BERTimbau

O BERTimbau é uma variante do BERT (Bidirectional Encoder Representations from Transformers), um modelo de linguagem pré-treinado desenvolvido pela Google. O BERT foi projetado para compreender a linguagem natural de maneira bidirecional, ou seja, ele considera o contexto das palavras à esquerda e à direita de uma determinada palavra em uma sentença. O BERTimbau, especificamente, é ajustado para a língua portuguesa e foi treinado em um grande corpus de textos em português.

Treinando BERTimbau

In [7]:

```python
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from transformers import BertTokenizer, BertForSequenceClassification, Trainer, TrainingArguments
import torch

# Carregar os dados
data = pd.read_csv('dados_reviews_tratados.csv')

# Preparar os dados de entrada e saída
X = data['content'].astype(str).tolist()
y = data['sentiment'].tolist()

# Codificar os rótulos
label_encoder = LabelEncoder()
y_encoded = label_encoder.fit_transform(y)

# Dividir os dados em treinamento e teste
X_train, X_test, y_train, y_test = train_test_split(X, y_encoded, test_size=0.2, random_state=42)

# Carregar o tokenizador e o modelo do bertimbau
tokenizer = BertTokenizer.from_pretrained('neuralmind/bert-base-portuguese-cased')
model = BertForSequenceClassification.from_pretrained('neuralmind/bert-base-portuguese-cased', num_labels=len(la

# Tokenizar os textos
def tokenize_function(texts):
    return tokenizer(texts, padding=True, truncation=True, return_tensors='pt', max_length=128)

train_encodings = tokenize_function(X_train)
test_encodings = tokenize_function(X_test)

# Criar os DataLoaders para treinamento e teste
class ReviewsDataset(torch.utils.data.Dataset):
    def __init__(self, encodings, labels):
        self.encodings = encodings
        self.labels = labels

    def __getitem__(self, idx):
        item = {key: torch.tensor(val[idx]) for key, val in self.encodings.items()}
        item['labels'] = torch.tensor(self.labels[idx])
        return item

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

train_dataset = ReviewsDataset(train_encodings, y_train)
test_dataset = ReviewsDataset(test_encodings, y_test)

# Configurar os parâmetros de treinamento
training_args = TrainingArguments(
    output_dir='./results',
    num_train_epochs=3,
    per_device_train_batch_size=8,
    per_device_eval_batch_size=8,
    warmup_steps=500,
    weight_decay=0.01,
    logging_dir='./logs',
    logging_steps=10,
)

trainer = Trainer(
    model=model,
    args=training_args,
    train_dataset=train_dataset,
    eval_dataset=test_dataset,
)

# Treinar o modelo
trainer.train()
```

```python
# Avaliar o modelo
results = trainer.evaluate()
print(results)
```

```
Some weights of BertForSequenceClassification were not initialized from the model checkpoint at neuralmind/bert-
base-portuguese-cased and are newly initialized: ['classifier.bias', 'classifier.weight']
You should probably TRAIN this model on a down-stream task to be able to use it for predictions and inference.
/tmp/ipykernel_6392/1983592204.py:39: UserWarning: To copy construct from a tensor, it is recommended to use sou
rceTensor.clone().detach() or sourceTensor.clone().detach().requires_grad_(True), rather than torch.tensor(sourc
eTensor).
  item = {key: torch.tensor(val[idx]) for key, val in self.encodings.items()}
```

[903/903 59:10, Epoch 3/3]

Step	Training Loss
10	1.913600
20	1.899700
30	1.875300
40	1.789600
50	1.778900
60	1.755400
70	1.581200
80	1.585100
90	1.584300
100	1.501200
110	1.421600
120	1.512400
130	1.414300
140	1.403200
150	1.325200
160	1.326000
170	1.265400
180	1.201500
190	1.143500
200	1.283500
210	1.121800
220	1.146800
230	1.110100
240	1.113700
250	1.104800
260	1.175300
270	1.077000
280	1.008800
290	1.196700
300	0.952800
310	1.125200
320	0.797000
330	0.915700
340	0.801300
350	1.083200
360	0.924300
370	1.039600
380	0.951500
390	1.348800
400	1.104600
410	0.929800
420	0.909200

