assignment_02_elvern_tanny

March 21, 2025

1 Assignment 2: sentiment analysis of SUTD Reddit

Assignment due 21 March 11:59pm

Welcome to the second assignment for 50.055 Machine Learning Operations. These assignments give you a chance to practice the methods and tools you have learned.

This assignment is an individual assignment.

- Read the instructions in this notebook carefully
- Add your solution code and answers in the appropriate places. The questions are marked as **QUESTION:**, the places where you need to add your code and text answers are marked as **ADD YOUR SOLUTION HERE**
- The completed notebook, including your added code and generated output and a labeled dataset which you create in the assignment will be your submission for the assignment.
- The notebook should execute without errors from start to finish when you select "Restart Kernel and Run All Cells..". Please test this before submission.
- Use the SUTD Education Cluster to solve and test the assignment.

Rubric for assessment

Your submission will be graded using the following criteria. 1. Code executes: your code should execute without errors. The SUTD Education cluster should be used to ensure the same execution environment. 2. Correctness: the code should produce the correct result or the text answer should state the factual correct answer. 3. Style: your code should be written in a way that is clean and efficient. Your text answers should be relevant, concise and easy to understand. 4. Partial marks will be awarded for partially correct solutions. 5. There is a maximum of 150 points for this assignment.

ChatGPT policy

If you use AI tools, such as ChatGPT, to solve the assignment questions, you need to be transparent about its use and mark AI-generated content as such. In particular, you should include the following in addition to your final answer: - A copy or screenshot of the prompt you used - The name of the AI model - The AI generated output - An explanation why the answer is correct or what you had to change to arrive at the correct answer

Assignment Notes: Please make sure to save the notebook as you go along. Submission Instructions are located at the bottom of the notebook.

[ ]:
```
# Installing all required packages
# Note: Do not add to this list.
```

```
# ----------------
! pip install transformers[torch]==4.37.2
! pip install datasets==2.17.1
! pip install seaborn==0.13.2
! pip install pyarrow==15.0.0
! pip install scikit-learn==1.4.0
! pip install emoji==0.6.0
! pip install accelerate==0.27.2
# ----------------
```

[2]:
```
# Importing all required packages
# ----------------
import pandas as pd
import numpy as np
import sklearn
import seaborn as sns
import matplotlib.pyplot as plt

from transformers import AutoTokenizer
from transformers import pipeline
from transformers import TrainingArguments, Trainer
from transformers import AutoModelForSequenceClassification
from datasets import Dataset
# ----------------
```

[3]:
```
%matplotlib inline
```

2 Sentiment analysis

Sentiment analysis is a natural language processing technique that identifies the polarity of a given text. There are different flavors of sentiment analysis, but one of the most widely used techniques labels data into positive, negative and neutral. We have already encountererd sentiment analysis in the hands-on sessions.

In this assignment, you will conduct sentiment analysis on posts and comments from the SUTD subreddit. You will run experiments with pre-trained sentiment models, evaluate their performance and simulate improving the model by re-training it with newly annotated data.

[4]:
```
# Load SUTD subreddit data set as dataframe
# posts and comments have been downloaded from https://www.reddit.com/r/sutd/

df_submissions = pd.read_parquet('reddit_submissions.parquet.gzip').
 ↪set_index("Id")
df_comments = pd.read_parquet('reddit_comments.parquet.gzip').
 ↪set_index("CommentId")
```

[5]:
```
#Let's have a look at the data. The data schema is as follows.

# Submissions
# Id - unique id for submission
# Title - text of the submission title
# Upvotes - upvotes on this submission
# Created - date time of submission creation date and time

# Comments
# CommentId - unique id for comment
# Comment - text content of the comment
# CommentCreated - date time of comment creation date and time
# Id - unique id for submission on which the comment was posted

# See the Reddit API documentation for details https://www.reddit.com/dev/api/
df_submissions
```

[5]:

Id	Title	Upvotes	…
xtdia0	Oh boy, 8am lectures. My favorite	627	
scyaig	IF I get my engineering degree	413	
zzxqop	Happy New Year!	339	
rbe5cz	Happy finals!	319	
zlci46	You know who you are	266	
…	…	…	
b7nv4i	SUTD started sending rejection letter already?	3	
b579t4	upcoming SUTD interviews	3	
b41vpw	Another new (prospective) undergraduate!	3	
axezas	How is the SUTD skype interview like?	3	
atijac	Open house starts tomorrow. Ask an ESD Senior …	3	

Id	Created
xtdia0	2022-10-02 02:49:01
scyaig	2022-01-26 05:24:35
zzxqop	2022-12-31 16:26:57
rbe5cz	2021-12-08 00:45:22
zlci46	2022-12-14 00:46:23
…	…
b7nv4i	2019-03-31 13:41:25
b579t4	2019-03-25 06:47:32
b41vpw	2019-03-22 07:04:34
axezas	2019-03-05 01:02:11
atijac	2019-02-22 14:59:05

[594 rows x 3 columns]

[6]:
```
# print(df_submissions)
```

[7]:
```
df_comments
```

[7]:

```
                                                    Comment  \
CommentId
iqps23l                                    HAHA Issa mood boiii
iqrmg9d                             Me everyday on a school day
iqso6tt                            Nothing a Vid test can't fix
iqpmt6t    I thought the earliest lecture we can get is 8…
j2gyvln           jan 3rd is when my secondary school starts
…                                                           …
jkrjznb                            hey! got my acceptance today
johzqeu    hi y'allz, mine updated to unsuccessful, wishi…
jo1hrsu    I'm an international student from china and I …
jklk6o3         Congratulation! Did you get any scholarship?
jkrk1pl    that's so cool, will you be matriculating this…

               CommentCreated       Id
CommentId
iqps23l   2022-10-02 05:25:29   xtdia0
iqrmg9d   2022-10-02 16:26:59   xtdia0
iqso6tt   2022-10-02 20:19:01   xtdia0
iqpmt6t   2022-10-02 04:26:53   xtdia0
j2gyvln   2023-01-01 05:13:21   zzxqop
…                         …      …
jkrjznb   2023-05-19 12:45:12  13jqat4
johzqeu   2023-06-17 18:50:10  13jqat4
jo1hrsu   2023-06-13 22:37:17  13jqat4
jklk6o3   2023-05-18 05:02:25  13jqat4
jkrk1pl   2023-05-19 12:45:40  13jqat4

[3904 rows x 3 columns]
```

[8]:
```
# print(df_comments)
```

You can read the SUTD reddit submissions in your web browser by navigating to https://www.reddit.com/r/sutd/comments/{Id}

2.0.1 QUESTION:

How easy is it to make sense of the submissions and comments? Is it easier to understand the posts when you read them in the browser? Explain why or why not (max 100 words)

— ADD YOUR SOLUTION HERE (5 points)—

It is harder to make sense of the submissions and comments by reading it from the DataFrame. The context, formatting, and thread structure are missing. Reading them in the browser is better

because of visual cues like indentation, author details, upvotes, and full discussion threads. This can help interpret tone, relevance, and relationships between posts and replies - which is important for sentiment analysis.

