```
#CNN Model ChatGpt Dataset oversampling  ..........


import pandas as pd
import numpy as np
import re
from nltk.stem import WordNetLemmatizer
from sklearn.model_selection import KFold
from keras.preprocessing.text import Tokenizer
from keras.preprocessing.sequence import pad_sequences
from keras.models import Sequential
from keras.layers import Embedding, Conv1D, MaxPooling1D, Flatten,
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('chatgptannoated_datset_final.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['category'].map(y_dict)
y = pd.get_dummies(df['category']).values
```

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

# 3. Define the CNN model
def create_model():
    model = Sequential()
    model.add(Embedding(input_dim=vocab_size, output_dim=100,
input_length=maxlen))
    model.add(Conv1D(128, 5, activation='relu'))
    model.add(MaxPooling1D(pool_size=2))
    model.add(Flatten())
    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_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
```

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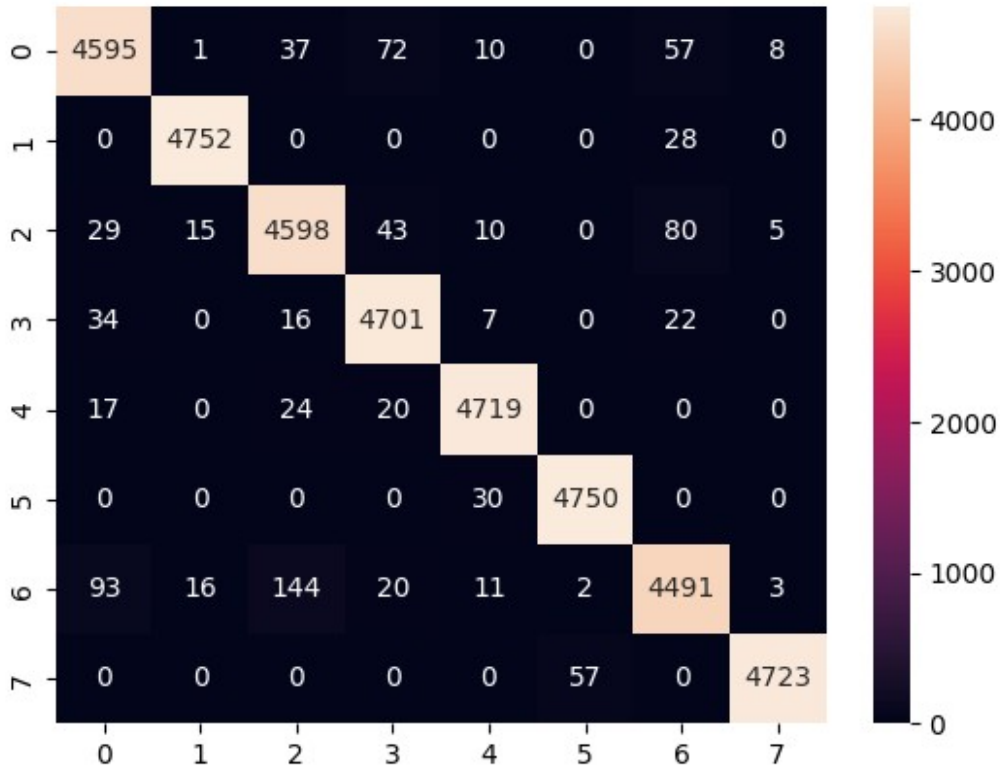
```
# 5. Performance Metrics
print(f'> Average Accuracy across {n_folds}-folds:
{np.mean(acc_per_fold):.2f}% (+/- {np.std(acc_per_fold):.2f}%)')
```

```
> Average Accuracy across 10-folds: 92.19% (+/- 0.63%)
```

```
# 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 10 folds')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.legend()
plt.show()
```

```
# 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()
```

```
1195/1195 [==============================] - 9s 8ms/step
```




```
# Classification Report
print(classification_report(y_true_classes, y_pred_classes,
target_names=list(y_dict.keys())))
```

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

