is equivalent as `tf.keras.layers.LSTMCell`, and will be replaced by that in Tensorflow 2.0.
    self.bas_enc_unit = tf.compat.v1.nn.rnn_cell.LSTMCell(self.num_unit, name='bas_enc_unit')
A:\SHANE_STUFF\Text-Generation-GAN\SummaryGeneration\model.py:497: UserWarning: `tf.nn.rnn_cell.LSTMCell` is deprecated and will be removed in a future version. This class is equivalent as `tf.keras.layers.LSTMCell`, and will be replaced by that in Tensorflow 2.0.
    self.bas_dec_unit = tf.compat.v1.nn.rnn_cell.LSTMCell(self.num_unit, name='bas_dec_unit')
Restore Model from ./model/pointer_cov_supervised-1900
```

Example Generation

```
In [2]: train_data = data.get_next_epoch()
test_data = data.get_next_epoch_test()
src, ref, gen, tokens, scores, attens, gt_attens = None, None, None, None, None, None, None
for feed_dict in train_data:
    real, fake, real_len, fake_len = model.sess.run(
        [model.real_reward, model.fake_reward, model.sum_len, model.tokens_len], feed_dict=feed_dict)
    print(np.mean(real[1, 0:int(real_len[1])]))
    print(np.mean(fake[1, 0:int(fake_len[1])]))
    break

for feed_dict in test_data:
    tokens, scores, attens = model.beam_search(feed_dict)
    src, ref, gen = data.id2word(feed_dict, tokens)
    gt_attens = model.sess.run(model.atten_dist, feed_dict = feed_dict)
    # print(src, ref, gen, gt_attens)
    x = 0
    print ("".join(src[x]).replace("(OOV)", ""), end = '\n\n')
    print ("".join(ref[x]).replace("(OOV)", ""), end = '\n\n')
    print (gen)
    # for i in range(len(src)):
    #     print ("".join(gen[x][i]))
    break
```

0.47486126

Dissident Plans a More Active Role in Myanmar<END>

Train Pointer Generator

Train without coverage

Start from step 4

Train Epoch 0

```
0%|          | 0/1908 [00:00<?, ?it/s]
```

Generate tokens

```
In [93]: def generate_top_k_tokens(coverage, top_k=1):
    test_data = data.get_next_epoch_test()
    src = [[] for i in range(top_k)]
    ref = [[] for i in range(top_k)]
    gen = [[] for i in range(top_k)]
    for feed_dict in test_data:
        tokens, scores, attens = model.beam_search(feed_dict, coverage_on = coverage, top_k = top_k)
        if top_k == 1:
            tokens = [tokens]
            scores = [scores]
        for i in range(top_k):
            src[i], ref[i], gen[i] = data.id2word(feed_dict, tokens[i])
    #     feed_dict['coverage_on:0'] = coverage
    #     gt_attens = model.sess.run(model.atten_dist, feed_dict = feed_dict)
    break
    return src, ref, gen, scores

