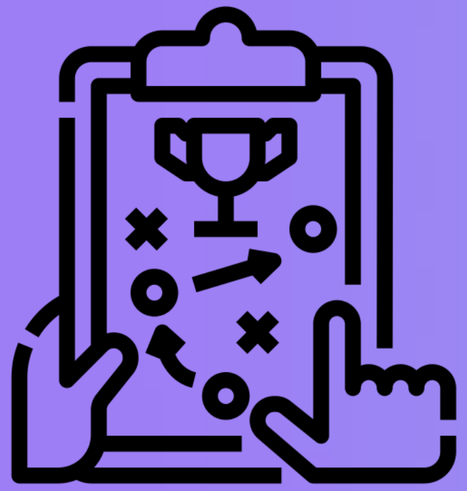
KUBIG Contest

월간 뉴스 토픽 분류 AI 경진대회

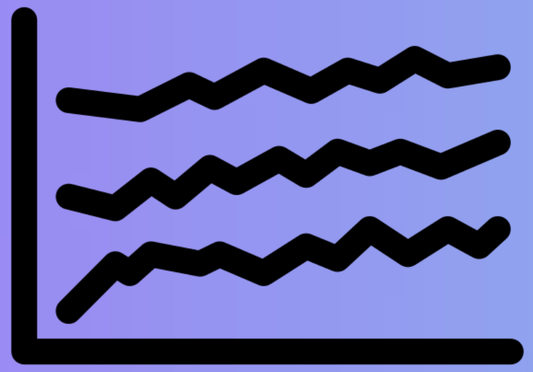
With LSTM , Klue/Roberta-Large

DL 2팀

원준혁 /우다경 /18기 정해원



분석 배경 및 목표



데이터 전처리

모델링

결과 / 해석

분석 배경 및 목표

텍스트 주제 추론

= 언어 이해 시스템이 보유해야 할 핵심 기능

한국어 자연어 데이터를 바탕으로
주제를 추론/분류하는 알고리즘의 개발 필요

01 분석 배경 및 목표

Deep Learning을 기반으로
NLP 알고리즘을 개발

YNAT *(주제 분류를 위한 연합 뉴스 헤드라인)* 데이터 세트를 활용

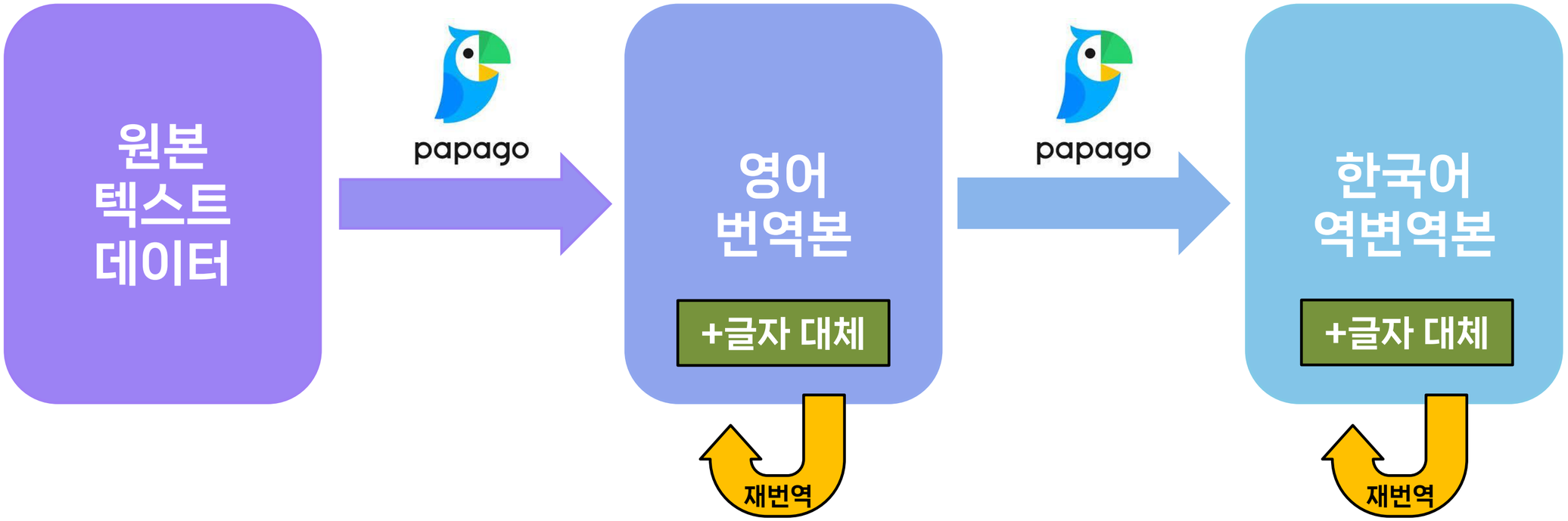
KLUE *(Korean Language Understanding Evaluation)* 데이터 세트를 이용
다양한 언어 모델의 성능을 비교

