Фреймворк PyTorch для разработки искусственных нейронных сетей

Урок 6. Нейросети в обработке текста

Практическое задание

Text classification using CNN

Задача (Sentiment Analysis)

Работаем по методичке (Lecture06.jpynb)

В [1]:
```
max_words = 2000
max_len = 40
num_classes = 1

# Training
epochs = 20
batch_size = 512
print_batch_n = 100
```

В [2]:
```
import pandas as pd
```

В [3]:
```
PATH_DATA = '.\\data\\'
df = pd.read_excel(PATH_DATA + "отзывы за лето.xls")
print(df.shape, '\n')
df.info()
df.head()
```

```
(20659, 3)

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 20659 entries, 0 to 20658
Data columns (total 3 columns):
 #   Column   Non-Null Count  Dtype 
---  ------   --------------  ----- 
 0   Rating   20659 non-null  int64 
 1   Content  20656 non-null  object
 2   Date     20659 non-null  object
dtypes: int64(1), object(2)
memory usage: 484.3+ KB
```

Out[3]:

	Rating	Content	Date
0	5	It just works!	2017-08-14
1	4	В целом удобноное приложение...из минусов хотя...	2017-08-14
2	5	Отлично все	2017-08-14
3	5	Стал зависать на 1% работы антивируса. Дальше ...	2017-08-14
4	5	Очень удобно, работает быстро.	2017-08-14

В [4]:
```
df.columns
```

Out[4]:
```
Index(['Rating', 'Content', 'Date'], dtype='object')
```

В [5]:
```
# выводим уникальные значения рейтинга

df.Rating.unique()
```

Out[5]:
```
array([5, 4, 2, 3, 1], dtype=int64)
```

В [6]:
```
df = df.drop(['Date'], axis='columns')
```

Разделим данные на trin, test и val

В [7]:
```
test_dt_size = 1000
test_dt_val_size = 5000

df_train = df[:-test_dt_size]
df_test = df[-test_dt_size:]
df_val = df[-test_dt_val_size:]
```

В [8]:
```
df_train.head(3)
```

Out[8]:

	Rating	Content
0	5	It just works!
1	4	В целом удобноное приложение...из минусов хотя...
2	5	Отлично все

В [9]:
```
df_test.head(3)
```

Out[9]:

	Rating	Content
19659	4	Дизайн неудобен и некрасив, режет глаз, все ра...
19660	5	Быстро, качественно и удобно.
19661	1	Поганое приложение, постоянно само запускается...

В [10]:
```
df_val.head(3)
```

Out[10]:

	Rating	Content
15659	5	Всё вроде норм
15660	3	Урезано в равнении с версией в браузере
15661	5	Все работает очень быстро и удобно мне нравится!

Предобработка

В [11]:
```
from string import punctuation
from stop_words import get_stop_words
from pymorphy2 import MorphAnalyzer
import re
```

В [12]:
```
sw = set(get_stop_words("ru"))
exclude = set(punctuation)
morpher = MorphAnalyzer()

def preprocess_text(txt):
    txt = str(txt)
    txt = "".join(c for c in txt if c not in exclude)
    txt = txt.lower()
    txt = re.sub("\sне", "не", txt)
    txt = [morpher.parse(word)[0].normal_form for word in txt.split() if word not in sw]
    return " ".join(txt)

df_train['Content'] = df_train['Content'].apply(preprocess_text)
```

```
<ipython-input-12-49ea34e9bc8c>:13: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a
-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-co
py)
  df_train['Content'] = df_train['Content'].apply(preprocess_text)
```

В [13]:
```
train_corpus = " ".join(df_train["Content"])
train_corpus = train_corpus.lower()
```

В [14]:
```
import nltk
from nltk.tokenize import word_tokenize
nltk.download("punkt")

tokens = word_tokenize(train_corpus)
```

```
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\sil\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
```