```
#CNN Model ChatGpt Dataset undersampling  ..........
# Import necessary libraries
import pandas as pd
import numpy as np
import re
from nltk.stem import WordNetLemmatizer
from sklearn.model_selection import KFold
from keras.preprocessing.text import Tokenizer
from keras.preprocessing.sequence import pad_sequences
from keras.models import Sequential
from keras.layers import Embedding, Conv1D, MaxPooling1D, Flatten,
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.under_sampling import RandomUnderSampler  # Import
RandomUnderSampler for undersampling

# 1. Load and Preprocess the dataset
df = pd.read_csv('chatgptannoated_datset_final.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':
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y = df['category'].map(y_dict)
y = pd.get_dummies(df['category']).values

# 2. Undersample to balance classes
undersampler = RandomUnderSampler(random_state=42)  # Use
RandomUnderSampler for undersampling
```

```
X_resampled, y_resampled = undersampler.fit_resample(X, y)

# Rest of the code remains the same
# Define the CNN model, K-Fold Cross-Validation, and Performance
Metrics
# ...

# 3. Define the CNN model
def create_model():
    model = Sequential()
    model.add(Embedding(input_dim=vocab_size, output_dim=100,
input_length=maxlen))
    model.add(Conv1D(128, 5, activation='relu'))
    model.add(MaxPooling1D(pool_size=2))
    model.add(Flatten())
    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_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

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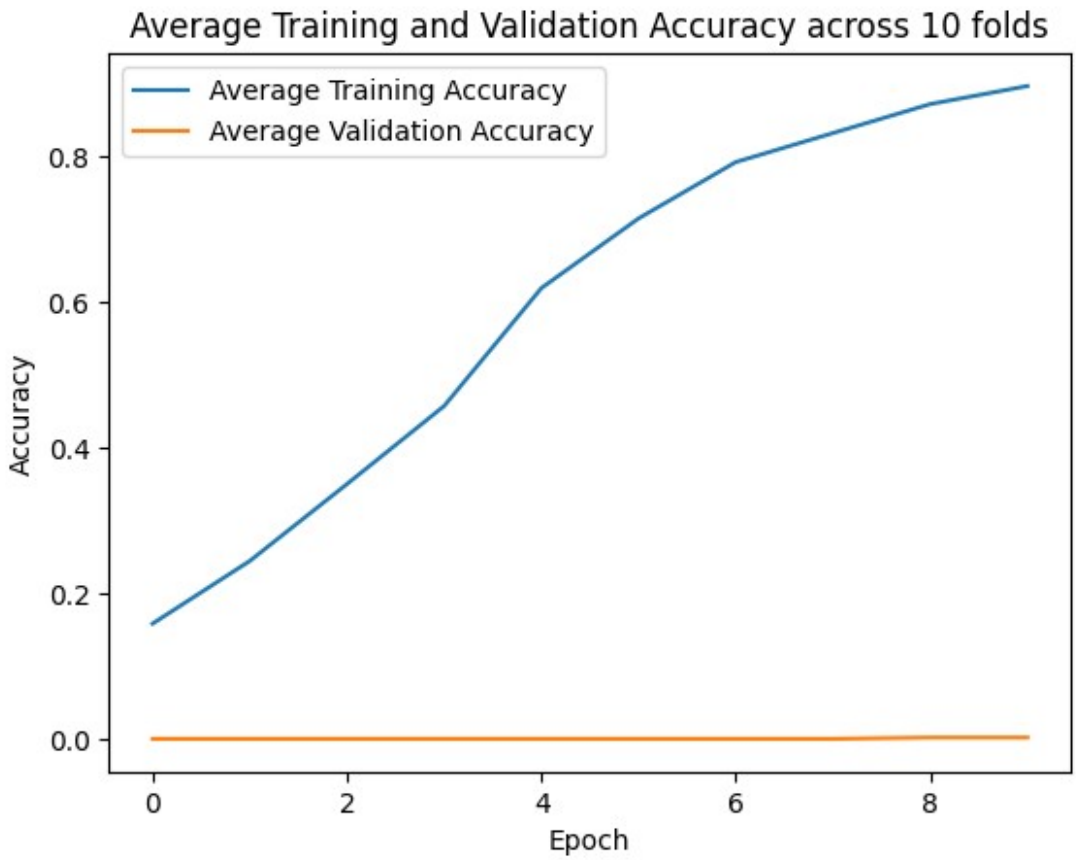
i.e., `tf.keras.optimizers.legacy.Adam`.