[9]:
```
# QUESTION: Join the data frames into a joined data_frame 'df_reddit' which contains both submissions and comments.
# Each row should contain a submission paired with one associated comment. Comments that do not have a matching submission shall be dropped. The joined data frame should have the following schema.

# Submissions
# Id - unique id for submission
# Title - text of the submission title
# Upvotes - upvotes on this submission
# Created - date time of submission creation date and time
# CommentId - unique id for comment, comment is posted for this submission
# Comment - text content of the comment
# CommentCreated - date time of comment creation date and time


#--- ADD YOUR SOLUTION HERE (5 points)---

df_reddit = pd.merge(
    df_comments.reset_index(),
    df_submissions.reset_index(),
    on="Id",
    how="inner"
)[['Id', 'Title', 'Upvotes', 'Created', 'CommentId', 'Comment', 'CommentCreated']]

# df_reddit

#------------------------------
```

[10]:
```
# Print the first 10 rows of the joined data frame
df_reddit.head(10)

# Hint: submission will be duplicated as many times as there are comments
```

[10]:

	Id	Title	Upvotes	Created	\
0	xtdia0	Oh boy, 8am lectures. My favorite	627	2022-10-02 02:49:01	
1	xtdia0	Oh boy, 8am lectures. My favorite	627	2022-10-02 02:49:01	
2	xtdia0	Oh boy, 8am lectures. My favorite	627	2022-10-02 02:49:01	
3	xtdia0	Oh boy, 8am lectures. My favorite	627	2022-10-02 02:49:01	
4	zzxqop	Happy New Year!	339	2022-12-31 16:26:57	
5	zzxqop	Happy New Year!	339	2022-12-31 16:26:57	
6	zzxqop	Happy New Year!	339	2022-12-31 16:26:57	

```
7  zzxqop                    Happy New Year!      339 2022-12-31 16:26:57
8  zzxqop                    Happy New Year!      339 2022-12-31 16:26:57
9  zzxqop                    Happy New Year!      339 2022-12-31 16:26:57
```

```
  CommentId                                              Comment  \
0   iqps23l                                  HAHA Issa mood boiii
1   iqrmg9d                           Me everyday on a school day
2   iqso6tt                          Nothing a Vid test can't fix
3   iqpmt6t  I thought the earliest lecture we can get is 8…
4   j2gyvln          jan 3rd is when my secondary school starts
5   j54ub3e                                          HEY, FUCK YOU
6   j2hjzse  Meanwhile me who has work on christmas eve, ch…
7   j2i7d80                                       hahahaaha same
8   j2m5mdr                                         f school man
9   j4fvc93                                                 Same

       CommentCreated
0 2022-10-02 05:25:29
1 2022-10-02 16:26:59
2 2022-10-02 20:19:01
3 2022-10-02 04:26:53
4 2023-01-01 05:13:21
5 2023-01-20 12:15:41
6 2023-01-01 09:44:48
7 2023-01-01 14:48:55
8 2023-01-02 09:54:47
9 2023-01-15 12:41:33
```

[11]:
```
# Now let's run a pre-trained sentiment analysis model on the submissions and␣
 ↪comments
# A convenient way to execute pre-trained models for standard tasks are␣
 ↪Huggingface pipelines
# Here we run a standard sentiment analysis pipeline on the first ten␣
 ↪submission titles
sentiment_pipeline = pipeline("sentiment-analysis", device=0)
print(df_submissions['Title'][:10])
print(sentiment_pipeline(list(df_submissions['Title'][:10])))
```

```
No model was supplied, defaulted to distilbert/distilbert-base-uncased-
finetuned-sst-2-english and revision 714eb0f
(https://huggingface.co/distilbert/distilbert-base-uncased-finetuned-
sst-2-english).
Using a pipeline without specifying a model name and revision in production is
not recommended.
```

```
Id
xtdia0                    Oh boy, 8am lectures. My favorite
scyaig                       IF I get my engineering degree
```

```
zzxqop                                        Happy New Year!
rbe5cz                                          Happy finals!
zlci46                                    You know who you are
twvwmf                                                    ))))
u4qwja    Not very much studying is gonna get done this …
ri6w8v              Last paper today freshie bois! Let's go!
qxd05z            >You are T1 Freshie doing the 2D projects
z5uai3                                   Data_Driven_World.png
Name: Title, dtype: object
[{'label': 'POSITIVE', 'score': 0.9927398562431335}, {'label': 'NEGATIVE',
'score': 0.7195642590522766}, {'label': 'POSITIVE', 'score': 0.999868631362915},
{'label': 'POSITIVE', 'score': 0.9998632669448853}, {'label': 'POSITIVE',
'score': 0.9992561936378479}, {'label': 'POSITIVE', 'score':
0.5723459720611572}, {'label': 'NEGATIVE', 'score': 0.9995667338371277},
{'label': 'POSITIVE', 'score': 0.9972499012947083}, {'label': 'NEGATIVE',
'score': 0.9956018924713135}, {'label': 'NEGATIVE', 'score':
0.9826338887214661}]
```

[12]:
```python
# QUESTION: Complete the function 'analyse_sentiment' which takes a data frame, a Huggingface sentiment pipeline object
# and a target column name and adds two columns 'Label' and 'Score' to the data frame in place.
# pass the provided tokenizer arguments to the pipeline
# The new columns should contain the sentiment labels and scores, respectively.


def analyse_sentiment(df, sentiment_pipeline, column):
    tokenizer_kwargs = {'padding':True, 'truncation':True, 'max_length':128,}
#--- ADD YOUR SOLUTION HERE (10 points)---
    results = sentiment_pipeline(list(df[column]), **tokenizer_kwargs)
    labels = [result['label'] for result in results]
    scores = [result['score'] for result in results]
    df['Label'] = labels
    df['Score'] = scores
#------------------------------
```

[13]:
```python
# add sentiment labels and scores to the submissions and comments dataframes
analyse_sentiment(df_submissions, sentiment_pipeline, 'Title')
analyse_sentiment(df_comments, sentiment_pipeline, 'Comment')
```

[14]:
```python
# display dataframe
df_submissions
```

[14]:
```
                                                Title  Upvotes  \
Id
xtdia0                 Oh boy, 8am lectures. My favorite      627
scyaig                    IF I get my engineering degree      413
```

```
zzxqop                                        Happy New Year!      339
rbe5cz                                          Happy finals!      319
zlci46                                   You know who you are      266
…                                                        …      …
b7nv4i     SUTD started sending rejection letter already?        3
b579t4                               upcoming SUTD interviews      3
b41vpw           Another new (prospective) undergraduate!        3
axezas              How is the SUTD skype interview like?        3
atijac  Open house starts tomorrow. Ask an ESD Senior …       3

                   Created     Label     Score
Id
xtdia0 2022-10-02 02:49:01  POSITIVE  0.992740
scyaig 2022-01-26 05:24:35  NEGATIVE  0.719564
zzxqop 2022-12-31 16:26:57  POSITIVE  0.999869
rbe5cz 2021-12-08 00:45:22  POSITIVE  0.999863
zlci46 2022-12-14 00:46:23  POSITIVE  0.999256
…                      …       …       …
b7nv4i 2019-03-31 13:41:25  NEGATIVE  0.998578
b579t4 2019-03-25 06:47:32  POSITIVE  0.845063
b41vpw 2019-03-22 07:04:34  POSITIVE  0.967637
axezas 2019-03-05 01:02:11  NEGATIVE  0.997661
atijac 2019-02-22 14:59:05  NEGATIVE  0.601494

[594 rows x 5 columns]
```