한국어 뉴스 헤드라인을 이용하여,
뉴스의 주제를 분류하는 알고리즘 개발

데이터 전처리

02 데이터 전처리

각 단계에서 네이버 파파고를 이용해서 번역



%, 한자 등의 특수 문자 → 한글/영문으로 대체

각 단계에서 결측치 발생시, 번역 시간을 늘려서 재번역

02 데이터 전처리

```python
# Crawling 한->영 번역
def kor_to_trans(text_data, trans_lang,start_index,final_index):

  target_present = EC.presence_of_element_located((By.XPATH, '//*[@id="txtTarget"]'))

  for i in tqdm(range(start_index,final_index)):

    if (i!=0)&(i%99==0):
      time.sleep(0.05)
      np.save(data_path+'kor_to_eng_train_{}_{}.npy'.format(start_index,final_index),trans_list)
    elif i==(final_index) :
      time.sleep(0.05)
      np.save(data_path+'kor_to_eng_train_{}_{}.npy'.format(start_index,final_index),trans_list)

    try:
      driver.get('https://papago.naver.com/?sk=ko&tk='+trans_lang+'&st='+text_data[i])
      time.sleep(1.5)
      element=WebDriverWait(driver, 10).until(target_present)
      time.sleep(0.1)
      backtrans = element.text

      if (backtrans=='')|(backtrans==' '):
        element=WebDriverWait(driver, 20).until(target_present)
        backtrans = element.text
        trans_list.append(backtrans)
      else:
        trans_list.append(backtrans)

    except:
      trans_list.append('')
```

```python
a=train.shape[0]
trans_list=[]
kor_to_trans(train['title'], 'en',0,a)
np.save(data_path+'kor_to_eng_train.npy',trans_list)
# 실제 데이터는 너무 커서 10000개씩 구간을 나눠서 번역 후 결합
# time sleep이나 wait time이 짧아 결측치가 생기는 문제가 발생하여 그 시간을 늘림
```

번역 : KOR → ENG

```python
def en_to_trans(text_data, trans_lang,start_index,final_index):

  target_present = EC.presence_of_element_located((By.XPATH, '//*[@id="txtTarget"]'))

  for i in tqdm(range(start_index,final_index)):

    if (i!=0)&(i%99==0):
      time.sleep(0.05)
      np.save(data_path+'eng_to_kor_train_{}_{}.npy'.format(start_index,final_index),trans_list)
    elif i==final_index :
      time.sleep(0.05)
      np.save(data_path+'eng_to_kor_train_{}_{}.npy'.format(start_index,final_index),trans_list)

    try:
      driver.get('https://papago.naver.com/?sk=en&tk='+trans_lang+'&st='+text_data[i])
      time.sleep(1.5)
      element=WebDriverWait(driver, 10).until(target_present)
      time.sleep(0.1)
      backtrans = element.text

      if (backtrans=='')|(backtrans==' '):
        element=WebDriverWait(driver, 20).until(target_present)
        backtrans = element.text
        trans_list.append(backtrans)
      else:
        trans_list.append(backtrans)

    except:
      trans_list.append('')
```

```python
a=train_eng.shape[0]
trans_list=[]
en_to_trans(train_eng['title_en'], 'ko',0,a)
np.save(data_path+'eng_to_kor_train.npy',trans_list)
```