def clean_generated_tokens(src, ref, gen):
```

In [74]:

Batch: 0

Generation: 0

Abstract: nuclear powered american submarine collided navy warship early friday strait hormuz n arrow passage much world oil must pas<END>

Title: 2 Navy Vessels Collide in Strait of Hormuz<END>

Generated: A Sase and Rase and Rase and Rase and Rase of

Score: -1.1149016847001745

Generation: 1

Abstract: barack obama said israel interest find peace palestinian said israel able defend<END>

Title: 2 Navy Vessels Collide in Strait of Hormuz<END>

Generated: A Sase and Rase and Rase and Rase and Rase and T

Score: -1.0473748031927614

Generation: 2

Abstract: ruling african national congress steamrolling big election victory third ballot count ed<END>

Title: 2 Navy Vessels Collide in Strait of Hormuz<END>

Generated: A Sase and Rase and Rase and Rase and Rase and

Score: -1.11961932892495

Generation: 3

Abstract: ultra orthodox israeli protest plan include community military draft arguing study to rah important defending israel carrying weapon army<END>

Title: 2 Navy Vessels Collide in Strait of Hormuz<END>

Generated: A Sase and Rase and Rase and Rase and Rase and

Score: -1.1125017531374668

Generation: 4

Abstract: accord militant pakistani army seems allowed taliban free rein swat<END>

Title: 2 Navy Vessels Collide in Strait of Hormuz<END>

Generated: A Sase and Rase and Rase and Rase and Rase of

Score: -1.0695390092565658

Generation: 5

Abstract: technical issue led rough landing european space agency philae lander made settled co met<END>

Title: 2 Navy Vessels Collide in Strait of Hormuz<END>

Generated: A Sase and Rase and Rase and Rase and Rase of

Score: -1.1111015969134392

Generation: 6

Abstract: arizona boundary mexico considered busiest border battlefield official declared make last stand<END>

Title: 2 Navy Vessels Collide in Strait of Hormuz<END>

Generated: A Sase and Rase and Rase and Rase and Ranistan

Score: -1.1236175374781832

Generation: 7

Abstract: see full result map 2020 presidential election maine<END>

Title: 2 Navy Vessels Collide in Strait of Hormuz<END>

Generated: A Sase and Rase and Rase and Rase and Rase of

Score: -1.114827663340467

Generation: 8

Abstract: age old process influencing opinion word mouth still hold true new hampshire local ex change idea opinion effort sway one another voting tuesday<END>

Title: 2 Navy Vessels Collide in Strait of Hormuz<END>

Generated: A Saster in Sanistan at the Seaders in Saristan

Score: -1.1986602471799266

Generation: 9

Abstract: former intelligence chief abdullah al senussi extradited libya mauritania wednesday h anding victory new tripoli government<END>

Title: 2 Navy Vessels Collide in Strait of Hormuz<END>

Generated: A Sase and Rase and Rase and Rase and Rase and

Score: -1.1283768998815658

Generation: 10

Abstract: arm transfer southern sudan soon vote secession revealed somali pirate<END>

Title: 2 Navy Vessels Collide in Strait of Hormuz<END>

Generated: A Sase and Rase and Rase and Rase and Rase and T

Score: -1.06398648631816
 Generation: 11
 Abstract: hamas militant fired dozen shell southern israel escalating tension along israel gaza border<END>
 Title: 2 Navy Vessels Collide in Strait of Hormuz<END>
 Generated: A Sase and Rase and Rase and Rase and Rase of
 Score: -1.08660434154754
 Generation: 12
 Abstract: though case ethan couch captured widespread attention many fugitive decade ago faded headline remain concern law enforcement official<END>
 Title: 2 Navy Vessels Collide in Strait of Hormuz<END>
 Generated: A Sase and Rase and Rase and Rase and Rase and
 Score: -1.1185679334275267
 Generation: 13
 Abstract: inside growing influence completely anonymous campaign contribution impact 2014 election<END>
 Title: 2 Navy Vessels Collide in Strait of Hormuz<END>
 Generated: A Saster in Afghanist |or Saresters in Afghaning
 Score: -1.1985371648048868
 Generation: 14
 Abstract: eve election decide replacement american president put troop new york time took informal snapshot iraqi living working green zone<END>
 Title: 2 Navy Vessels Collide in Strait of Hormuz<END>
 Generated: Traning to Readers in Afghaning to Raristanister
 Score: -1.220322122379225
 Generation: 15
 Abstract: among maria da graças foster oil company chief executive handpicked president dilma Rousseff<END>
 Title: 2 Navy Vessels Collide in Strait of Hormuz<END>
 Generated: A Sase and Rase and Rase and Rase and Ranistan
 Score: -1.0957964633373505

Rouge Evaluation