[15]:
```
# print(df_submissions)
```

[16]:
```
# display dataframe
df_comments
```

[16]:
```
                                                   Comment  \
CommentId
iqps23l                                    HAHA Issa mood boiii
iqrmg9d                                Me everyday on a school day
iqso6tt                               Nothing a Vid test can't fix
iqpmt6t    I thought the earliest lecture we can get is 8…
j2gyvln           jan 3rd is when my secondary school starts
…                                                        …
jkrjznb                               hey! got my acceptance today
johzqeu    hi y'allz, mine updated to unsuccessful, wishi…
jo1hrsu    I'm an international student from china and I …
jklk6o3         Congratulation! Did you get any scholarship?
jkrk1pl    that's so cool, will you be matriculating this…

               CommentCreated       Id     Label     Score
CommentId
```

```
iqps23l   2022-10-02 05:25:29   xtdia0  NEGATIVE  0.881345
iqrmg9d   2022-10-02 16:26:59   xtdia0  POSITIVE  0.987902
iqso6tt   2022-10-02 20:19:01   xtdia0  NEGATIVE  0.999672
iqpmt6t   2022-10-02 04:26:53   xtdia0  NEGATIVE  0.992340
j2gyvln   2023-01-01 05:13:21   zzxqop  NEGATIVE  0.696360
…                        …       …       …         …
jkrjznb   2023-05-19 12:45:12  13jqat4  POSITIVE  0.999398
johzqeu   2023-06-17 18:50:10  13jqat4  POSITIVE  0.619021
jo1hrsu   2023-06-13 22:37:17  13jqat4  POSITIVE  0.651071
jklk6o3   2023-05-18 05:02:25  13jqat4  NEGATIVE  0.922409
jkrk1pl   2023-05-19 12:45:40  13jqat4  POSITIVE  0.999650

[3904 rows x 5 columns]
```

[17]:
```
# print(df_comments)
```

2.0.2 QUESTION:

From a first inspection of the results, what problems can you see with our current sentiment analysis? What model is used for the sentiment analysis and how was is trained?

— ADD YOUR SOLUTION HERE (5 points) —

The current sentiment analysis misclassifies sarcastic or context-specific expressions. For example, "HAHA Issa mood boiii" was labeled negative, even though it's meant to be humorous or relatable. Similarly, subtle negative emotions may be marked as positive due to keyword bias. The default model in HuggingFace sentiment-analysis pipeline uses "distilbert/distilbert-base-uncased-finetuned-sst-2-english", which is trained on movie reviews from the SST-2 dataset. This dataset lacks Reddit-style language, which uses a lot of emojis, slang, and sarcasm, making it unsuitable for social media content like SUTD subreddit comments.

[ ]:
```
import os
from dotenv import load_dotenv

load_dotenv()
hf_token = os.getenv("HF_TOKEN")
print(hf_token)
```

[ ]:
```
# QUESTION: Update the sentiment pipeline to use the model "finiteautomata/
  ↪bertweet-base-sentiment-analysis" from Huggingface
# The model should output three classes: 'POS', 'NEG', 'NEU'
# Store the model name in separate variable "model_name"

#--- ADD YOUR SOLUTION HERE (5 points) ---

model_name = "finiteautomata/bertweet-base-sentiment-analysis"
sentiment_pipeline = pipeline(
```

```
    "sentiment-analysis",
    model=model_name,
    tokenizer=model_name,
    token=hf_token, # Add your Huggingface token here
    device=0
)

#------------------------------
```

2.0.3 QUESTION:

Explain why this model is better suited for the task (max 100 words).

— ADD YOUR SOLUTION HERE (5 points) —

The `finiteautomata/bertweet-base-sentiment-analysis` model is pre-trained on social media data, like tweets, which closely resemble Reddit comments in tone, length, slang, and informality. It supports three sentiment classes (POS, NEU, NEG), making it more nuance. Since Reddit posts often contain neutral or sarcastic expressions, this model better captures those contexts compared to models trained on formal datasets like SST-2.

[20]:
```
# re-run the sentiment analysis of submissions and comments
analyse_sentiment(df_submissions, sentiment_pipeline, 'Title')
analyse_sentiment(df_comments, sentiment_pipeline, 'Comment')
```

```
model.safetensors:   0%|          | 0.00/540M [00:00<?, ?B/s]
```

[21]:
```
# display dataframe
df_submissions
```

[21]:
```
                                                  Title  Upvotes  \
Id
xtdia0                  Oh boy, 8am lectures. My favorite      627
scyaig                     IF I get my engineering degree      413
zzxqop                                  Happy New Year!      339
rbe5cz                                    Happy finals!      319
zlci46                               You know who you are      266
…                                                    …      …
b7nv4i     SUTD started sending rejection letter already?        3
b579t4                           upcoming SUTD interviews        3
b41vpw           Another new (prospective) undergraduate!        3
axezas              How is the SUTD skype interview like?        3
atijac  Open house starts tomorrow. Ask an ESD Senior …        3

                    Created Label     Score
Id
xtdia0 2022-10-02 02:49:01   POS  0.987462
scyaig 2022-01-26 05:24:35   NEU  0.846714
```

```
zzxqop 2022-12-31 16:26:57   POS  0.992498
rbe5cz 2021-12-08 00:45:22   POS  0.992441
zlci46 2022-12-14 00:46:23   NEU  0.611753
…                     …   …       …
b7nv4i 2019-03-31 13:41:25   NEG  0.825060
b579t4 2019-03-25 06:47:32   NEU  0.963418
b41vpw 2019-03-22 07:04:34   POS  0.675288
axezas 2019-03-05 01:02:11   NEU  0.973041
atijac 2019-02-22 14:59:05   NEU  0.938415

[594 rows x 5 columns]
```

[22]:
```
# print(df_submissions)
```

[23]:
```
# display dataframe
df_comments
```

[23]:
```
                                                  Comment  \
CommentId
iqps23l                                  HAHA Issa mood boiii
iqrmg9d                               Me everyday on a school day
iqso6tt                              Nothing a Vid test can't fix
iqpmt6t    I thought the earliest lecture we can get is 8…
j2gyvln           jan 3rd is when my secondary school starts
…                                                           …
jkrjznb                              hey! got my acceptance today
johzqeu    hi y'allz, mine updated to unsuccessful, wishi…
jo1hrsu    I'm an international student from china and I …
jklk6o3         Congratulation! Did you get any scholarship?
jkrk1pl    that's so cool, will you be matriculating this…

               CommentCreated       Id Label     Score
CommentId
iqps23l   2022-10-02 05:25:29   xtdia0   POS  0.764860
iqrmg9d   2022-10-02 16:26:59   xtdia0   NEU  0.932431
iqso6tt   2022-10-02 20:19:01   xtdia0   POS  0.808931
iqpmt6t   2022-10-02 04:26:53   xtdia0   NEU  0.962069
j2gyvln   2023-01-01 05:13:21   zzxqop   NEU  0.972655
…                        …      …   …       …
jkrjznb   2023-05-19 12:45:12  13jqat4   POS  0.968053
johzqeu   2023-06-17 18:50:10  13jqat4   NEG  0.874082
jo1hrsu   2023-06-13 22:37:17  13jqat4   NEG  0.901180
jklk6o3   2023-05-18 05:02:25  13jqat4   POS  0.983739
jkrk1pl   2023-05-19 12:45:40  13jqat4   POS  0.983521

[3904 rows x 5 columns]
```

[24]:
```
# print(df_comments)
```

[25]:
```
# QUESTION: What is the time frame covered by the data set, i.e. what is the␣
 ↪earliest time of a submission or comment and what is the most recent time?
# Find the earliest and latest timestamp and print them
#--- ADD YOUR SOLUTION HERE (8 points)---

earliest_submission = df_submissions["Created"].min()
latest_submission = df_submissions["Created"].max()
earliest_comment = df_comments["CommentCreated"].min()
latest_comment = df_comments["CommentCreated"].max()

print("Earliest Submission/Comment:", min(earliest_submission,␣
 ↪earliest_comment))
print("Latest Submission/Comment:", max(latest_submission, latest_comment))

#------------------------------
```

```
Earliest Submission/Comment: 2017-11-12 17:06:27
Latest Submission/Comment: 2024-01-24 03:39:32
```