430	0.950900
440	0.939700
450	1.168100
460	1.172700
470	0.946700
480	1.046900
490	0.948900
500	0.963200
510	1.208600
520	0.993500
530	0.965700
540	0.911900
550	1.078900
560	0.991400
570	1.063100
580	0.888500
590	1.072900
600	0.947200
610	0.886900
620	0.915500
630	0.674700
640	0.925200
650	0.577800
660	0.692100
670	0.628200
680	0.791700
690	0.688800
700	0.465700
710	0.621600
720	0.577000
730	0.571000
740	0.576100
750	0.467700
760	0.650700
770	0.705200
780	0.645900
790	0.566200
800	0.656800
810	0.651000
820	0.672400
830	0.573500
840	0.610300
850	0.496700
860	0.611100
870	0.474500
880	0.606100
890	0.608100
900	0.581200

```
/tmp/ipykernel_6392/1983592204.py:39: UserWarning: To copy construct from a tensor, it is recommended to use sou
rceTensor.clone().detach() or sourceTensor.clone().detach().requires_grad_(True), rather than torch.tensor(sourc
eTensor).
  item = {key: torch.tensor(val[idx]) for key, val in self.encodings.items()}
/tmp/ipykernel_6392/1983592204.py:39: UserWarning: To copy construct from a tensor, it is recommended to use sou
rceTensor.clone().detach() or sourceTensor.clone().detach().requires_grad_(True), rather than torch.tensor(sourc
eTensor).
  item = {key: torch.tensor(val[idx]) for key, val in self.encodings.items()}
```

[76/76 00:59]

```
{'eval_loss': 0.9598256945610046, 'eval_runtime': 60.1054, 'eval_samples_per_second': 10.032, 'eval_steps_per_se
cond': 1.264, 'epoch': 3.0}
```

Salvando treinamento

In [8]:

```
model.save_pretrained('./modelo_bertimbau_emocao')
tokenizer.save_pretrained('./modelo_bertimbau_emocao')
```

Out[8]:

```
('./modelo_bertimbau_emocao/tokenizer_config.json',
 './modelo_bertimbau_emocao/special_tokens_map.json',
 './modelo_bertimbau_emocao/vocab.txt',
 './modelo_bertimbau_emocao/added_tokens.json')
```

Previsão a partir do modelo treinado salvo

In [7]:

```
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from transformers import BertTokenizer, BertForSequenceClassification
import torch
from torch.utils.data import Dataset, DataLoader

# Carregar os dados
data = pd.read_csv('dados_reviews_tratados.csv')

# Preparar os dados de entrada e saída
X = data['content'].astype(str).tolist()
y = data['sentiment'].tolist()

# Codificar as etiquetas
label_encoder = LabelEncoder()
y = label_encoder.fit_transform(y)

# Dividir os dados em treino e validação
X_train, X_val, y_train, y_val = train_test_split(X, y, test_size=0.2, random_state=42)

# Carregar o tokenizador e o modelo treinado
tokenizer = BertTokenizer.from_pretrained('./modelo_bertimbau_emocao')
model = BertForSequenceClassification.from_pretrained('./modelo_bertimbau_emocao')

# Definir o dataset
class ReviewsDataset(Dataset):
    def __init__(self, texts, labels, tokenizer, max_len=128):
        self.texts = texts
        self.labels = labels
        self.tokenizer = tokenizer
        self.max_len = max_len

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

    def __getitem__(self, idx):
        text = self.texts[idx]
        label = self.labels[idx]
        encoding = self.tokenizer.encode_plus(
            text,
            add_special_tokens=True,
            max_length=self.max_len,
            return_token_type_ids=False,
            padding='max_length',
            truncation=True,
            return_attention_mask=True,
            return_tensors='pt',
        )
        return {
            'input_ids': encoding['input_ids'].flatten(),
            'attention_mask': encoding['attention_mask'].flatten(),
            'labels': torch.tensor(label, dtype=torch.long)
        }

val_dataset = ReviewsDataset(X_val, y_val, tokenizer)

# Obter previsões
def get_predictions(dataset):
    predictions = []
    true_labels = []
    model.eval()
    for batch in DataLoader(dataset, batch_size=8):
        input_ids = batch['input_ids'].to(model.device)
        attention_mask = batch['attention_mask'].to(model.device)
        labels = batch['labels'].to(model.device)
        with torch.no_grad():
            outputs = model(input_ids, attention_mask=attention_mask)
            logits = outputs.logits
            preds = torch.argmax(logits, dim=1).cpu().numpy()
            predictions.extend(preds)
            true_labels.extend(labels.cpu().numpy())
    return np.array(predictions), np.array(true_labels)

# Função para prever a emoção de um texto
def predict_emotion(text):
    inputs = tokenizer(text, return_tensors='pt', truncation=True, padding=True, max_length=128)
    inputs = {key: value.to(model.device) for key, value in inputs.items()}
    with torch.no_grad():
        outputs = model(**inputs)
    logits = outputs.logits
    probs = torch.nn.functional.softmax(logits, dim=-1)
    pred = torch.argmax(probs, dim=1)
    return label_encoder.inverse_transform(pred.cpu().numpy())[0]

# Obter previsões e etiquetas verdadeiras
y_pred, y_true = get_predictions(val_dataset)
```