역번역 : ENG → KOR

02 데이터 전처리

```
22126th :  Criticism of God's abandonment to Prague, which has severed its sisterhood relationship with Beijing
22425th :  Hyundai Opens Premium Outlet in Namyangju in 2019
22724th :  Although he caught a monster, IS forces were reinforced by Trump's withdrawal
23023th :
23322th :
23621th :  FIFA expanded to 48 participating countries from the 2026 World Cup.....
23920th :  Let's compete for coverage, not KT 5G subsidies...A goal of 1.5 million people at the end of the year
24219th :
24518th :  It's raining... Cheonan-Asan Spring Flower Scenery Minister Next Month
24817th :  U.S. teen iPhone preference intensifies
25116th :
25415th :  Minister Yoo Young-min emphasizes the need to cut telecommunication costs to KT Chairman Hwang Chang-kyu
25714th :
26013th :  Weekend N trip Gangwon-do Province's leisure sports stunt that will blow away the late heat
```

Q) 번역 돌리고 중간에 발생한 결측치의 처리?

```
15    try:
16      driver.get('https://papago.naver.com/?sk=ko&tk='+trans_lang+'&st='+text_data[i])
17      time.sleep(1.5)
18      element=WebDriverWait(driver, 10).until(target_present)
19      time.sleep(0.1)
20      backtrans = element.text
21
```

번역 시간을 늘린다(10초)

02 데이터 전처리

```
### 역번역 자료에서 한자 및 특정 문자 변환
train_final["title_kor"]=train_final["title_kor"].apply(ch2_eda)
train_final["title_kor"]=train_final["title_kor"].apply(per2_eda)
```

```
### 특수문자, 한자 등 없애기
import re

def remove_chr(str):

    new = re.sub(r'[^a-zA-Z가-힣0-9₩s]', '', str) #
    return new

# train_final 데이터에 적용
train_final1 = train_final
temp = train_final1['title_kor'].apply(remove_chr)
temp2 = train_final1['title_en'].apply(remove_chr)
temp3 = train_final1['title'].apply(remove_chr)
train_final1['title'] = temp3
train_final1['title_kor'] = temp
train_final1['title_en'] = temp2

train_final1
```

```
def ch_eda(title) :
    title=title.replace("英","Great Britain")
    title=title.replace("美", "the United States")
    title=title.replace("伊","Italy")
    title=title.replace("與","the rulling party")
    title=title.replace("野","the opposition party")
    title=title.replace("獨","Germany")
    title=title.replace("女","woman")
    title=title.replace("親","friendly")
    title=title.replace("亞","Asia")
    title=title.replace("反","opposing")
    title=title.replace("印","India")
    title=title.replace("檢","the prosecution")
    title=title.replace("佛","France")
    return title
```

```
# 영-한 역번역 시 한자의 경우 제대로 번역이 되지 않는 문제가 발생
# 한자가 포함된 데이터 확인 후 ch_eda 적용 후 재번역 실시
def contains_hanja(text):
  hanja_range = (0x4E00, 0x9FFF)  # 한자 유니코드 범위
  for char in text:
    if hanja_range[0] <= ord(char) <= hanja_range[1]:
      return True
    else:
      return False

kor_data2_hanja = train_eng[train_eng['title_en'].apply(contains_hanja)]
```

```
# 한자어 포함 데이터프레임 추출
example_list=["英","美","伊","獨","野","與","女","親","亞","反","印","檢","佛"]
test = '|'.join(example_list)
train_eng_c=train_eng[train_eng["title_en"].str.contains(test)]
```

역번역 과정에서 번역되지 않은 한자들을 인위적으로 번역하여 전처리

02 데이터 전처리

```python
# 전처리
def word_delete(title):
    delete_word = [
        "1보",
        "2보",
        "3보",
        "4보",
        "5보",
        "6보",
        "게시판",
        "신간",
        "그래픽",
        "속보",
        "영상",
        "...",
        "주말 N",
        "QA",
        "동정",
        "위클리",
        "주간 화제의 뉴스",
        "카드뉴스",
        "팩트체크",
######## 스포츠 10대 뉴스, 관련주 등 키워드 추론 가능 내용은 제거하지 않음
    ]
    for i in delete_word:
        if title.endswith(i) or title.startswith(i):
            title = title.replace(i, "")
    if title.endswith("종합"):
        title = title[:-2]
    title = title.replace("↑", " 증가")
    title = title.replace("↓", " 감소")
    title = title.replace("→", "에서 ")
    title = title.replace("~", "에서 ")
    title = title.replace("·", " 그리고 ")
    title = title.replace(":", " 대 ")
    title = title.replace("%", "퍼센트")
    title=title.replace("…"," ")
    title=title.replace("...", " ")
    title=title.replace("&","그리고")
    return title
```