```
In [79]: from rouge import Rouge
from tqdm import tqdm_notebook
rouge = Rouge()

def generate_evaluation_sets(coverage):
    refs = []
    gens = []
    cnt = 0
    test_n = min(data.n_test_batch, 50)
    test_data = data.get_next_epoch_test()
    for feed_dict in tqdm_notebook(test_data, total = test_n):
        tokens, scores, attens = model.beam_search(feed_dict, coverage_on = coverage)
        # sample tokens = model.sess.run(model.tokens, feed_dict = feed_dict)
        src, ref, gen = data.id2word(feed_dict, tokens)
        for i in range(len(ref)):
            refs.append(" ".join(ref[i][::-1]))
            gens.append(" ".join(gen[i][::-1]))
        cnt += 1
        if cnt > test_n:
            break
    new_gens = []
    new_refs = []
    for i in range(len(gens)):
        if not (gens[i] == ""):
            new_gens.append(gens[i])
            new_refs.append(refs[i])
    return new_refs, new_gens

def rouge_evaluation(ref, gen):
    rouge_score = rouge.get_scores(gen, ref)
    r1, r2, rL = 0., 0., 0.
    for score in rouge_score:
        r1 = r1 + score['rouge-1']['f']
        r2 = r2 + score['rouge-2']['f']
        rL = rL + score['rouge-l']['f']
    r1 /= len(rouge_score)
    r2 /= len(rouge_score)
    rL /= len(rouge_score)
    print (r1, r2, rL)
    return r1, r2, rL
```

```
In [80]: test1_eval_refs, test1_eval_gens = generate_evaluation_sets(coverage=False)
test1_r1, test1_r2, test1_rL = rouge_evaluation(test1_eval_refs, test1_eval_gens)
```

C:\Users\kush5\AppData\Local\Temp\ipykernel_888\1670607890.py:11: TqdmDeprecationWarning: This function will be removed in tqdm==5.0.0
 Please use `tqdm.notebook.tqdm` instead of `tqdm.tqdm_notebook`
 for feed_dict in tqdm_notebook(test_data, total = test_n):

```
0%|          | 0/50 [00:00<?, ?it/s]
0.5283459926872293 0.14496090360978436 0.4170432907200313
```

Train with coverage

```
In [82]: train_max_epoch = 1
print (f'Start from step {model.sess.run(model.gen_global_step)}')
for i in range(train_max_epoch):
    print (f'Train Epoch {i}')
    train_data = data.get_next_epoch()
    model.train_one_epoch(train_data, data.n_train_batch, coverage_on = True, model_name = 'with_coverage')
```

Start from step 1899

Train Epoch 0

```
0%|          | 0/1908 [00:00<?, ?it/s]
```

Generate tokens

```
In [85]: test2_src, test2_ref, test2_gen, test2_scores = generate_top_k_tokens(coverage=True, top_k=1)
test2_src_list, test2_ref_list, test2_gen_list = clean_generated_tokens(test2_src, test2_ref, test2_gen)
print_cleaned_tokens(test2_src_list, test2_ref_list, test2_gen_list, test2_scores)
```

Batch: 0

Generation: 0

Abstract: republican senator voted border security deal come state large house republican deleg
ation<END>

Title: Prospects in the House<END>

Generated: Afghanistan:

Score: -0.8208288046029898

Generation: 1

Abstract: danish celebrity chef claus meyer opening restaurant la paz hoping start bolivian foo
d movement rediscover local ingredient<END>

Title: Prospects in the House<END>

Generated: Afghanistan:

Score: -0.8298874634962815

Generation: 2

Abstract: see latest chart map coronavirus case death hospitalization harris county georgia<END
>

Title: Prospects in the House<END>

Generated: Alabama Povid Case and Risk Trackers of

Score: -0.5524458885192871

Generation: 3

Abstract: detention journalist unspecified security offense first time hamas arrested foreigner
since took gaza 2007<END>

Title: Prospects in the House<END>

Generated: Aftermath on the

Score: -0.7901968114516315

Generation: 4

Abstract: elderly farmer demonstration new delhi<END>

Title: Prospects in the House<END>

Generated: Thina: Pounty, Iesults of the Tay of the

Score: -0.9394987152843941

Generation: 5

Abstract: disputed presidential runoff led clash demonstrator police call opposition boycott<EN
D>

Title: Prospects in the House<END>

Generated: Afghanistan:

Score: -0.8348959409273587

Generation: 6

Abstract: international herald tribune<END>

Title: Prospects in the House<END>

Generated: Than and Rounty, Iesults of the Teaders in

Score: -0.922599615052689

Generation: 7

Abstract: former australian cricketer brett lee icc cricket world cup 2015 trophy new delhi<END
>

Title: Prospects in the House<END>

Generated: Aftermath of ther

Score: -0.8307949701944987

Generation: 8

Abstract: saudi arabia promised cease fighting group could deliver aid million starving yemeni
indication would happen monday planned<END>

Title: Prospects in the House<END>

Generated: Afghanistan:

Score: -0.833802003126878

Generation: 9

Abstract: several near miss democrat taste victory georgia republican fear president trump lack
luster number may drag party senate candidate<END>

Title: Prospects in the House<END>

Generated: Aftermath on the

Score: -0.8127229914945715

Generation: 10

Abstract: many 200 people may abducted connection ethnic fighting 30 000 head cattle stolen<END