В [15]:
```
tokens = word_tokenize(train_corpus)
```

Отфильтруем данные

и соберём в корпус N наиболее частых токенов

В [16]:
```
tokens_filtered = [word for word in tokens if word.isalnum()]
```

В [17]:
```
from nltk.probability import FreqDist
dist = FreqDist(tokens_filtered)
tokens_filtered_top = [pair[0] for pair in dist.most_common(max_words-1)]
```

В [18]:
```
tokens_filtered_top[10:]
```

```
 'случиться',
 'чёткий',
 'утро',
 'спустя',
 'вновь',
 'письмо',
 'почемунельзя',
 'развиваться',
 'наш',
 'восстановить',
 'платежина',
 'ващий',
 'вбивать',
 'претензийнуть',
 'нахрен',
 'пожелание',
 'класа',
 'диван',
 ...]
```

В [19]:
```
vocabulary = {v: k for k, v in dict(enumerate(tokens_filtered_top, 1)).items()}
```

В [20]:
```
import numpy as np
def text_to_sequence(text, maxlen):
    result = []
    tokens = word_tokenize(text.lower())
    tokens_filtered = [word for word in tokens if word.isalnum()]
    for word in tokens_filtered:
        if word in vocabulary:
            result.append(vocabulary[word])
    padding = [0]*(maxlen-len(result))
    return padding + result[-maxlen:]
```

В [21]:
```
x_train = np.asarray([text_to_sequence(text, max_len) for text in df_train["Content"]], dtype=np.int32)
x_test = np.asarray([text_to_sequence(text, max_len) for text in df_test["Content"]], dtype=np.int32)
x_val = np.asarray([text_to_sequence(text, max_len) for text in df_val["Content"]], dtype=np.int32)
```

В [22]:
```
x_train.shape
```

Out[22]:
```
(19659, 40)
```

В [23]:
```
x_train[1]
```

Out[23]:
```
array([   0,    0,    0,    0,    0,    0,    0,    0,    0,    0,    0,
          0,    0,    0,    0,    0,    0,    0,    0,    0,    0,    0,
          0,    0,    0,    0,    0,    0,    0,    0,  104,  126,  170,
        111,   78, 1370,  411,   15,  609,  441])
```

В [24]:
```
import random
import torch
import torch.nn as nn

seed = 0

random.seed(seed)
np.random.seed(seed)
torch.manual_seed(seed)
torch.cuda.manual_seed(seed)
torch.backends.cudnn.deterministic = True
```

В [25]:

```
class Net(nn.Module):
    def __init__(self, vocab_size=20, embedding_dim = 128, out_channel = 128, num_classes = 1):
        super().__init__()
        self.embedding = nn.Embedding(vocab_size, embedding_dim)
        self.conv = nn.Conv1d(embedding_dim, out_channel, kernel_size=3)
        self.relu = nn.ReLU()
        self.linear = nn.Linear(out_channel, num_classes)

    def forward(self, x):
        output = self.embedding(x)
        #                       B  F  L
        output = output.permute(0, 2, 1)
        output = self.conv(output)
        output = self.relu(output)
        output = torch.max(output, axis=2).values
        output = self.linear(output)

        return output
```

В [26]:

```
from torch.utils.data import DataLoader, Dataset

class DataWrapper(Dataset):
    def __init__(self, data, target=None, transform=None):
        self.data = torch.from_numpy(data).long()
        if target is not None:
            self.target = torch.from_numpy(target).long()
        self.transform = transform

    def __getitem__(self, index):
        x = self.data[index]
        y = self.target[index] if self.target is not None else None

        if self.transform:
            x = self.transform(x)

        return x, y

    def __len__(self):
        return len(self.data)
```