Classificação e Matriz e Confusão

In [9]:

```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.metrics import classification_report, confusion_matrix, ConfusionMatrixDisplay

# Calcular e exibir o relatório de classificação
report = classification_report(y_true, y_pred, target_names=label_encoder.classes_)
print("Classification Report:")
print(report)

# Gerar e exibir a matriz de confusão
cm = confusion_matrix(y_true, y_pred, labels=range(len(label_encoder.classes_)))
disp = ConfusionMatrixDisplay(confusion_matrix=cm, display_labels=label_encoder.classes_)
disp.plot(cmap='Blues', values_format='d')
```

```
/home/arthurwsl/classificao_textos/Classificacao_textos/myenv/lib/python3.12/site-packages/sklearn/metrics/_clas
sification.py:1531: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no pred
icted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
/home/arthurwsl/classificao_textos/Classificacao_textos/myenv/lib/python3.12/site-packages/sklearn/metrics/_clas
sification.py:1531: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no pred
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  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
/home/arthurwsl/classificao_textos/Classificacao_textos/myenv/lib/python3.12/site-packages/sklearn/metrics/_clas
sification.py:1531: UndefinedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no pred
icted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Classification Report:
              precision    recall  f1-score   support

       anger       0.72      0.65      0.68       153
     disgust       0.59      0.66      0.62       188
        fear       0.00      0.00      0.00         5
   happiness       0.70      0.70      0.70        64
     neutral       0.31      0.53      0.39        19
     sadness       0.71      0.65      0.68       172
    surprise       0.00      0.00      0.00         2

    accuracy                           0.65       603
   macro avg       0.43      0.46      0.44       603
weighted avg       0.65      0.65      0.65       603
```
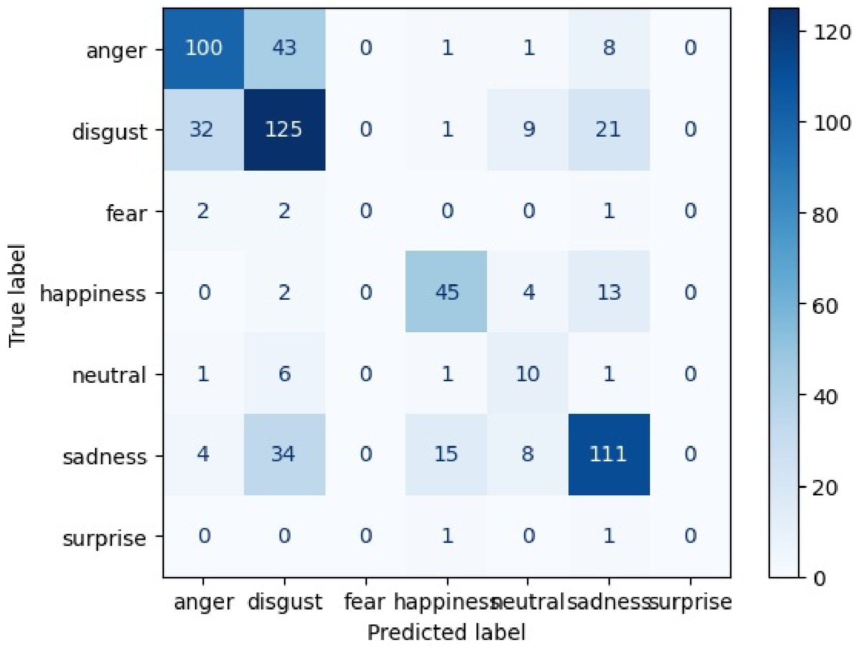

Out[9]:

```
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay at 0x7f62626c52b0>
```



Teste com avalições da Google Play

In [27]:

```
teste_emocoes = pd.read_csv('teste_tratado.csv')

# Aplicar a função a todos os elementos da coluna 'content'
teste_emocoes['predicted_emotion'] = teste_emocoes['content'].apply(predict_emotion)

# Exibir o DataFrame com a nova coluna de previsões
teste_emocoes[['app', 'sentiment', 'predicted_emotion']]
```

Out[27]:

	app	sentiment	predicted_emotion
0	iFood	disgust	disgust
1	iFood	sadness	anger
2	Nubank	happiness	sadness
3	Brave Mobile	happiness	sadness
4	Figurinhas do Lula - PT	anger	anger
5	Shopee	sadness	sadness
6	Shopee	anger	disgust
7	Shopee	happiness	sadness
8	Shopee	happiness	happiness

In [ ]:

Loading [MathJax]/jax/output/CommonHTML/fonts/TeX/fontdata.js