```

>
    Title: Prospects in the House<END>
    Generated: Aftermath on the
    Score: -0.771519099964815
    Generation: 11
    Abstract: president trump accept nomination general election season officially begin<END>
    Title: Prospects in the House<END>
    Generated: Afghanistan:
    Score: -0.8090845254751352
    Generation: 12
    Abstract: politics newsletter real world consequence campaign scare tactic plus surprising volu
n   nteer georgia poll florida<END>
    Title: Prospects in the House<END>
    Generated: Afghanistan:
    Score: -0.8343593157254733
    Generation: 13
    Abstract: egypt hamas made effort restore calm sunday cross border violence israel smaller pale
s   stinian group killed two civilian<END>
    Title: Prospects in the House<END>
    Generated: Aftermath of ther
    Score: -0.835058848063151
    Generation: 14
    Abstract: estimate exit poll offer initial indication group voted election night<END>
    Title: Prospects in the House<END>
    Generated: Aftermath on the
    Score: -0.7903290916891659
    Generation: 15
    Abstract: company part surge battalion received crash course afghan war began assault last larg
e   e taliban stronghold helmand province<END>
    Title: Prospects in the House<END>
    Generated: Aftermath of the Tay of the
    Score: -0.8362052100045341

```

Rouge Evaluation

```

In [86]: test2_eval_refs, test2_eval_gens = generate_evaluation_sets(coverage=True)
test2_r1, test2_r2, test2_rl = rouge_evaluation(test2_eval_refs, test2_eval_gens)

C:\Users\kush5\AppData\Local\Temp\ipykernel_888\1670607890.py:11: TqdmDeprecationWarning: This function will be
r   removed in tqdm==5.0.0
Please use `tqdm.notebook.tqdm` instead of `tqdm.tqdm_notebook`
  for feed_dict in tqdm_notebook(test_data, total = test_n):
    0%|          | 0/50 [00:00<?, ?it/s]
0.49432528823714433 0.1006288352997728 0.3716033682313441

```

Train GAN

Pretrain Discriminator

```

In [87]: train_max_epoch = 1
print (f'Start from step {model.sess.run(model.gen_global_step_2)}')
for i in range(train_max_epoch):
    print (f'Train Epoch {i}')
    train_data = data.get_next_epoch()
    model.train_one_epoch_pre_dis(train_data, data.n_train_batch, coverage_on = True)

Start from step 0
Train Epoch 0
  0%|          | 0/1908 [00:00<?, ?it/s]

```

Generate tokens

```

In [88]: test3_src, test3_ref, test3_gen, test3_scores = generate_top_k_tokens(coverage=True, top_k=1)
test3_src_list, test3_ref_list, test3_gen_list = clean_generated_tokens(test3_src, test3_ref, test3_gen)
print_cleaned_tokens(test3_src_list, test3_ref_list, test3_gen_list, test3_scores)