В [27]:

```
model = Net(vocab_size=max_words)

print(model)
print("Parameters:", sum([param.nelement() for param in model.parameters()]))

model.train()
#model = model.cuda()

optimizer = torch.optim.Adam(model.parameters(), lr=10e-3)
criterion = nn.BCEWithLogitsLoss()


train_dataset = DataWrapper(x_train, df_train['Rating'].values)
train_loader = DataLoader(train_dataset, batch_size=batch_size, shuffle=True)

val_dataset = DataWrapper(x_val, df_val['Rating'].values)
val_loader = DataLoader(val_dataset, batch_size=batch_size, shuffle=True)

loss_history = []

for epoch in range(1, epochs + 1):
    print(f"Train epoch {epoch}/{epochs}")
    for i, (data, target) in enumerate(train_loader):
        optimizer.zero_grad()

        # data = data.cuda()
        # target = target.cuda()

        # compute output
        output = model(data)

        # compute gradient and do SGD step
        loss = criterion(output, target.float().view(-1, 1))
        loss.backward()

        optimizer.step()

        if i%print_batch_n == 0:
            loss = loss.float().item()
            print("Step {}: loss={}".format(i, loss))
            loss_history.append(loss)
```

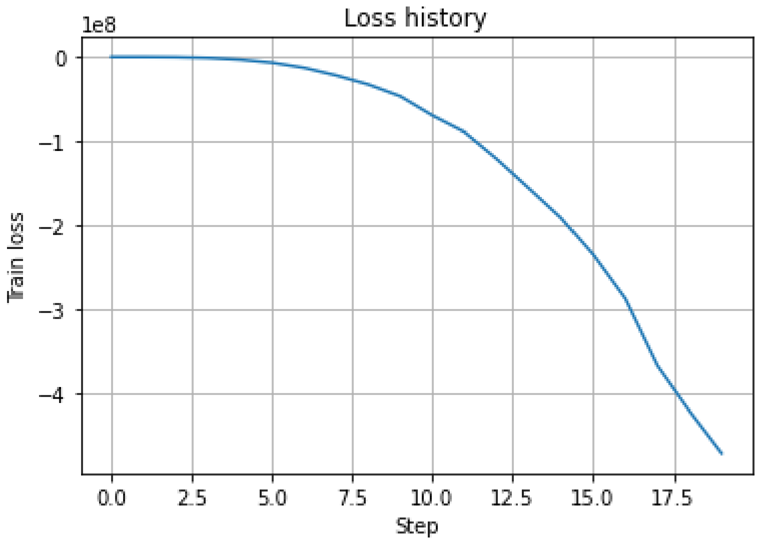
```
Net(
  (embedding): Embedding(2000, 128)
  (conv): Conv1d(128, 128, kernel_size=(3,), stride=(1,))
  (relu): ReLU()
  (linear): Linear(in_features=128, out_features=1, bias=True)
)
Parameters: 305409
Train epoch 1/20
Step 0: loss=-1.6998882293701172
Train epoch 2/20
Step 0: loss=-26912.890625
Train epoch 3/20
Step 0: loss=-265666.15625
Train epoch 4/20
Step 0: loss=-1153712.5
Train epoch 5/20
Step 0: loss=-3214220.25
Train epoch 6/20
Step 0: loss=-6851678.0
Train epoch 7/20
Step 0: loss=-12969374.0
Train epoch 8/20
Step 0: loss=-22007086.0
Train epoch 9/20
Step 0: loss=-32805878.0
Train epoch 10/20
Step 0: loss=-46847064.0
Train epoch 11/20
Step 0: loss=-69649096.0
Train epoch 12/20
Step 0: loss=-89202800.0
Train epoch 13/20
Step 0: loss=-121019288.0
Train epoch 14/20
Step 0: loss=-155820464.0
Train epoch 15/20
Step 0: loss=-191131008.0
Train epoch 16/20
Step 0: loss=-234939648.0
Train epoch 17/20
Step 0: loss=-287445760.0
Train epoch 18/20
Step 0: loss=-367297216.0
Train epoch 19/20
Step 0: loss=-421405248.0
```

```
Train epoch 20/20
Step 0: loss=-471328544.0
```

В [28]:

```
import matplotlib.pyplot as plt

plt.title('Loss history')
plt.grid(True)
plt.ylabel('Train loss')
plt.xlabel('Step')
plt.plot(loss_history);
```



В [29]:

```
test_dataset = DataWrapper(x_test)
test_loader = DataLoader(test_dataset, batch_size=batch_size, shuffle=True)
```

В [ ]:

В [ ]:

В [ ]:

В [ ]: