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#BiGRU Model For Manual Annotated dataset..............

import pandas as pd
import numpy as np
import re
from nltk.stem import WordNetLemmatizer
from sklearn.model_selection import KFold


from tensorflow.keras.preprocessing.text import Tokenizer
from keras.preprocessing.sequence import pad_sequences
from keras.models import Sequential
from keras.layers import Embedding, Bidirectional, GRU, Dropout, Dense
from keras.optimizers import Adam
from sklearn.metrics import confusion_matrix, classification_report
import matplotlib.pyplot as plt
import seaborn as sns
from imblearn.over_sampling import RandomOverSampler

# 1. Load and Preprocess the dataset
df = pd.read_csv('R2_ChatGPt_dataset.csv', encoding='latin1')
lemmatizer = WordNetLemmatizer()

def clean_text(text):
    text = text.lower()
    text = re.sub(r'[^\w\s]', '', text)
    text = re.sub(r'\d+', '', text)
    tokens = text.split()
    tokens = [lemmatizer.lemmatize(token) for token in tokens]
    return ' '.join(tokens)

df['Base_Reviews'] = df['Base_Reviews'].apply(clean_text)

tokenizer = Tokenizer()
tokenizer.fit_on_texts(df['Base_Reviews'])
X = tokenizer.texts_to_sequences(df['Base_Reviews'])
vocab_size = len(tokenizer.word_index) + 1
maxlen = 100
X = pad_sequences(X, padding='post', maxlen=maxlen)

y_dict = {'anger': 0, 'confusion': 1, 'disappointment': 2, 'distrust':
3, 'disgust': 4, 'frustration': 5, 'fear': 6, 'sadness': 7}
y = df['ChatGPT_Annotations'].map(y_dict)
y = pd.get_dummies(df['ChatGPT_Annotations']).values

# 2. Oversample to balance classes
oversampler = RandomOverSampler(random_state=42)
X_resampled, y_resampled = oversampler.fit_resample(X, y)

# 3. Define the BiGRU model
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def create_bigru_model():
    model = Sequential()
    model.add(Embedding(input_dim=vocab_size, output_dim=100,
input_length=maxlen))
    model.add(Bidirectional(GRU(64, return_sequences=True)))
    model.add(Dropout(0.2))
    model.add(Bidirectional(GRU(64)))
    model.add(Dropout(0.2))
    model.add(Dense(8, activation='softmax'))
    model.compile(optimizer=Adam(learning_rate=0.001),
loss='categorical_crossentropy', metrics=['accuracy'])
    return model

# 4. K-Fold Cross-Validation
n_folds = 10
kfold = KFold(n_splits=n_folds, shuffle=True)
fold_no = 1
acc_per_fold = []

# Lists to store average accuracies across folds
avg_train_acc = []
avg_val_acc = []

for train, test in kfold.split(X_resampled, y_resampled):
    model = create_bigru_model()
    history = model.fit(X_resampled[train], y_resampled[train],
validation_split=0.1, epochs=10, batch_size=32, verbose=0)

    avg_train_acc.append(history.history['accuracy'])
    avg_val_acc.append(history.history['val_accuracy'])

    scores = model.evaluate(X_resampled[test], y_resampled[test],
verbose=0)
    acc_per_fold.append(scores[1] * 100)
    fold_no += 1

# 5. Performance Metrics
print(f'> Average Accuracy across {n_folds}-folds:
{np.mean(acc_per_fold):.2f}% (+/- {np.std(acc_per_fold):.2f}%)')

# Average Training and Validation Accuracy for 5 folds
plt.plot(np.mean(avg_train_acc, axis=0), label='Average Training
Accuracy')
plt.plot(np.mean(avg_val_acc, axis=0), label='Average Validation
Accuracy')
plt.title('Average Training and Validation Accuracy across 5 folds')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.legend()
plt.show()
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# Confusion Matrix
y_pred = model.predict(X_resampled)
y_pred_classes = np.argmax(y_pred, axis=1)
y_true_classes = np.argmax(y_resampled, axis=1)
cm = confusion_matrix(y_true_classes, y_pred_classes)
sns.heatmap(cm, annot=True, fmt='g')
plt.show()