Batch: 0
    Generation: 0
    Abstract: many greek taking hard look country day seeing mismanagement corruption<END>
    Title: Digging Deep and Seeing Greece's Flaws<END>
    Generated: Aftermath on the
    Score: -0.8156286127427045
    Generation: 1
    Abstract: gen sarath fonseka led military campaign ended two decade civil war ran unsuccessfull
y   y president freed nearly two year prison<END>
    Title: Digging Deep and Seeing Greece's Flaws<END>
    Generated: Aftermath of ther
    Score: -0.8385739856296115
    Generation: 2
    Abstract: see latest chart map coronavirus case death hospitalization ames area<END>
    Title: Digging Deep and Seeing Greece's Flaws<END>

```

Generated: Afabama Covid Case and Risk Trackers
Score: -0.5203059428447002

Generation: 3
Abstract: everyone want democracy sympathizes protest crashing across middle east<END>
Title: Digging Deep and Seeing Greece's Flaws<END>
Generated: Aftermath on the
Score: -0.7647354462567497

Generation: 4
Abstract: president trump prime minister justin trudeau canada need work together despite vast difference climate change trade migrant<END>
Title: Digging Deep and Seeing Greece's Flaws<END>
Generated: Aftermath on the
Score: -0.7923805012422449

Generation: 5
Abstract: sorin grindeanu former minister communication named prime minister beating candidate would romania first woman first muslim hold post<END>
Title: Digging Deep and Seeing Greece's Flaws<END>
Generated: Aftermath on the
Score: -0.8135464612175437

Generation: 6
Abstract: pope benedict xvi decision resign puzzled faithful scholar wonder pope infallible one day fallible next<END>
Title: Digging Deep and Seeing Greece's Flaws<END>
Generated: Aftermath of ther
Score: -0.832253721025255

Generation: 7
Abstract: white house said early sure target russia hitting inside syria support president bash ar al assad<END>
Title: Digging Deep and Seeing Greece's Flaws<END>
Generated: Afabamanists on the
Score: -0.8995393753051758

Generation: 8
Abstract: team mechanic welder heavy machinery operator gathered saturday support vladimir puti n happy<END>
Title: Digging Deep and Seeing Greece's Flaws<END>
Generated: Aftermath on the
Score: -0.8062950022080365

Generation: 9
Abstract: woman said assaulted approaching group men tuesday ask direction hotel according poli ce<END>
Title: Digging Deep and Seeing Greece's Flaws<END>
Generated: Aftermath of ther
Score: -0.8370549943712022

Generation: 10
Abstract: chancellor angela merkel must walk fine line party younger voter increasingly favor g ay right older conservative voter<END>
Title: Digging Deep and Seeing Greece's Flaws<END>
Generated: Afghanistan:
Score: -0.8253895686222956

Generation: 11
Abstract: watching united state choose president sydney correspondent wonder division end<END>
Title: Digging Deep and Seeing Greece's Flaws<END>
Generated: Aftermath on the
Score: -0.8003060957964729

Generation: 12
Abstract: move came israel refusal apologize raid last year nine people died trying break naval blockade gaza<END>
Title: Digging Deep and Seeing Greece's Flaws<END>
Generated: Aftermath of Afgh
Score: -0.8405642509460449

Generation: 13
Abstract: president nicolas sarkozy presided ceremony remembrance seven service member killed a fghanistan last week<END>
Title: Digging Deep and Seeing Greece's Flaws<END>
Generated: Aftermath of ther
Score: -0.8389831119113498

Generation: 14
Abstract: growing array military leader arctic expert lawmaker say united state losing ability patrol safeguard arctic water<END>
Title: Digging Deep and Seeing Greece's Flaws<END>
Generated: Aftermath on the
Score: -0.7932117125567268

Generation: 15
Abstract: last three year briton debated brexit sense relief even though country still must dec ide sort brexit want<END>
Title: Digging Deep and Seeing Greece's Flaws<END>
Generated: Aftermath on the
Score: -0.7791721119600183

Rouge Evaluation

