Language Detection

WITH **MULTINOMIAL NAIVE BAYES**

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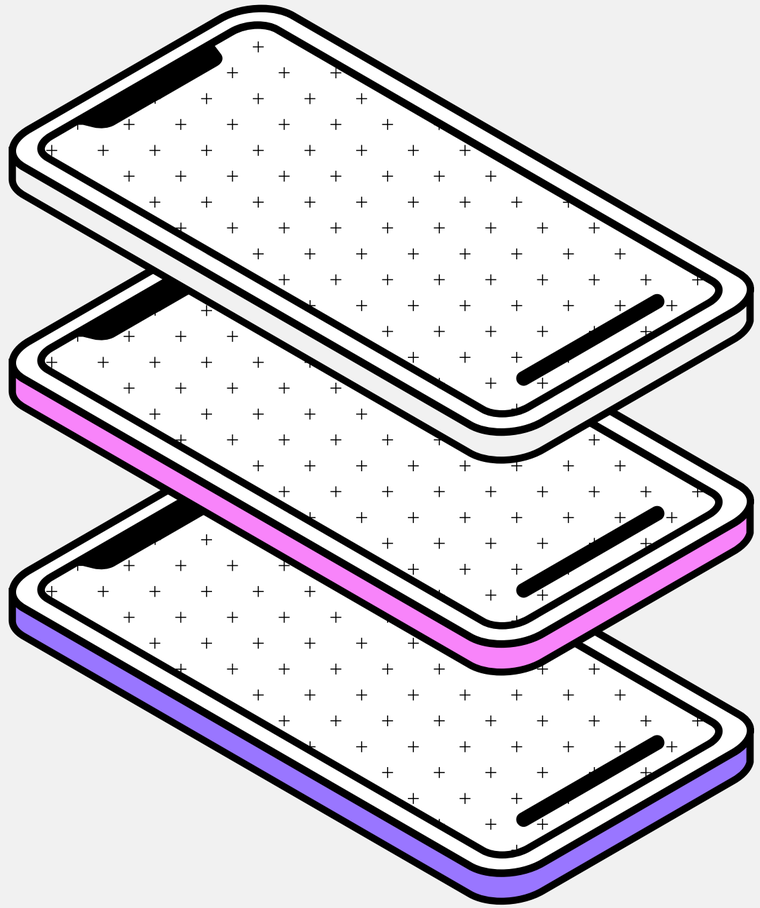
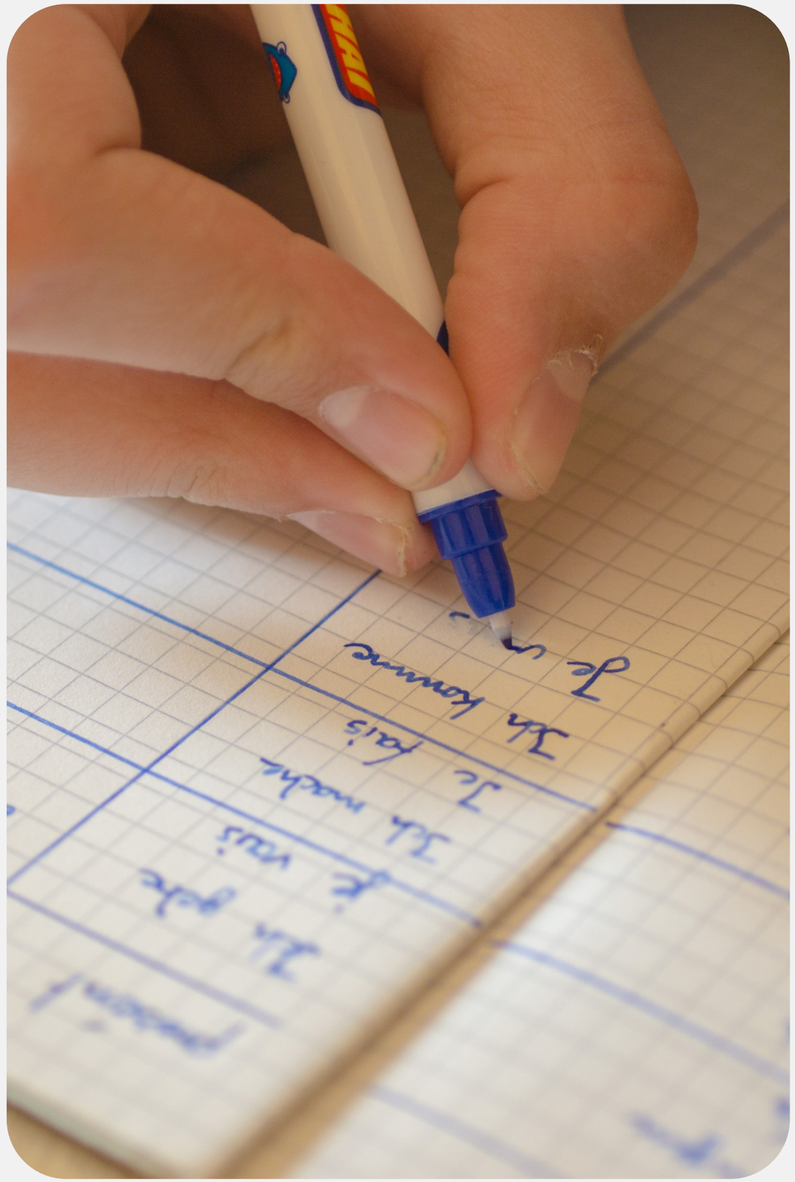