불용어 제거

title_kor
인천발 핀란드 항공기 결항 명절 여행객 분노
실리콘밸리 넘어 구글 **15**조원 들여 미국 글로벌 허브로 도약
이란 외무부 긴장완화 해법은 미국이 경제전쟁을 멈추는 것입니다
NYT 클린턴 한국 기업 최측근 특수관계 부각 공과 연계
시진핑은 가능한 한 빨리 중미 무역 협상을 타결하기
…
KB금융 미국 **IB** 스티펠과 제휴 선진시장 공략
서울시교육청 코로나**19** 확산에 개 그리고 폐교 연기 검토
키움증권 **2020** 키움영웅대회 실물투자대회
배기동 국립중앙박물관장 답변
다음달 **1**일 **2020** 한국인터넷기자대상 시상식 특별상 김성후

전처리 완료

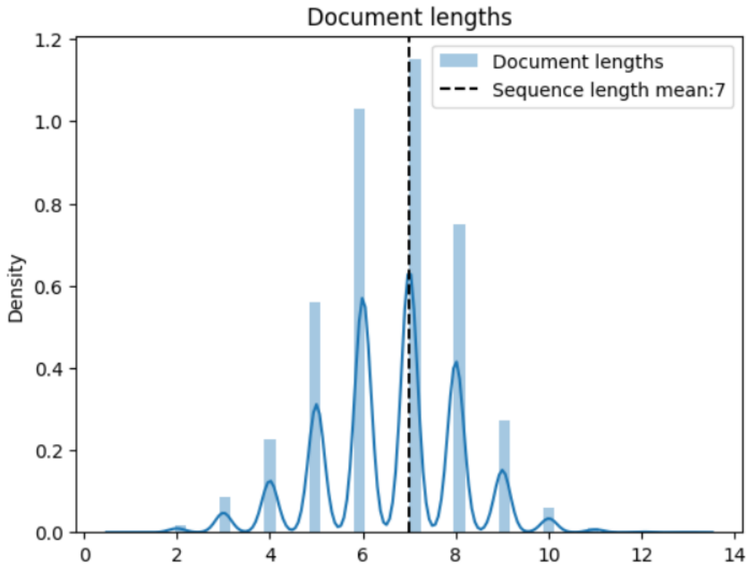
모델링

❶ Bidirectional LSTM

❶ Bidirectional LSTM - Parameters

```
from keras.preprocessing.text import Tokenizer
vocab_size = 5000

tokenizer = Tokenizer(num_words = vocab_size)
  # Tokenizer 는 데이터에 출현하는 모든 단어의 개수를 세고 빈도 수로 정렬해서
  # num_words 에 지정된 만큼만 숫자로 반환하고, 나머지는 0 으로 반환합니다
tokenizer.fit_on_texts(X_train) # Tokenizer 에 데이터 실제로 입력
sequences_train = tokenizer.texts_to_sequences(X_train)    # 문장 내 모든 단어를 시퀀스 번호로 변환
sequences_test = tokenizer.texts_to_sequences(X_test)      # 문장 내 모든 단어를 시퀀스 번호로 변환

print(len(sequences_train), len(sequences_test))
```

```
45654 9131
```



Text Data

↓

Tokenize

그래프를 통해 문장 내
단어 수 분포 파악

최대 길이 : 14

❶ Bidirectional LSTM - Parameters

```
import tensorflow as tf
from tensorflow.keras.preprocessing.sequence import pad_sequences

 ## 문장의 길이가 제각각이기 때문에 벡터 크기 다 다름
  ## 그러므로 최대 시퀀스 길이 크기(211) 만큼 넉넉하게 늘리고
  ## 패딩(padding) 작업을 통해 나머지 빈 공간을 0으로 채움

max_length = 14    # 위에서 그래프 확인 후 정함
padding_type='post'

train_X = pad_sequences(sequences_train, padding='post', maxlen=max_length)
test_X = pad_sequences(sequences_test, padding=padding_type, maxlen=max_length)
```

```
from tensorflow.keras.utils import plot_model, to_categorical
from tensorflow.keras.optimizers import Adam

from keras.utils import np_utils

# 종속변수 데이터 전처리
train_Y = np_utils.to_categorical(Y_train) # Y_train 에 원-핫 인코딩
print(train_Y)
print(train_Y.shape)
```

```
[[0. 0. 0. ... 1. 0. 0.]
 [0. 0. 0. ... 1. 0. 0.]
 [0. 0. 0. ... 1. 0. 0.]
 ...
 [0. 1. 0. ... 0. 0. 0.]
 [0. 0. 1. ... 0. 0. 0.]
 [0. 0. 1. ... 0. 0. 0.]]
(45654, 7)
```