```
In [89]: test3_eval_refs, test3_eval_gens = generate_evaluation_sets(coverage=True)
test3_r1, test3_r2, test3_rl = rouge_evaluation(test3_eval_refs, test3_eval_gens)
```



```
C:\Users\kush5\AppData\Local\Temp\ipykernel_888\1670607890.py:11: TqdmDeprecationWarning: This function will be removed in tqdm==5.0.0
Please use `tqdm.notebook.tqdm` instead of `tqdm.tqdm_notebook`
  for feed_dict in tqdm_notebook(test_data, total = test_n):
    0%|          | 0/50 [00:00<?, ?it/s]
0.49311720341328225 0.09652547784773684 0.3691956659410668
```

Adversarial Training

```
In [91]: train_max_epoch = 1
print (f'Start from step {model.sess.run(model.gen_global_step_2)}')
for i in range(train_max_epoch):
    print (f'Train Epoch {i}')
    train_data = data.get_next_epoch()
    model.train_one_epoch_unsup(train_data, data.n_train_batch, coverage_on = True)
```

```
Start from step 14
Train Epoch 0
 0%|          | 0/1908 [00:00<?, ?it/s]
Restart Done!
Restart Done!
Restart Done!
Restart Done!
Restart Done!
Restart Done!
Restart Done!
Restart Done!
```

Generate Tokens

```
In [94]: test4_src, test4_ref, test4_gen, test4_scores = generate_top_k_tokens(coverage=True, top_k=1)
test4_src_list, test4_ref_list, test4_gen_list = clean_generated_tokens(test4_src, test4_ref, test4_gen)
print_cleaned_tokens(test4_src_list, test4_ref_list, test4_gen_list, test4_scores)
```