Why Language Detection?

Kami ingin membuat model yang dapat membedakan berbagai jenis bahasa terutama bahasa dengan aksara sejenis, juga aksara yang unik seperti bahasa Mandarin, Korea, Jepang, Hindi, dan lainnya. Pembuatan model ini dapat membantu kami untuk mendeteksi bahasa yang kita temui sehari-hari seperti di email, chat, sosial media, dan lain-lain.



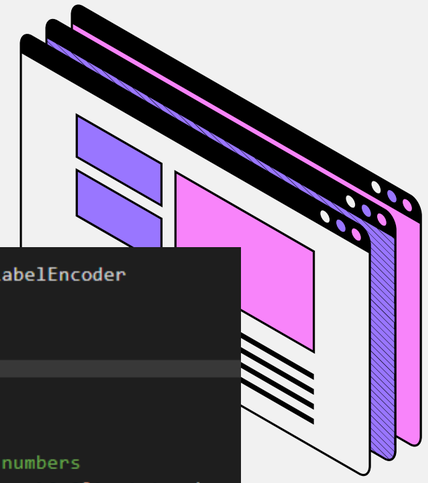
Dataset

21 Languages

11.000 Rows of Sents.

2 kaggle

Data Preprocessing



```
[ ]  from sklearn.preprocessing import LabelEncoder
     le = LabelEncoder()
     y = le.fit_transform(y)

[ ]  data_list = []
     for x in X:
             # removing the symbols and numbers
             x = re.sub(r'[!@#$(),n"%^*?:;~`0-9]', ' ', x)
             x = re.sub(r'[[]]', ' ', x)
             # converting the text to lower case
             x = x.lower()
             #remove mentions
             x = re.sub('@\S+' , ' ' , x)
             #remove url
             x = re.sub('https*\S+' , ' ' , x)
             #remove hastag
             x= re.sub('#\S+' , ' ' , x)
             # appending to data_list
             data_list.append(x)
```