Padding 완료 후
Y_train 데이터

❶ Bidirectional LSTM - Parameters

```
#파라미터 설정
vocab_size = 5000 # 제일 많이 사용하는 사이즈
embedding_dim = 200
max_length = 14    # 위에서 그래프 확인 후 정함
padding_type='post'
```

```
from tensorflow.keras import Sequential
from tensorflow.keras.layers import Dense, Embedding, LSTM, Dropout, Bidirectional

model3 = Sequential([Embedding(vocab_size, embedding_dim, input_length =max_length),
        tf.keras.layers.Bidirectional(LSTM(units = 64, return_sequences = True)),
        tf.keras.layers.Bidirectional(LSTM(units = 64, return_sequences = True)),
        tf.keras.layers.Bidirectional(LSTM(units = 64)),
        Dense(7, activation='softmax')    # 결과값이 0~4 이므로 Dense(5)
    ])

model3.compile(loss= 'categorical_crossentropy', #여러개 정답 중 하나 맞추는 문제이므로 손실 함수는 categorical_crossentropy
              optimizer= 'adam',
              metrics = ['accuracy'])
model3.summary()
```

Sequential 함수를 이용해 모델 설정

❶ Bidirectional LSTM – CV X

Train/Val Split : O
Cross Validation : X
Early Stopping : X

```
# 모델 실행해보기
history = model3.fit(train_X, train_Y, epochs=30, batch_size=128, validation_split= 0.2)
  # 양방향 LSTM 레이어에서는 batch size 를 100으로 잡고 30회 학습 해보았다.
```

```
Epoch 1/30
286/286 [==============================] - 37s 84ms/step - loss: 0.9537 - accuracy: 0.6594 - val_loss: 1.0427 - val_accuracy: 0.6120
Epoch 2/30
286/286 [==============================] - 7s 25ms/step - loss: 0.5104 - accuracy: 0.8317 - val_loss: 0.9999 - val_accuracy: 0.6371
Epoch 3/30
286/286 [==============================] - 9s 31ms/step - loss: 0.3870 - accuracy: 0.8738 - val_loss: 1.0684 - val_accuracy: 0.6203
Epoch 4/30
286/286 [==============================] - 5s 19ms/step - loss: 0.3186 - accuracy: 0.8956 - val_loss: 1.2018 - val_accuracy: 0.5988
Epoch 5/30
286/286 [==============================] - 6s 20ms/step - loss: 0.2674 - accuracy: 0.9113 - val_loss: 1.3868 - val_accuracy: 0.5945
Epoch 6/30
286/286 [==============================] - 5s 18ms/step - loss: 0.2270 - accuracy: 0.9231 - val_loss: 1.3635 - val_accuracy: 0.6131
Epoch 7/30
286/286 [==============================] - 4s 16ms/step - loss: 0.1964 - accuracy: 0.9342 - val_loss: 1.5381 - val_accuracy: 0.5917
Epoch 8/30
286/286 [==============================] - 6s 20ms/step - loss: 0.1665 - accuracy: 0.9437 - val_loss: 1.7284 - val_accuracy: 0.5936
Epoch 9/30
286/286 [==============================] - 5s 18ms/step - loss: 0.1501 - accuracy: 0.9480 - val_loss: 1.8077 - val_accuracy: 0.5897
Epoch 10/30
286/286 [==============================] - 5s 16ms/step - loss: 0.1309 - accuracy: 0.9551 - val_loss: 1.9329 - val_accuracy: 0.5972
```