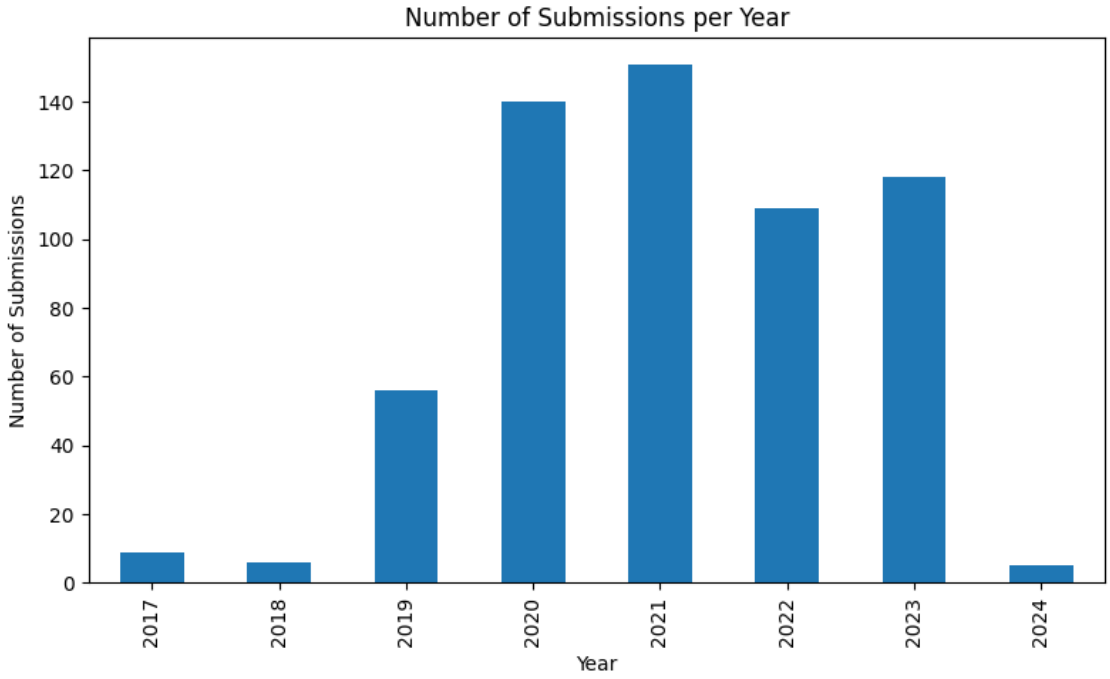
[26]:
```
# QUESTION: How did the volume of posts on the SUTD subreddit change over the␣
 ↪years?
# Create a bar chart diagram that plots the number of submissions per year on␣
 ↪the y-axis and the year on the x-axis.

#--- ADD YOUR SOLUTION HERE (8 points) ---

df_submissions['Year'] = df_submissions['Created'].dt.year
submission_counts = df_submissions['Year'].value_counts().sort_index()

plt.figure(figsize=(8,5))
submission_counts.plot(kind='bar')
plt.title('Number of Submissions per Year')
plt.xlabel('Year')
plt.ylabel('Number of Submissions')
plt.tight_layout()
plt.show()

#------------------------------
```



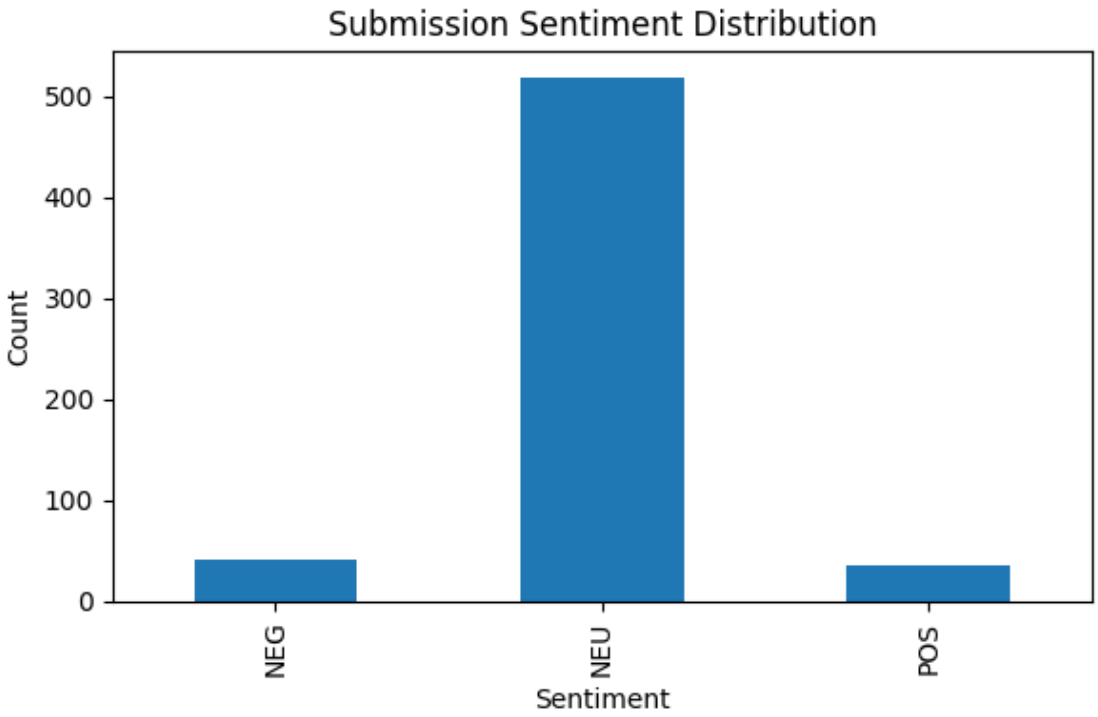
[27]:
```
# QUESTION: What is the distribution of positive, neutral and negative␣
 ↪sentiment?
# Create a bar chart diagram that plots the number of submissions on the y-axis␣
 ↪and the sentiment label on the x-axis.

#--- ADD YOUR SOLUTION HERE (5 points)---

sentiment_counts = df_submissions['Label'].value_counts().sort_index()

plt.figure(figsize=(6,4))
sentiment_counts.plot(kind='bar')
plt.title('Submission Sentiment Distribution')
plt.xlabel('Sentiment')
plt.ylabel('Count')
plt.tight_layout()
plt.show()

#------------------------------
```