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

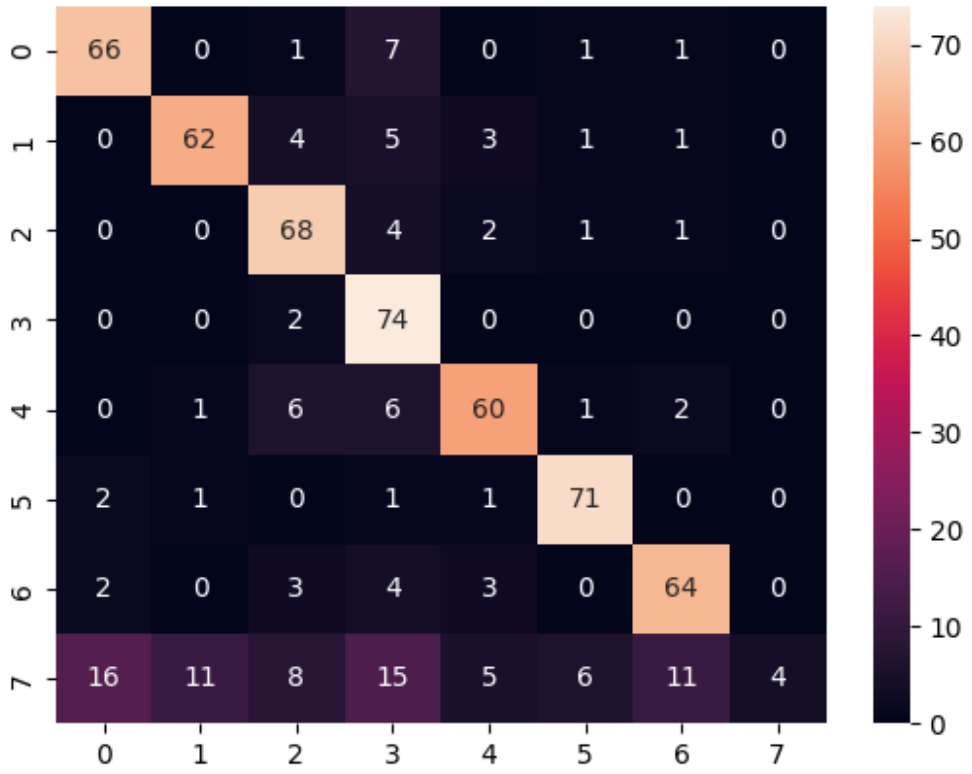
> Average Accuracy across 10-folds: 31.08% (+/- 6.28%)

# 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 10 folds')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.legend()
plt.show()
```




```
# 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()
```

```
19/19 [==============================] - 0s 12ms/step
```




```
# Classification Report
print(classification_report(y_true_classes, y_pred_classes,
target_names=list(y_dict.keys())))
```

```
                precision    recall  f1-score   support

         anger       0.77      0.87      0.81        76
     confusion       0.83      0.82      0.82        76
disappointment       0.74      0.89      0.81        76
      distrust       0.64      0.97      0.77        76
       disgust       0.81      0.79      0.80        76
   frustration       0.88      0.93      0.90        76
          fear       0.80      0.84      0.82        76
       sadness       1.00      0.05      0.10        76

      accuracy                           0.77       608
     macro avg       0.81      0.77      0.73       608
  weighted avg       0.81      0.77      0.73       608
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import pandas as pd
import numpy as np
import re
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from keras.preprocessing.text import Tokenizer
from keras.preprocessing.sequence import pad_sequences
```

```
from keras.models import Sequential
from keras.layers import Embedding, Conv1D, MaxPooling1D, Flatten,
Dropout, Dense
from keras.optimizers import Adam
from sklearn.metrics import roc_curve, auc
import matplotlib.pyplot as plt
from imblearn.under_sampling import RandomUnderSampler
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# Load and preprocess the dataset
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    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()
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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)