```
Batch: 0
  Generation: 0
    Abstract: call foreigner pause fighting talk rebel increasingly angered government colombo<END>
    Title: Sri Lanka Bars Swede Over Stand on War<END>
    Generated: Tndia Sattler th the
    Score: -0.9276477268763951
  Generation: 1
    Abstract: psychiatrist said german archdiocese led future pope benedict xvi ignored warning ear
ly 1980s priest accused sexually abusing boy<END>
    Title: Doctor Asserts Church Ignored Abuse Warnings<END>
    Generated: Attacks on the
    Score: -0.8075149536132813
  Generation: 2
    Abstract: white house friday released 2015 joint tax return president michelle obama document s
uggests planning future beyond mr obama white house tenure<END>
    Title: The Obamas' 2015 Tax Return<END>
    Generated: Attacks on the
    Score: -0.7968966801961263
  Generation: 3
    Abstract: tahrir square birthplace uprising place many felt like dream egypt like<END>
    Title: Birthplace of Uprising Welcomes Its Success<END>
    Generated: Attacks on the
    Score: -0.7942705790201823
  Generation: 4
    Abstract: child terrified noise finding food challenge rarely power many people yemen beyond dr
eam end fighting<END>
    Title: The Many Miseries of Yemeni Families<END>
    Generated: Indians Pith the Htattle in Ir
    Score: -0.9776635939075101
  Generation: 5
    Abstract: reporter ursula gauthier written article criticizing beijing attempt link paris attac
k ethnic violence china northwest<END>
    Title: China Says It Will Expel French Journalist<END>
    Generated: Attack on the Htate on the
    Score: -0.7681929976851852
  Generation: 6
    Abstract: nate silver mitt romney target audience speech republican national convention<END>
    Title: Nate Silver on Romney's Target Audience<END>
    Generated: Attacks on the
    Score: -0.8042524973551433
  Generation: 7
    Abstract: china executed two men involvement contamination milk product killed least six infant
sickened 300 000 child<END>
    Title: 2 Executed in China for Selling Tainted Milk<END>
    Generated: Attacks on the
    Score: -0.8075647989908854
  Generation: 8
    Abstract: bomb embassy string explosion seen attempt strike georgia united state<END>
```

Title: U.S. Ties a Russian to Bombings in Georgia<END>
 Generated: Iattle on the
 Score: -0.7876383236476353

Generation: 9
 Abstract: pet goldfish may seem tiny harmless wild take entire ecosystem<END>
 Title: In the Wild, Goldfish Turn From Pet to Pest<END>
 Generated: Attacks on the
 Score: -0.7780005772908528

Generation: 10
 Abstract: r proposed new restriction rein political activity nonprofit social welfare group inc
 reased change federal campaign finance law past decade<END>
 Title: How Nonprofits Have Played in Politics<END>
 Generated: Attacks on the
 Score: -0.8037520090738932

Generation: 11
 Abstract: natural gas explosion two week ago delivered deep psychic blow bozeman mont already g
 oing difficulty declining economy<END>
 Title: Explosion Wounds Montana Town<END>
 Generated: Indians Pith the State of the
 Score: -0.9274494171142578

Generation: 12
 Abstract: prime minister gordon brown use speech united nation security council thursday offer
 possibility britain reducing fleet ballistic nuclear missile submarine<END>
 Title: Brown to Offer to Cut British Nuclear Subs<END>
 Generated: Indians Ptate on the State in
 Score: -0.9279025395711263

Generation: 13
 Abstract: mr louis named willie reed testified 1955 trial two men murder emmett till killed fol
 lowing interaction white woman death galvanized civil right movement<END>
 Title: Testimony of Willie Louis<END>
 Generated: Attacks on the
 Score: -0.8047676086425781

Generation: 14
 Abstract: pakistan prime minister said country top intelligence officer would appear court 2008
 mumbai attack<END>
 Title: Pakistan Spy Chief to Ignore U.S. Summons<END>
 Generated: Attacks on the
 Score: -0.7924755096435547

Generation: 15
 Abstract: french president said criticism european effort libya leveled robert gate represented
 unfair statement even correspond kind truth<END>
 Title: Sarkozy Rebuts Gates's Remarks on Libya Strikes<END>
 Generated: Attacks on the
 Score: -0.7998697916666667

Rouge Evaluation

```
In [95]: test4_eval_refs, test4_eval_gens = generate_evaluation_sets(coverage=True)
test4_r1, test4_r2, test4_rl = rouge_evaluation(test4_eval_refs, test4_eval_gens)
```

```
C:\Users\kush5\AppData\Local\Temp\ipykernel_888\1670607890.py:11: TqdmDeprecationWarning: This function will be
removed in tqdm==5.0.0
Please use `tqdm.notebook.tqdm` instead of `tqdm.tqdm_notebook`
  for feed_dict in tqdm_notebook(test_data, total = test_n):
    0%|          | 0/50 [00:00<?, ?it/s]
0.5139641795130951 0.137870443942698 0.3837935762467773
```

```
In [96]: test_data = data.get_next_epoch_test()
src, ref, gen, tokens, scores, attens, gt_attens = None, None, None, None, None, None, None
for feed_dict in train_data:
    real, fake, real_len, fake_len = model.sess.run(
        [model.real_reward, model.fake_reward, model.sum_len, model.tokens_len], feed_dict=feed_dict)
    print(np.mean(real[1, 0:int(real_len[1])]))
    print(np.mean(fake[1, 0:int(fake_len[1])]))
    break
```

Analysis & Conclusion

```
In [97]: Requirement already satisfied: pandadoc in a:\shane_stuff\text-generation-gan\venv\lib\site-packages (0.1.0)
WARNING: You are using pip version 21.3.1; however, version 22.3.1 is available.
You should consider upgrading via the 'A:\SHANE_STUFF\Text-Generation-GAN\venv\Scripts\python.exe -m pip instal
l --upgrade pip' command.
```

Limitations & Future Work

```
In [ ]:
```