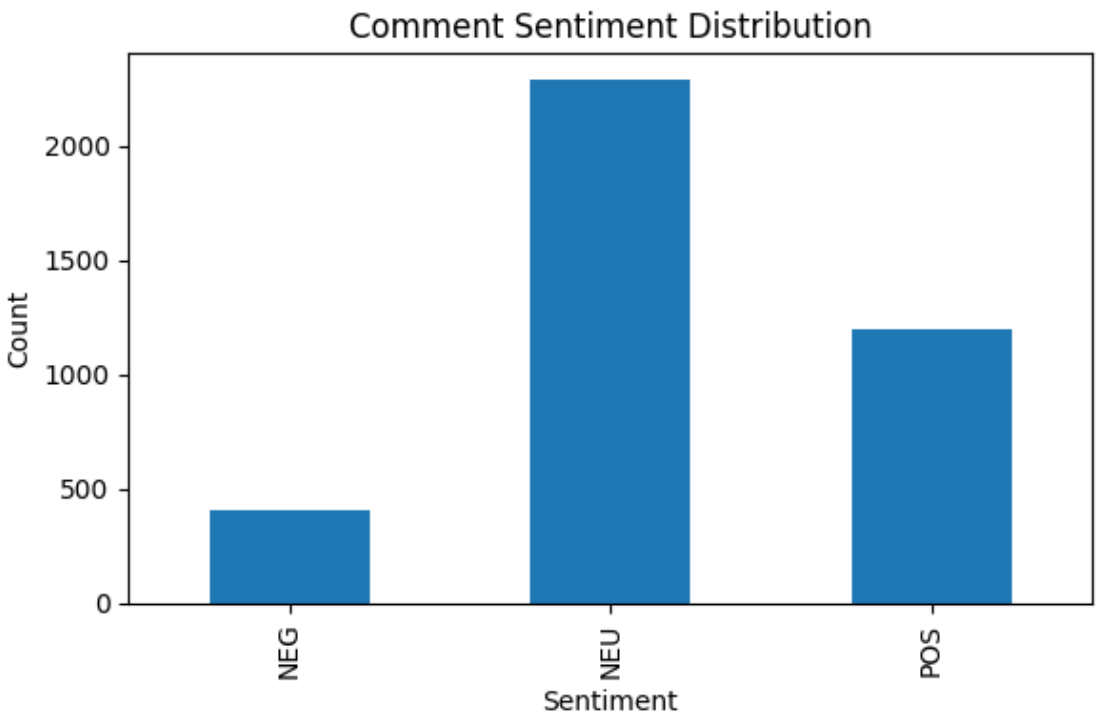
[28]:
```
# QUESTION: What is the distribution of positive, neutral and negative␣
 ↪sentiment for comments?
# Create a bar chart diagram that plots the number of comments on the y-axis␣
 ↪and the sentiment label on the x-axis.

#--- ADD YOUR SOLUTION HERE (5 points)---

comment_sentiment_counts = df_comments['Label'].value_counts().sort_index()

plt.figure(figsize=(6,4))
comment_sentiment_counts.plot(kind='bar')
plt.title('Comment Sentiment Distribution')
plt.xlabel('Sentiment')
plt.ylabel('Count')
plt.tight_layout()
plt.show()

#------------------------------
```



[29]:
```
# QUESTION: combine submission titles and comments for the time period from␣
 ↪2021 until today into one data frame.
# The resulting data frame 'df_text' should have the following schema

# Id - unique id of the comment or the submissions, this column is the index of␣
 ↪the data frame
# Text - text content of the comment or the submission title
# Created - date time when submission or comment was created
# Label - sentiment label as predicted by ML

#--- ADD YOUR SOLUTION HERE (10 points)---

# Filter
submissions_filtered = df_submissions[df_submissions['Created'] >= '2021-01-01']
comments_filtered = df_comments[df_comments['CommentCreated'] >= '2021-01-01']

# Rename and align
df_sub = submissions_filtered.rename(columns={"Title": "Text"}).loc[:, ["Text",␣
 ↪"Created", "Label"]]
df_com = comments_filtered.rename(columns={"Comment": "Text", "CommentCreated":␣
 ↪"Created"}).loc[:, ["Text", "Created", "Label"]]

# Set index as ID
```

```
df_sub.index.name = "Id"
df_com.index.name = "Id"

# Combine
df_text = pd.concat([df_sub, df_com])
df_text.sort_values("Created", ascending=False, inplace=True)

#-------------------------------
```

[30]:
```
# inspect the resulting data frame
df_text
```

[30]:
```
                                                      Text  \
Id
kjaudx2  Unfortunately no and I don’t foresee it to cha…
kjau765  Hi! I would like to ask if it is possible for …
kj74anz  Thks! Hope you have a great FEAST II, all the …
kj6z72l  I see, wishing you all the best for the result…
kj6x184  Haha yup, should be out by tmr. Yes, FEAST II …
…                                                      …
ghwf0at  Yes. I am indoneisan myself. In fact we have a…
kpde9d                                  Subjects in Year 1
kp0zuf                               HASS mod recommendation
kovm76   I am currently still in highschool (indo) and …
ghq4jty  woww thank you so much for taking the time to …

                     Created Label
Id
kjaudx2 2024-01-24 03:39:32   NEG
kjau765 2024-01-24 03:38:13   NEU
kj74anz 2024-01-23 14:25:22   POS
kj6z72l 2024-01-23 13:50:05   POS
kj6x184 2024-01-23 13:34:29   POS
…                       …   …
ghwf0at 2021-01-03 04:32:08   NEU
kpde9d  2021-01-03 04:13:53   NEU
kp0zuf  2021-01-02 17:02:09   NEU
kovm76  2021-01-02 10:52:03   NEU
ghq4jty 2021-01-01 16:06:17   POS

[2916 rows x 3 columns]
```

[31]:
```
print(df_text)
```

```
                                                      Text  \
Id
kjaudx2  Unfortunately no and I don’t foresee it to cha…
kjau765  Hi! I would like to ask if it is possible for …
```

```
kj74anz  Thks! Hope you have a great FEAST II, all the …
kj6z72l  I see, wishing you all the best for the result…
kj6x184  Haha yup, should be out by tmr. Yes, FEAST II …
…                                                      …
ghwf0at  Yes. I am indoneisan myself. In fact we have a…
kpde9d                                  Subjects in Year 1
kp0zuf                               HASS mod recommendation
kovm76   I am currently still in highschool (indo) and …
ghq4jty  woww thank you so much for taking the time to …

                    Created Label
Id
kjaudx2 2024-01-24 03:39:32   NEG
kjau765 2024-01-24 03:38:13   NEU
kj74anz 2024-01-23 14:25:22   POS
kj6z72l 2024-01-23 13:50:05   POS
kj6x184 2024-01-23 13:34:29   POS
…                       …   …
ghwf0at 2021-01-03 04:32:08   NEU
kpde9d  2021-01-03 04:13:53   NEU
kp0zuf  2021-01-02 17:02:09   NEU
kovm76  2021-01-02 10:52:03   NEU
ghq4jty 2021-01-01 16:06:17   POS

[2916 rows x 3 columns]
```

[32]:
```
# QUESTION: sort the data frame by date time descending and save it in the same␣
 ↪variable

#--- ADD YOUR SOLUTION HERE (3 points)---
df_text = df_text.sort_values(by="Created", ascending=False)
#------------------------------
```

[33]:
```
# inspect the resulting data frame
df_text
```

[33]:
```
                                                      Text  \
Id
kjaudx2  Unfortunately no and I don’t foresee it to cha…
kjau765  Hi! I would like to ask if it is possible for …
kj74anz  Thks! Hope you have a great FEAST II, all the …
kj6z72l  I see, wishing you all the best for the result…
kj6x184  Haha yup, should be out by tmr. Yes, FEAST II …
…                                                      …
ghwf0at  Yes. I am indoneisan myself. In fact we have a…
kpde9d                                  Subjects in Year 1
kp0zuf                               HASS mod recommendation
```

```
kovm76   I am currently still in highschool (indo) and …
ghq4jty  woww thank you so much for taking the time to …

                    Created Label
Id
kjaudx2 2024-01-24 03:39:32   NEG
kjau765 2024-01-24 03:38:13   NEU
kj74anz 2024-01-23 14:25:22   POS
kj6z72l 2024-01-23 13:50:05   POS
kj6x184 2024-01-23 13:34:29   POS
…                        …   …
ghwf0at 2021-01-03 04:32:08   NEU
kpde9d  2021-01-03 04:13:53   NEU
kp0zuf  2021-01-02 17:02:09   NEU
kovm76  2021-01-02 10:52:03   NEU
ghq4jty 2021-01-01 16:06:17   POS

[2916 rows x 3 columns]
```

[34]:
```
# save data frame to csv
df_text.to_csv("reddit.csv")
```

Download the csv file and open it in a spreadsheet application or text editor.