# Define class labels, oversampling, and undersampling
y_dict = {'anger': 0, 'confusion': 1, 'disappointment': 2, 'distrust':
3, 'disgust': 4, 'frustration': 5, 'fear': 6, 'sadness': 7}
y = df['category'].map(y_dict)
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oversampler = RandomOverSampler(random_state=42)
undersampler = RandomUnderSampler(random_state=42)

# Define the CNN model
def create_model():
    model = Sequential()
    model.add(Embedding(input_dim=vocab_size, output_dim=100,
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    model.add(Conv1D(128, 5, activation='relu'))
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```
    model.add(Dense(8, activation='softmax'))
    model.compile(optimizer=Adam(learning_rate=0.001),
loss='categorical_crossentropy', metrics=['accuracy'])
    return model

# Train and evaluate the model for oversampling
X_oversampled, y_oversampled = oversampler.fit_resample(X, y)
model_oversampling = create_model()
model_oversampling.fit(X_oversampled, y_oversampled, epochs=10,
batch_size=32, verbose=0)

# Train and evaluate the model for undersampling
X_undersampled, y_undersampled = undersampler.fit_resample(X, y)
model_undersampling = create_model()
model_undersampling.fit(X_undersampled, y_undersampled, epochs=10,
batch_size=32, verbose=0)

# Function to plot ROC curve and calculate AUC
def plot_roc_auc(models, X, y, titles):
    plt.figure()
    for model, title in zip(models, titles):
        y_pred = model.predict(X)
        fpr, tpr, thresholds = roc_curve(y, y_pred[:, 1])
        roc_auc = auc(fpr, tpr)
        plt.plot(fpr, tpr, lw=2, label=f'{title} (area =
{roc_auc:.2f})')

    plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')
    plt.xlim([0.0, 1.0])
    plt.ylim([0.0, 1.05])
    plt.xlabel('False Positive Rate')
    plt.ylabel('True Positive Rate')
    plt.title('ROC Curve for Sampling Methods (CNN)')
    plt.legend(loc='lower right')
    plt.show()

# Plot both ROC curves on the same diagram
plot_roc_auc([model_oversampling, model_undersampling], X_oversampled,
y_oversampled[:, 1], titles=['Oversampling', 'Undersampling'])
```

```
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i.e., `tf.keras.optimizers.legacy.Adam`.

1195/1195 [==============================] - 5s 4ms/step
1195/1195 [==============================] - 7s 6ms/step
```

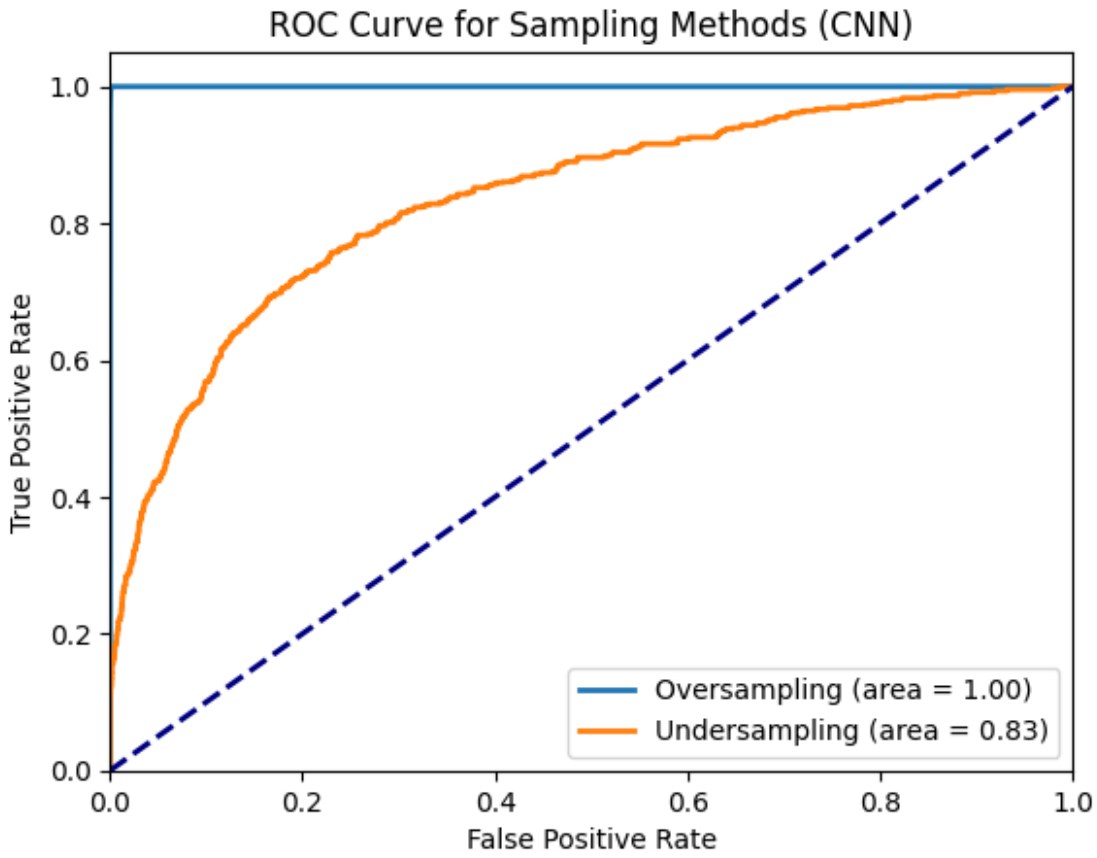