Relatively low Validation Accuracy

❶ Bidirectional LSTM – CV O

```
#CV

from sklearn.metrics import accuracy_score, log_loss
from sklearn.model_selection import StratifiedKFold
from tensorflow.keras.callbacks import EarlyStopping, ReduceLROnPlateau


# 계층 교차 검증
n_fold = 5
seed = 42

cv = StratifiedKFold(n_splits = n_fold, shuffle=True, random_state=seed)

# 테스트데이터의 예측값 담을 곳 생성
test_Y = np.zeros((test_X.shape[0], 7))

# 조기 종료 옵션 추가
es = EarlyStopping(monitor='val_loss', min_delta=0.001, patience=4,
                   verbose=1, mode='min', baseline=None, restore_best_weights=True)

for i, (i_trn, i_val) in enumerate(cv.split(train_X, Y_train), 1):
    print(f'training model for CV #{i}')

    model3.fit(train_X[i_trn],
            to_categorical(Y_train[i_trn]),
            validation_data=(train_X[i_val], to_categorical(Y_train[i_val])),
            epochs=20,
            batch_size=256,
            callbacks=[es])     # 조기 종료 옵션

    test_Y += model3.predict(test_X) / n_fold    # 나온 예측값들을 교차 검증 횟수로 나눈다
```

성능 저하 방지를 위해

학습 조기 종료 옵션 추가

❶ Bidirectional LSTM – CV O

Train/Val Split : O
Cross Validation : O
Early Stopping : O

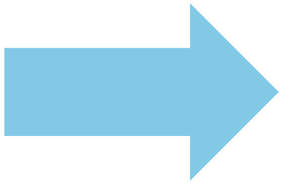
```
training model for CV #1
Epoch 1/20
143/143 [==============================] - 19s 135ms/step - loss: 0.3461 - accuracy: 0.9098 - val_loss: 0.3079 - val_accuracy: 0.9138
Epoch 2/20
143/143 [==============================] - 9s 58ms/step - loss: 0.1930 - accuracy: 0.9449 - val_loss: 0.3230 - val_accuracy: 0.9088
Epoch 3/20
143/143 [==============================] - 5s 38ms/step - loss: 0.1391 - accuracy: 0.9599 - val_loss: 0.3558 - val_accuracy: 0.9015
Epoch 4/20
143/143 [==============================] - 4s 27ms/step - loss: 0.1085 - accuracy: 0.9663 - val_loss: 0.3950 - val_accuracy: 0.8975
Epoch 5/20
143/143 [==============================] - ETA: 0s - loss: 0.0906 - accuracy: 0.9705Restoring model weights from the end of the best epoch: 1.
143/143 [==============================] - 4s 29ms/step - loss: 0.0906 - accuracy: 0.9705 - val_loss: 0.4366 - val_accuracy: 0.8921
Epoch 5: early stopping
286/286 [==============================] - 4s 7ms/step
training model for CV #2
Epoch 1/20
143/143 [==============================] - 4s 26ms/step - loss: 0.2268 - accuracy: 0.9355 - val_loss: 0.2004 - val_accuracy: 0.9428
Epoch 2/20
143/143 [==============================] - 3s 19ms/step - loss: 0.1545 - accuracy: 0.9550 - val_loss: 0.2166 - val_accuracy: 0.9366
Epoch 3/20
143/143 [==============================] - 3s 19ms/step - loss: 0.1192 - accuracy: 0.9645 - val_loss: 0.2364 - val_accuracy: 0.9316
Epoch 4/20
143/143 [==============================] - 3s 22ms/step - loss: 0.0977 - accuracy: 0.9693 - val_loss: 0.2601 - val_accuracy: 0.9290
Epoch 5/20
142/143 [============================>.] - ETA: 0s - loss: 0.0832 - accuracy: 0.9727Restoring model weights from the end of the best epoch: 1.
143/143 [==============================] - 4s 23ms/step - loss: 0.0833 - accuracy: 0.9726 - val_loss: 0.2882 - val_accuracy: 0.9231
Epoch 5: early stopping
286/286 [==============================] - 1s 5ms/step
```

Relatively high Validation Accuracy

❶ Bidirectional LSTM – CV 0

```
#각 topic으로 예측할 확률
test_Y
```

```
array([[9.44389701e-01, 9.01007565e-03, 2.83175334e-02, ...,
        1.38251950e-03, 1.66954952e-04, 5.99076988e-04],
       [3.84923920e-04, 2.33899472e-04, 4.70364605e-03, ...,
        4.80864146e-04, 1.67542895e-04, 1.22500940e-04],
       [1.71786897e-03, 4.08202619e-03, 9.44459438e-01, ...,
        1.27410095e-02, 1.29243880e-03, 2.70027912e-02],
       ...,
       [2.05261539e-02, 9.36366245e-01, 3.68497777e-02, ...,
        1.42606560e-03, 1.85704723e-04, 4.29753281e-03],
       [3.73810984e-03, 1.10083399e-01, 8.34659934e-01, ...,
        1.99600916e-03, 3.63314377e-03, 4.31525263e-02],
       [2.97852172e-03, 1.90633907e-02, 9.51867089e-01, ...,
        1.18569049e-03, 1.12048228e-03, 2.18246346e-02]])
```



	index	topic_idx
0	45654	0
1	45655	3
2	45656	2
3	45657	2
4	45658	3
...	...	...
9126	54780	4
9127	54781	6
9128	54782	1
9129	54783	2
9130	54784	2