Inspec the first 10-20 entries in the list to get a feeling for the data domain.

2.0.4 QUESTION:

Write a short labeling guide for annotating the SUTD reddit data with sentiment labels. You can write the labeling guide in a bullet point format and should have 5-10 points.

— ADD YOUR SOLUTION HERE (10 points)—

SUTD Reddit Sentiment Labeling Guide - POS (Positive): In general, the text should expresses joy, appreciation, excitement, humor, encouragement, or general positivity. - NEG (Negative): In general, the text should expresses frustration, anger, complaint, fear, or sadness. - NEU (Neutral): In general, the text should expresses something that is factual, informative, or lacks of emotional tone. - Emojis and slang should be interpreted in context. - Replies that is mirror or just echo previous posts without added tone are generally NEU. - Humor or memes should lean toward POS (unless they include sarcasm or complaint). - Contextual sarcasm or passive-aggressive statements should lean toward NEG. - Ambiguous statements should lean toward NEU. - Apply labels consistently across the dataset.

2.1 Label the data

Add a new column 'HumanLabel' to the csv file and label the 500 most recent entries, including the first 10-20 you inspected to create the label guide, using a spreadsheet application (Excel, Google Docs, Numbers) or just a text editor.

2.1.1 QUESTION:

What were some of the ambiguous cases or corner cases you encountered? List 3-5 issues

— ADD YOUR SOLUTION HERE (30 points)—

---

1. Polite or formal phrases masking negative context
   Example: "The training is difficult as the learning curve is steep."
   Model labeled it NEU, but I label it as NEG due to implicit struggle. The tone is polite but the sentiment reflects difficulty or stress.
2. One-Word or Very Short Replies
   Example: "i doubt so" or "maybe"
   These are tricky, they could be interpreted as negative, neutral, or hesitant positive, depending on context.
3. Lack of Context in Comment Chains
   Some comments only make sense when paired with the original submission. Without that, interpretation becomes speculative and inconsistent.
4. Conflicting Sentiment Between Text and Emoji
   Example: Text sounds positive but ends with a sad or sarcastic emoji (e.g., "Fun if you join fifth rows that you like. Yeah ").
   It's unclear whether the sentiment should lean POS, NEU, or NEG.

Upload your 500 labeled instances as **reddit_labeled.csv** to JupyterLab.

2.2 Evaluate

Compare your human-corrected labels with the original predicted labels.

[87]:
```
#
# QUESTION: Read the 500 labeled rows from the CSV file into a dataframe␣
 ↪"df_labeled".
# The data frame should have this schema.

# Id - unique id of the comment or the submissions, Id is the index of the data␣
 ↪frame
# Text - text content of the comment or the submission title
# Created - date time when submission or comment was created
# Label - sentiment label as predicted by ML
# HumanLabel - manually reviewed 'gold sentiment label'

#--- ADD YOUR SOLUTION HERE (5 points)---
df_labeled = pd.read_csv("reddit_labeled.csv", parse_dates=["Created"])

df_labeled.set_index("Id", inplace=True)
#------------------------------
```

[88]:
```
# check the data was loaded correctly
df_labeled
```

[88]:
```
                                                      Text  \
Id
kjaudx2  Unfortunately no and I don't foresee it to cha…
kjau765  Hi! I would like to ask if it is possible for …
kj74anz  Thks! Hope you have a great FEAST II, all the …
kj6z72l  I see, wishing you all the best for the result…
kj6x184  Haha yup, should be out by tmr. Yes, FEAST II …
…                                                      …
jlsz8pd  Entered having not taken physics since sec 2 b…
jlsjszp  Fun if you join fifth rows that you like. Yeah…
jls9yp6   If you have access to a gpu cloud, anything goes
jls8deo  OOo i see!! Any medical examination requiremen…
jlpez8k  hey no worries, feel free to DM if you have an…

                    Created Label HumanLabel
Id
kjaudx2 2024-01-24 03:39:32   NEG        NEG
kjau765 2024-01-24 03:38:13   NEU        NEU
kj74anz 2024-01-23 14:25:22   POS        POS
kj6z72l 2024-01-23 13:50:05   POS        POS
kj6x184 2024-01-23 13:34:29   POS        POS
…                       …   …        …
jlsz8pd 2023-05-27 09:33:55   NEU        POS
jlsjszp 2023-05-27 05:57:25   POS        NEU
jls9yp6 2023-05-27 04:04:37   POS        POS
jls8deo 2023-05-27 03:48:31   NEU        NEU
jlpez8k 2023-05-26 14:45:11   POS        POS

[500 rows x 4 columns]
```

[89]:
```
# split the labeled data into two chunks, ordered by time
df_labeled.sort_values('Created', ascending=True, inplace=True)

df_labeled1 = df_labeled[:250]
df_labeled2 = df_labeled[250:]
```

[90]:
```
# check that the each split is 250 instances and that they don't overlap
df_labeled1
```

[90]:
```
                                                      Text  \
Id
jlpez8k  hey no worries, feel free to DM if you have an…
jls8deo  OOo i see!! Any medical examination requiremen…
jls9yp6   If you have access to a gpu cloud, anything goes
```

```
jlsjszp  Fun if you join fifth rows that you like. Yeah…
jlsz8pd  Entered having not taken physics since sec 2 b…
…                                                      …
jspjvu2  I am afraid it is rather common for most insti…
jsprthk  Well, just because it's common doesn't mean it…
jsukd5z            Hi, if you need a place near sutd dm me
jt7l539  What are you going to do about it? It happens …
jt7wz8x  I won't do anything about it other than expres…

                    Created Label HumanLabel
Id
jlpez8k 2023-05-26 14:45:11   POS        POS
jls8deo 2023-05-27 03:48:31   NEU        NEU
jls9yp6 2023-05-27 04:04:37   POS        POS
jlsjszp 2023-05-27 05:57:25   POS        NEU
jlsz8pd 2023-05-27 09:33:55   NEU        POS
…                        …    …        …
jspjvu2 2023-07-20 10:03:44   NEG        NEG
jsprthk 2023-07-20 11:31:52   NEG        NEG
jsukd5z 2023-07-21 10:26:32   NEU        NEU
jt7l539 2023-07-24 04:26:02   NEU        NEU
jt7wz8x 2023-07-24 06:43:24   NEG        NEG

[250 rows x 4 columns]
```