```python
# Import necessary libraries
from sklearn.metrics import confusion_matrix, classification_report,
roc_curve, auc
import matplotlib.pyplot as plt
import seaborn as sns

import pandas as pd
import numpy as np
import re
from nltk.stem import WordNetLemmatizer
from sklearn.model_selection import KFold
from keras.preprocessing.text import Tokenizer
from keras.preprocessing.sequence import pad_sequences
from keras.models import Sequential
from keras.layers import Embedding, Conv1D, MaxPooling1D, Flatten,
```

```
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('chatgptannoated_datset_final.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['category'].map(y_dict)
y = pd.get_dummies(df['category']).values

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

# 3. Define the CNN model
def create_model():
    model = Sequential()
    model.add(Embedding(input_dim=vocab_size, output_dim=100,
input_length=maxlen))
    model.add(Conv1D(128, 5, activation='relu'))
    model.add(MaxPooling1D(pool_size=2))
    model.add(Flatten())
    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_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 10 folds')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.legend()
plt.show()

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optimizers on M1/M2 Macs. Falling back to the legacy Keras optimizer,
i.e., `tf.keras.optimizers.legacy.Adam`.

> Average Accuracy across 10-folds: 92.28% (+/- 0.45%)
```
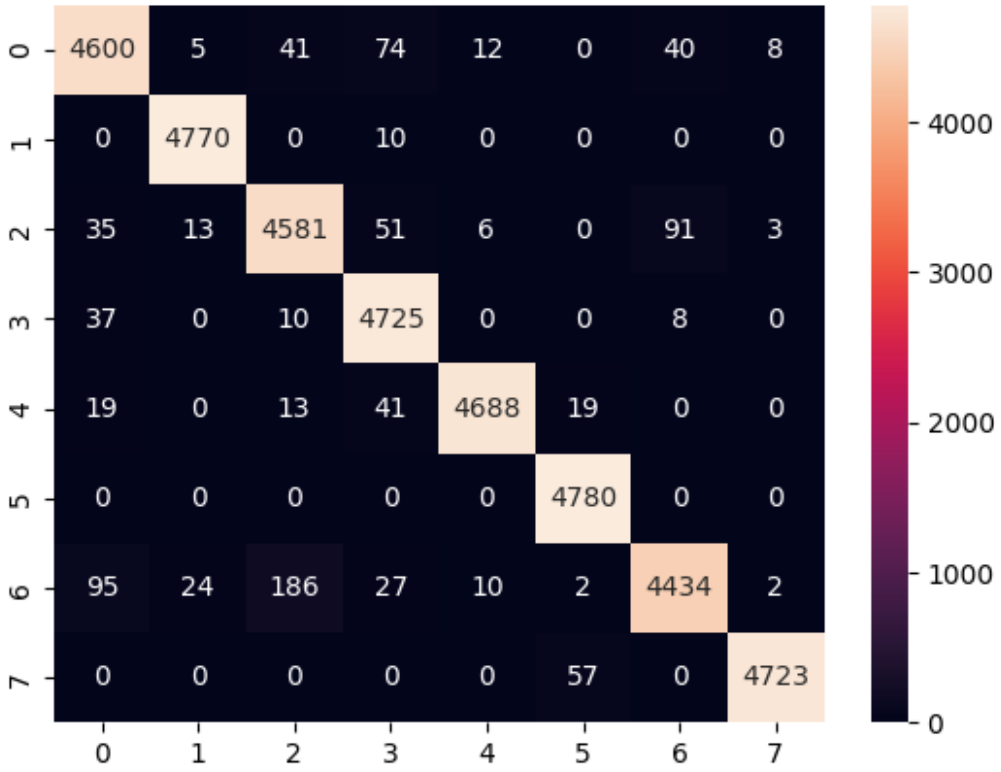