9131 rows × 2 columns

모델링

❷ Klue-Roberta/Large

❷ Klue-Roberta/Large – Import Module&Data

```
!pip install transformers
```

Transformer 모델 설치

```
import pandas as pd

from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score

import transformers
from transformers import AutoTokenizer, AdamW, RobertaForSequenceClassification

import torch
from torch.nn import functional as F
from torch.utils.data import DataLoader, Dataset

from tqdm.notebook import tqdm
```

Import Modules

```
a=pd.DataFrame()
a["title"]=back_train["title_kor"]
a["index"]=back_train["index"]
a["topic_idx"]=back_train["topic_idx"]
b=pd.DataFrame()
b["title"]=train["title"]
b["index"]=train["index"]
b["topic_idx"]=train["topic_idx"]
```

Read Data

❷ Klue-Roberta/Large – Class

```python
class NTDataset(Dataset):

  def __init__(self, csv_file):
    self.dataset = csv_file
    self.tokenizer = AutoTokenizer.from_pretrained("klue/roberta-large")

    print(self.dataset.describe())

  def __len__(self):
    return len(self.dataset)

  def __getitem__(self, idx):
    row = self.dataset.iloc[idx, 1:3].values
    text = row[0]
    y = row[1]
    inputs = self.tokenizer(
        text,
        return_tensors='pt',
        truncation=True,
        max_length=14,
        pad_to_max_length=True,
        add_special_tokens=True
        )

    input_ids = inputs['input_ids'][0]
    attention_mask = inputs['attention_mask'][0]

    return input_ids, attention_mask, y
```

Train / Validation

```python
class NTDataset_test(Dataset):

  def __init__(self, csv_file):
    self.dataset = csv_file
    self.tokenizer = AutoTokenizer.from_pretrained("klue/roberta-large")

    print(self.dataset.describe())

  def __len__(self):
    return len(self.dataset)

  def __getitem__(self, idx):
    row = self.dataset.iloc[idx, 1:2].values
    text = row[0]
    inputs = self.tokenizer(
        text,
        return_tensors='pt',
        truncation=True,
        max_length=14,
        pad_to_max_length=True,
        add_special_tokens=True
        )

    input_ids = inputs['input_ids'][0]
    attention_mask = inputs['attention_mask'][0]

    return input_ids, attention_mask
```

Test

❷ Klue-Roberta/Large – Model Setting

```
model = RobertaForSequenceClassification.from_pretrained("klue/roberta-large", num_labels=7).to(device)
```

RobertaForSequenceClassification 함수 이용

```
epochs = 1
batch_size = 128
```

```
optimizer = AdamW(model.parameters(), lr=1e-5)
train_loader = DataLoader(train_dataset, batch_size=batch_size, shuffle=True)
val_loader = DataLoader(val_dataset, batch_size=batch_size, shuffle=True)
test_loader = DataLoader(test_dataset, batch_size=batch_size, shuffle=False)
```

Optimizer : AdamW 이용

❷ Klue-Roberta/Large – Train

```
# train
losses = []
accuracies = []
total_loss = 0.0
correct = 0
total = 0

for i in range(epochs):

  model.train()

  for input_ids_batch, attention_masks_batch, y_batch in tqdm(train_loader):
    optimizer.zero_grad()
    y_batch = y_batch.to(device)
    y_pred = model(input_ids_batch.to(device), attention_mask=attention_masks_batch.to(device))[0]
    loss = F.cross_entropy(y_pred, y_batch)
    loss.backward()
    optimizer.step()

    total_loss += loss.item()

    _, predicted = torch.max(y_pred, 1)
    correct += (predicted == y_batch).sum()
    total += len(y_batch)

  losses.append(total_loss)
  accuracies.append(correct.float() / total)
  print("Train Loss:", total_loss / total, "Accuracy:", correct.float() / total)
```