# Classification Report
print(classification_report(y_true_classes, y_pred_classes,
target_names=list(y_dict.keys())))
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/Users/nekdilkhan/miniforge3/lib/python3.12/site-packages/keras/src/
layers/core/embedding.py:90: UserWarning: Argument `input_length` is
deprecated. Just remove it.
  warnings.warn(
```

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> Average Accuracy across 10-folds: 91.55% (+/- 0.55%)
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1195/1195 ━━━━━━━━━━━━━━━━━━━━ 46s 38ms/step
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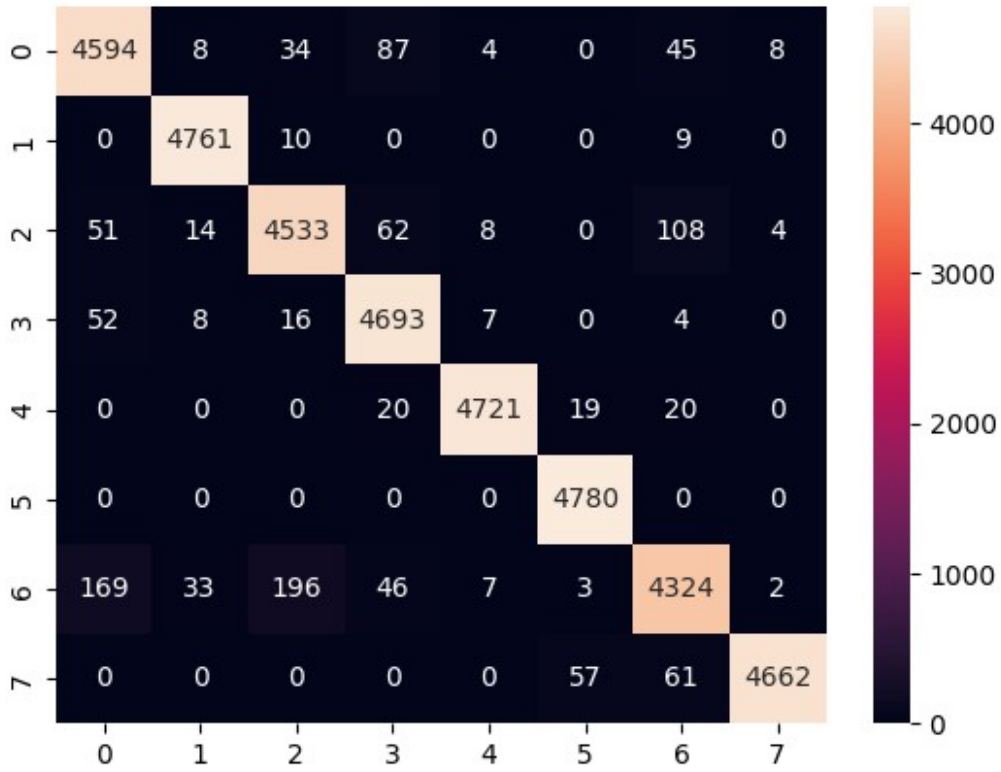

	precision	recall	f1-score	support
anger	0.94	0.96	0.95	4780
confusion	0.99	1.00	0.99	4780
disappointment	0.95	0.95	0.95	4780
distrust	0.96	0.98	0.97	4780
disgust	0.99	0.99	0.99	4780
frustration	0.98	1.00	0.99	4780
fear	0.95	0.90	0.92	4780
sadness	1.00	0.98	0.99	4780
accuracy			0.97	38240
macro avg	0.97	0.97	0.97	38240
weighted avg	0.97	0.97	0.97	38240