```
# Confusion Matrix
y_pred = model.predict(X_resampled)
y_pred_classes = np.argmax(y_pred, axis=1)
y_true_classes = np.argmax(y_resampled, axis=1)
cm = confusion_matrix(y_true_classes, y_pred_classes)
sns.heatmap(cm, annot=True, fmt='g')
plt.show()
```

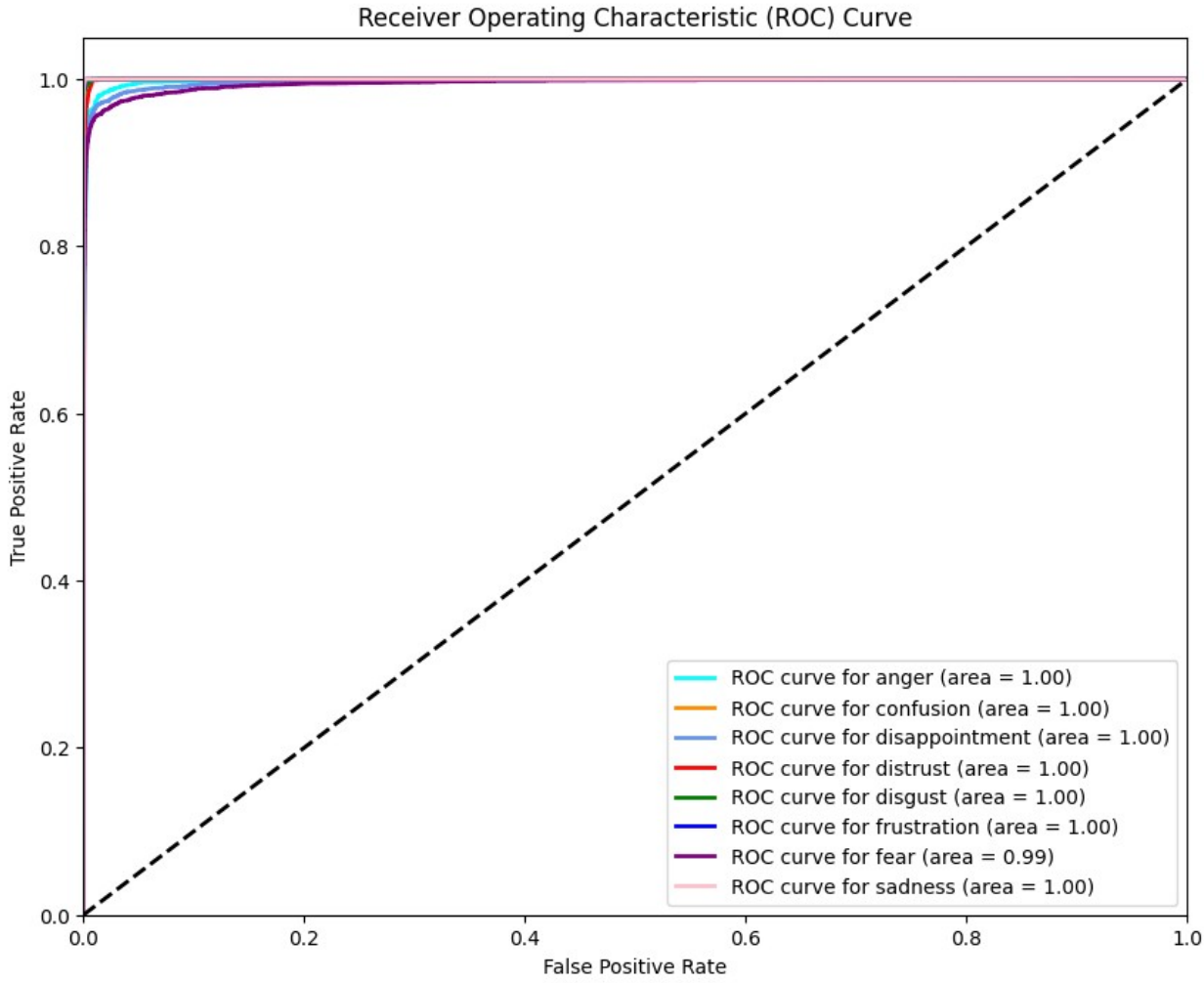
```
# ROC Curve
n_classes = len(y_dict)
fpr = dict()
tpr = dict()
roc_auc = dict()
for i in range(n_classes):
    fpr[i], tpr[i], _ = roc_curve(y_resampled[:, i], y_pred[:, i])
    roc_auc[i] = auc(fpr[i], tpr[i])
```