Train

❷ Klue-Roberta/Large – Validation&Test

```python
# validation
model.eval()

pred = []
correct = 0
total = 0

for input_ids_batch, attention_masks_batch, y_batch in tqdm(val_loader):
  y_batch = y_batch.to(device)
  y_pred = model(input_ids_batch.to(device), attention_mask=attention_masks_batch.to(device))[0]
  _, predicted = torch.max(y_pred, 1)
  pred.append(predicted)
  correct += (predicted == y_batch).sum()
  total += len(y_batch)

print("val accuracy:", correct.float() / total)
```

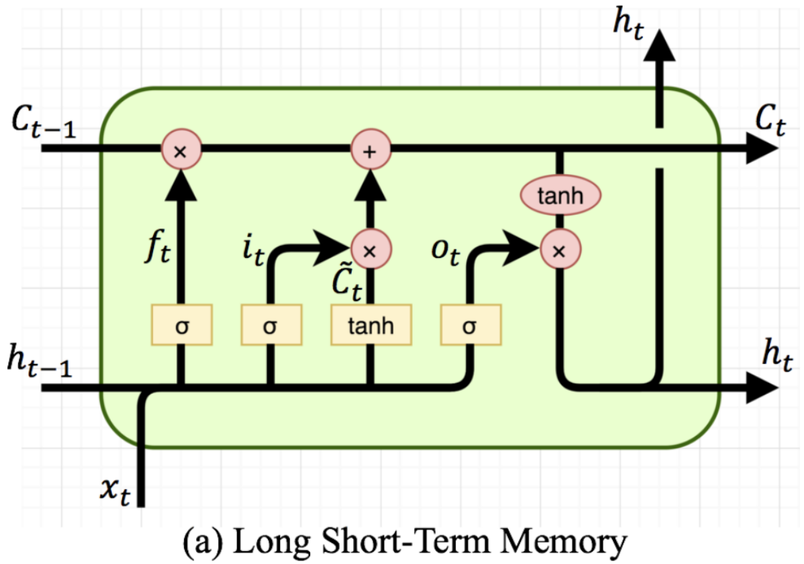
Validation

```python
# test
model.eval()

pred = []

for input_ids_batch, attention_masks_batch in tqdm(test_loader):
  y_pred = model(input_ids_batch.to(device), attention_mask=attention_masks_batch.to(device))[0]
  _, predicted = torch.max(y_pred, 1)
  pred.extend(predicted.tolist())
```

Test

결과 / 해석

04 결과 및 해석

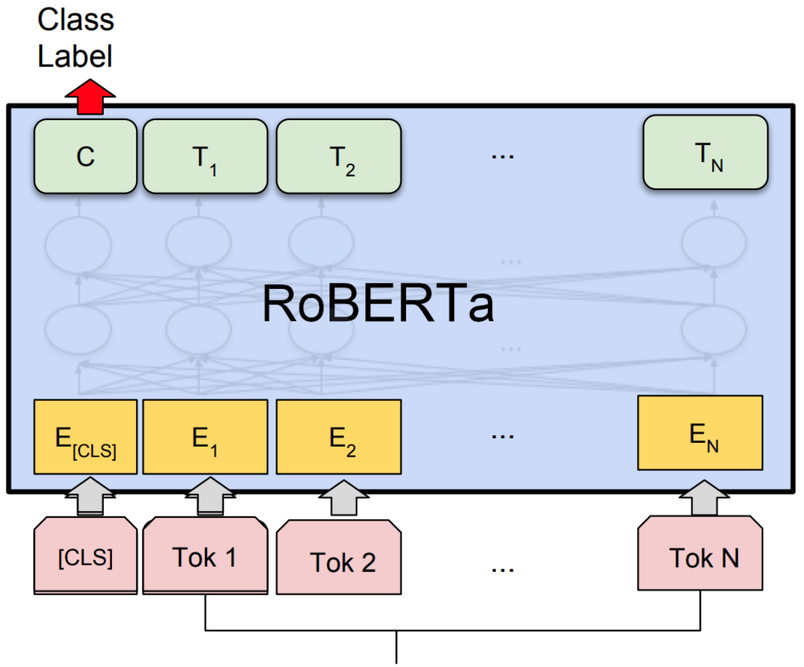


(a) Long Short-Term Memory

LSTM

Public : 0.738269

Private : 0.721993



KLUE/Roberta-Large

Public : 0.786352

Private : 0.776801

감사합니다