[91]:
```
df_labeled2
```

[91]:
```
                                                    Text  \
Id
jtbmjt5  Maybe disappointing but is it very common in a…
jtbrr1z  Hi for me I had to call them directly after ma…
jtceipf  Just email them..! I waited about 3 days after…
jtcz75k  I mean I don't have experience but I always us…
jtjpyao                                          Ok thanks
…                                                      …
kj6x184  Haha yup, should be out by tmr. Yes, FEAST II …
kj6z72l  I see, wishing you all the best for the result…
kj74anz  Thks! Hope you have a great FEAST II, all the …
kjau765  Hi! I would like to ask if it is possible for …
kjaudx2  Unfortunately no and I don’t foresee it to cha…

                    Created Label HumanLabel
Id
jtbmjt5 2023-07-25 00:32:56   NEG        NEG
jtbrr1z 2023-07-25 01:12:56   NEU        NEU
jtceipf 2023-07-25 04:22:48   NEU        NEU
jtcz75k 2023-07-25 08:33:15   NEG        NEG
```

```
jtjpyao 2023-07-26 17:16:09   NEU        POS
…                       …   …        …
kj6x184 2024-01-23 13:34:29   POS        POS
kj6z72l 2024-01-23 13:50:05   POS        POS
kj74anz 2024-01-23 14:25:22   POS        POS
kjau765 2024-01-24 03:38:13   NEU        NEU
kjaudx2 2024-01-24 03:39:32   NEG        NEG

[250 rows x 4 columns]
```

[92]:
```
# Compute the agreement between the predicted labels and your manually created␣
 ↪"gold labels" in split 1.
# Compute scores for overall accuracy as well as precision/recall/f1 score for␣
 ↪each label class
# Print all scores

print(sklearn.metrics.classification_report(df_labeled1["Label"],␣
 ↪df_labeled1["HumanLabel"]))
```

```
              precision    recall  f1-score   support

         NEG       0.77      0.68      0.72        25
         NEU       0.93      0.87      0.90       156
         POS       0.79      0.93      0.85        69

    accuracy                           0.87       250
   macro avg       0.83      0.83      0.82       250
weighted avg       0.87      0.87      0.87       250
```

[93]:
```
# Compute the agreement between the predicted labels and your manually created␣
 ↪"gold labels" in split 2.
# Compute scores for overall accuracy as well as precision/recall/f1 score for␣
 ↪each label class
# Print all scores

print(sklearn.metrics.classification_report(df_labeled2["Label"],␣
 ↪df_labeled2["HumanLabel"]))
```

```
              precision    recall  f1-score   support

         NEG       0.74      0.83      0.78        35
         NEU       0.93      0.88      0.90       156
         POS       0.84      0.90      0.87        59

    accuracy                           0.88       250
   macro avg       0.84      0.87      0.85       250
weighted avg       0.88      0.88      0.88       250
```

2.3 Retrain sentiment model

Now let us use the data in df_labeled1 to try improve the sentiment classifier. Train the Huggingface model you have chosen with the 250 examples and your human gold labels.

Start by converting the data from data frames into a 2 Huggingface datasets. - dataset1 : a Huggingface dataset object which includes the data from dataframe df_labeled1 - dataset2 : a Huggingface dataset object which includes the data from dataframe df_labeled2

In each dataset, there should be the following fields - text : the text of the reddit submission or comment - label: the human gold label, encoded as integer

With these dataset we will simulate the process of improving a model in production. Dataset1 is simulating a batch of data which we observed in production, annotated and then use to improve the model. We evaluate the change on the new training data and on the next batch of production data, simulated by dataset2.

[94]:
```
def convert_label(df, pipeline):
    # drop predicted label column
    df = df.drop("Label", axis=1)
    # convert string labels to integers as column 'label' using the sentiment␣
 ↪pipeline config
    label_id_mapping = lambda label: pipeline.model.config.label2id[label]
    df['label'] = df['HumanLabel'].apply(label_id_mapping)
    return df

df_labeled1 = convert_label(df_labeled1, sentiment_pipeline)
df_labeled2 = convert_label(df_labeled2, sentiment_pipeline)
```

[95]:
```
# QUESTION: Convert the text and human labels from the data frame to a␣
 ↪huggingface dataset format
# create a huggingface 'dataset1' from data frame 'df_labeled1' and 'dataset2'␣
 ↪from data frame 'df_labeled2'
#
# each dataset has the following fields
# text : the text of the reddit submission or comment
# label: the human gold label, encoded as integer

#--- ADD YOUR SOLUTION HERE (5 points)---

from datasets import Dataset

dataset1 = Dataset.from_pandas(df_labeled1[["Text", "label"]].
 ↪rename(columns={"Text": "text"}).reset_index(drop=True))
dataset2 = Dataset.from_pandas(df_labeled2[["Text", "label"]].
 ↪rename(columns={"Text": "text"}).reset_index(drop=True))
```

```
#------------------------------
```

[96]:
```
# inspect the first example
dataset1[0]
```

[96]:
```
{'text': 'hey no worries, feel free to DM if you have any other questions,
always happy to help a junior out',
 'label': 2}
```

[97]:
```
# load tokenizer and tokenize data set
#
# QUESTION: Load the required tokenizer from Huggingface into a variable␣
 ↪'tokenizer'
# Then tokenize 'dataset1' into 'tokenized_dataset1' and 'dataset2' into␣
 ↪'tokenized_dataset2'
# Use the Huggingface libraries. Remember that we stored the model name in a␣
 ↪variable "model_name"

# helper function for tokenization
def tokenize_function(examples):
    return tokenizer(examples['text'], padding=True, truncation=True,␣
 ↪max_length=128)

#--- ADD YOUR SOLUTION HERE (5 points)---

model_name = "finiteautomata/bertweet-base-sentiment-analysis"

from transformers import AutoTokenizer

tokenizer = AutoTokenizer.from_pretrained(model_name)

tokenized_dataset1 = dataset1.map(tokenize_function, batched=True)
tokenized_dataset2 = dataset2.map(tokenize_function, batched=True)

#------------------------------
```

```
Map:   0%|          | 0/250 [00:00<?, ? examples/s]
```

```
Map:   0%|          | 0/250 [00:00<?, ? examples/s]
```

[98]:
```
# load Hugging model for classification initialized with the sentiment model␣
 ↪you have chosen

#--- ADD YOUR SOLUTION HERE (3 points)---

from transformers import AutoModelForSequenceClassification

model = AutoModelForSequenceClassification.from_pretrained(model_name)
```

```
#------------------------------
# Hint: make sure your model corresponds to your tokenizer
```

[99]:
```
# add custom metrics that computes precision, recall, f1, accuracy

from sklearn.metrics import accuracy_score, precision_score, recall_score,␣
 ↪f1_score

def compute_metrics(pred):
    labels = pred.label_ids
    preds = pred.predictions.argmax(-1)

    # Calculate accuracy
    accuracy = accuracy_score(labels, preds)

   # Calculate precision, recall, and F1-score
    precision = precision_score(labels, preds, average='weighted')
    recall = recall_score(labels, preds, average='weighted')
    f1 = f1_score(labels, preds, average='weighted')

    return {
        'accuracy': accuracy,
        'precision': precision,
        'recall': recall,
        'f1': f1
    }
```

[100]:
```
#
# QUESTION: configure the training parameters using the Hugginface␣
 ↪TrainingArguments class
# - set the output directory to "finetuning-reddit"
# - do not report training metrics to an external experiment tracking service
# - learning rate to 2e-5,
# - set weight decay to 0.01
# - set logging_steps to 10,
# - set evaluation_strategy to "steps",
# - set epochs to 3


#--- ADD YOUR SOLUTION HERE (3 points)---

from transformers import TrainingArguments

training_args = TrainingArguments(
    output_dir="finetuning-reddit",
    report_to="none",
```

```
    learning_rate=2e-5,
    weight_decay=0.01,
    logging_steps=10,
    evaluation_strategy="steps",
    num_train_epochs=3,
    per_device_train_batch_size=8,
    per_device_eval_batch_size=8
)

#------------------------------
```

```
c:\Users\ASUS\anaconda3\envs\ai\lib\site-
packages\transformers\training_args.py:1568: FutureWarning:
`evaluation_strategy` is deprecated and will be removed in version 4.46 of
Transformers. Use `eval_strategy` instead
  warnings.warn(
```