```
1195/1195 [==============================] - 3s 2ms/step
```




```
# Plot ROC curve for each class
plt.figure(figsize=(10, 8))
colors = ['aqua', 'darkorange', 'cornflowerblue', 'red', 'green',
'blue', 'purple', 'pink']
for i in range(n_classes):
   plt.plot(fpr[i], tpr[i], color=colors[i], lw=2, label=f'ROC curve
for {list(y_dict.keys())[i]} (area = {roc_auc[i]:.2f})')


plt.plot([0, 1], [0, 1], 'k--', lw=2)
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
```

```
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver Operating Characteristic (ROC) Curve')
plt.legend(loc='best')
plt.show()
```




```
# Classification Report
print(classification_report(y_true_classes, y_pred_classes,
target_names=list(y_dict.keys())))
```

```
                precision    recall  f1-score   support

         anger       0.96      0.96      0.96      4780
     confusion       0.99      1.00      0.99      4780
disappointment       0.95      0.96      0.95      4780
      distrust       0.96      0.99      0.97      4780
       disgust       0.99      0.98      0.99      4780
```

```
   frustration       0.98      1.00      0.99      4780
          fear       0.97      0.93      0.95      4780
       sadness       1.00      0.99      0.99      4780

      accuracy                           0.98     38240
     macro avg       0.98      0.98      0.98     38240
  weighted avg       0.98      0.98      0.98     38240
```

```
#new Ex :
```

```
#CNN Model ChatGpt Dataset oversampling  ..........
```

```
import pandas as pd
import numpy as np
import re
from nltk.stem import WordNetLemmatizer
from sklearn.model_selection import KFold
from keras.preprocessing.text import Tokenizer
from keras.preprocessing.sequence import pad_sequences
from keras.models import Sequential
from keras.layers import Embedding, Conv1D, MaxPooling1D, Flatten,
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('chatgptannoated_datset_finalll.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'])
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y_dict = {'anger': 0, 'confusion': 1, 'disappointment': 2, 'distrust':
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y = df['category'].map(y_dict)
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oversampler = RandomOverSampler(random_state=42)
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# 3. Define the CNN model
def create_model():
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    model.add(MaxPooling1D(pool_size=2))
    model.add(Flatten())
    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_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
```

```
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i.e., `tf.keras.optimizers.legacy.Adam`.
```

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

```
> Average Accuracy across 10-folds: 93.97% (+/- 0.23%)
```

```python
# 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 10 folds')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
```

```
plt.legend()
plt.show()
```

```

```