[101]:
```
# initialize trainer
# train on the split dataset1
trainer = Trainer(
    model=model,
    args=training_args,
    train_dataset=tokenized_dataset1,
    eval_dataset=tokenized_dataset2,
    compute_metrics=compute_metrics,
)
```

[102]:
```
# Evaluate on dataset1 set before training
predictions = trainer.predict(tokenized_dataset1)
print(sklearn.metrics.classification_report(predictions.predictions.argmax(-1),␣
 ↪dataset1['label']))
```

```
  0%|          | 0/32 [00:00<?, ?it/s]
              precision    recall  f1-score   support

           0       0.77      0.68      0.72        25
           1       0.93      0.87      0.90       156
           2       0.79      0.93      0.85        69

    accuracy                           0.87       250
   macro avg       0.83      0.83      0.82       250
weighted avg       0.87      0.87      0.87       250
```

[103]:
```
# Evaluate on dataset2 set before training
predictions = trainer.predict(tokenized_dataset2)
print(sklearn.metrics.classification_report(predictions.predictions.argmax(-1),␣
 ↪dataset2['label']))
```

```
  0%|          | 0/32 [00:00<?, ?it/s]
```

	precision	recall	f1-score	support
0	0.74	0.83	0.78	35
1	0.93	0.88	0.90	156
2	0.84	0.90	0.87	59
accuracy			0.88	250
macro avg	0.84	0.87	0.85	250
weighted avg	0.88	0.88	0.88	250

[104]:
```
# train the model
train_output = trainer.train()
```

```
  0%|          | 0/96 [00:00<?, ?it/s]
{'loss': 0.5317, 'grad_norm': 23.551959991455078, 'learning_rate':
1.7916666666666667e-05, 'epoch': 0.31}
  0%|          | 0/32 [00:00<?, ?it/s]
{'eval_loss': 0.3580198287963867, 'eval_model_preparation_time': 0.004,
'eval_accuracy': 0.848, 'eval_precision': 0.8544668327623793, 'eval_recall':
0.848, 'eval_f1': 0.8418545891542737, 'eval_runtime': 1.6314,
'eval_samples_per_second': 153.245, 'eval_steps_per_second': 19.615, 'epoch':
0.31}
{'loss': 0.306, 'grad_norm': 10.445727348327637, 'learning_rate':
1.5833333333333333e-05, 'epoch': 0.62}
  0%|          | 0/32 [00:00<?, ?it/s]
{'eval_loss': 0.3934594988822937, 'eval_model_preparation_time': 0.004,
'eval_accuracy': 0.848, 'eval_precision': 0.8592222222222222, 'eval_recall':
0.848, 'eval_f1': 0.8456822300986685, 'eval_runtime': 1.5733,
'eval_samples_per_second': 158.897, 'eval_steps_per_second': 20.339, 'epoch':
0.62}
{'loss': 0.2855, 'grad_norm': 5.294536590576172, 'learning_rate': 1.375e-05,
'epoch': 0.94}
  0%|          | 0/32 [00:00<?, ?it/s]
{'eval_loss': 0.3291862905025482, 'eval_model_preparation_time': 0.004,
'eval_accuracy': 0.864, 'eval_precision': 0.8735190998433272, 'eval_recall':
0.864, 'eval_f1': 0.8658619307832423, 'eval_runtime': 1.5765,
'eval_samples_per_second': 158.577, 'eval_steps_per_second': 20.298, 'epoch':
0.94}
{'loss': 0.2448, 'grad_norm': 10.072566986083984, 'learning_rate':
1.1666666666666668e-05, 'epoch': 1.25}
  0%|          | 0/32 [00:00<?, ?it/s]
```

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  0%| | 0/32 [00:00<?, ?it/s]

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  0%| | 0/32 [00:00<?, ?it/s]

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{'train_runtime': 92.0247, 'train_samples_per_second': 8.15,
'train_steps_per_second': 1.043, 'train_loss': 0.19695733239253363, 'epoch':
3.0}
```

[105]:
```
# Evaluate on dataset1, i.e the training set again
preditions = trainer.predict(tokenized_dataset1)
print(sklearn.metrics.classification_report(preditions.predictions.argmax(-1),␣
↪dataset1['label']))
```

```
  0%|          | 0/32 [00:00<?, ?it/s]
              precision    recall  f1-score   support

           0       0.95      1.00      0.98        21
           1       0.99      0.99      0.99       146
           2       1.00      0.98      0.99        83

    accuracy                           0.99       250
   macro avg       0.98      0.99      0.98       250
weighted avg       0.99      0.99      0.99       250
```

[106]:
```
# Evaluate on dataset2 set i.e. the test set again
predictions = trainer.predict(tokenized_dataset2)
print(sklearn.metrics.classification_report(predictions.predictions.argmax(-1),␣
↪dataset2['label']))
```

```
  0%|          | 0/32 [00:00<?, ?it/s]
              precision    recall  f1-score   support

           0       0.69      0.93      0.79        29
           1       0.93      0.89      0.91       154
           2       0.90      0.85      0.88        67

    accuracy                           0.88       250
   macro avg       0.84      0.89      0.86       250
weighted avg       0.89      0.88      0.89       250
```

2.3.1 QUESTION:

Has the model improved performance on the first batch of data? Does the model generalize well to the next batch of data? Do you see any signs of overfitting or underfitting based on the evaluation scores Explain why or why not

— ADD YOUR SOLUTION HERE (5 points)—

Yes, the model has improved performance on the first batch (dataset1) after re-training as the accuracy increased from 87% to 99%, and all class-wise precision, recall, and F1-scores are nearly

perfect. However, on the second batch (dataset2), the performance remains almost the same (~88% accuracy), with a slight improvement in recall for class 0 and in precision for class 2. This indicates that the model has fit the training data very well, but did not show meaningful generalization gains. While not a clear case of overfitting (since test performance didn't drop), the training-test gap suggests early signs of overfitting, especially with such a small dataset.

2.3.2 QUESTION:

Is the model good enough to be used for practical applications? Given the results you have so far, what additional measures would you recommend to continuously improve the SUTD reddit sentiment classifier? What other functionalities beyond sentiment could be useful? Write a paragraph (max 200 words) to explain your choice

— ADD YOUR SOLUTION HERE (10 points)—

The model performs well overall (88% accuracy on unseen data), therefore it is suitable for practical applications like content moderation or sentiment trend analysis. However, there's room for improvement. I recommend to periodically retraining the model on fresh data. Beyond sentiment, useful extensions could include emotion classification (e.g., joy, anger, sadness), or topic modeling to track recurring themes.

3 End

This concludes assignment 2.

Please submit this notebook with your answers and the generated output cells as a **Jupyter notebook file** and the **text file reddit_labeled_STUDENT_NAME.csv** via github.

1. Create a private github repository **sutd_5055mlop** under your github user.
2. Add your instructors as collaborator: ddahlmeier and lucainiaoge
3. Save your submission as assignment_02_STUDENT_NAME.ipynb and reddit_labeled_STUDENT_NAME.csv where STUDENT_NAME is your name in your SUTD email address.

4. Push the submission files to your repo
5. Submit the link to the repo via eDimensions

Example: Email: michael_tan@mymail.sutd.edu.sg STUDENT_NAME: michael_tan Submission file name: assignment_02_michael_tan.ipynb

Assignment due 21 March 2025 11:59pm