Label Encoder

encoding *target* to labels

Symbols & Numbers

removing symbols and numbers from *features*

Lower Case

lower casing features

Mentions

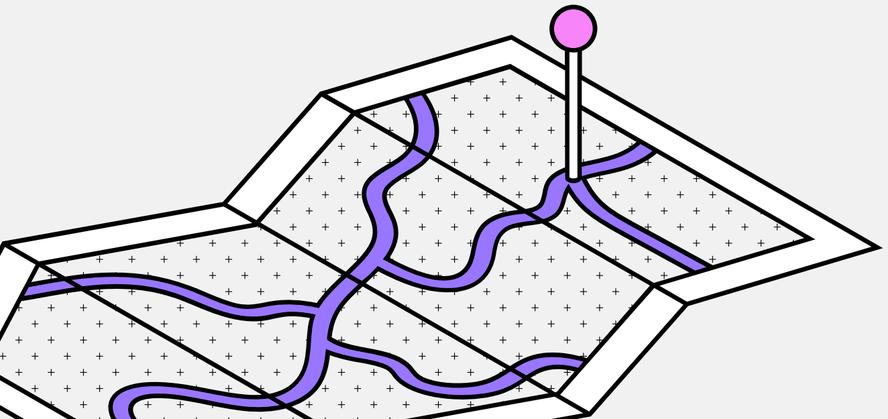
removing mentions

URL

removing URLs

Hashtag

removing hastags

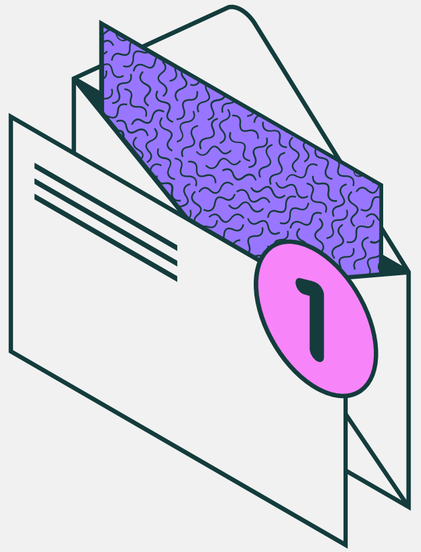


Bag of Words (BoW)

Feature Text Vectorization

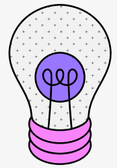
using **CountVectorizer**

```
[ ]  from sklearn.feature_extraction.text import CountVectorizer
     cv = CountVectorizer()
     X = cv.fit_transform(data_list).toarray()
     X.shape

     (11000, 58874)
```



Data Splitting

train_test_split

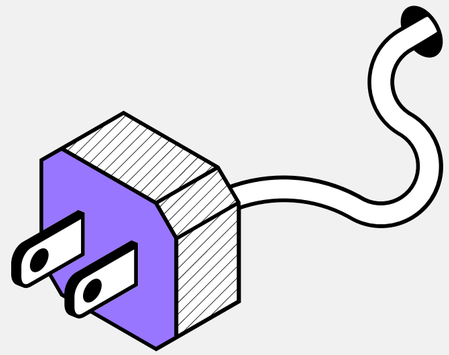


Ratio

Train : Test
(4 : 1)
(8800 : 2200)

```
[ ]  from sklearn.model_selection import train_test_split
     x_train, x_test, y_train, y_test = train_test_split(X, y, test_size = 0.20, random_state = 42)
```

Building **Multinomial** Naive Bayes Model from scratch

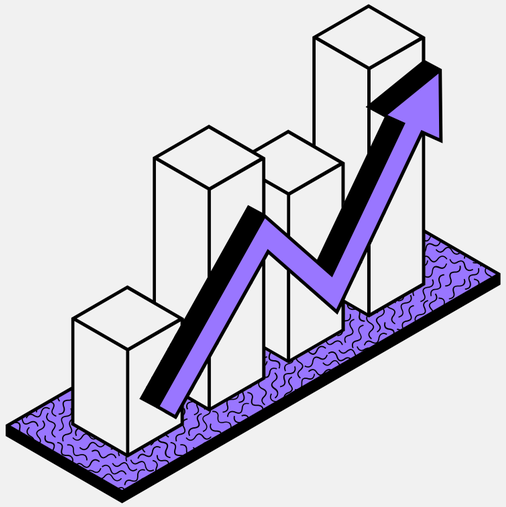


```
[ ]  class MultinomialNB:
       def __init__(self,alpha=1):
         self.alpha = alpha

       def _prior(self):
         P = np.zeros((self.n_classes_))
         _, self.dist = np.unique(self.y,return_counts=True)
         for i in range(self.classes_.shape[0]):
             P[i] = self.dist[i] / self.n_samples
         return P
```

```
       def fit(self, X, y):
         self.X = X
         self.y = y
         self.n_samples, self.n_features = X.shape
         self.classes_ = np.unique(y)
         self.n_classes_ = self.classes_.shape[0]
         self.class_priors_ = self._prior()

         self.uniques = []
         for i in range(self.n_features):
             tmp = np.unique(X[:,i])
             self.uniques.append( tmp )

         self.N_yi = np.zeros((self.n_classes_, self.n_features))
         self.N_y = np.zeros((self.n_classes_))
         for i in self.classes_:
             indices = np.argwhere(self.y==i).flatten()
             columnwise_sum = []
             for j in range(self.n_features):
                 columnwise_sum.append(np.sum(X[indices,j]))

             self.N_yi[i] = columnwise_sum
             self.N_y[i] = np.sum(columnwise_sum)


       def _theta(self, x_i, i, h):
         Nyi = self.N_yi[h,i]
         Ny  = self.N_y[h]

         numerator = Nyi + self.alpha
         denominator = Ny + (self.alpha * self.n_features)

         return  (numerator / denominator)**x_i
```

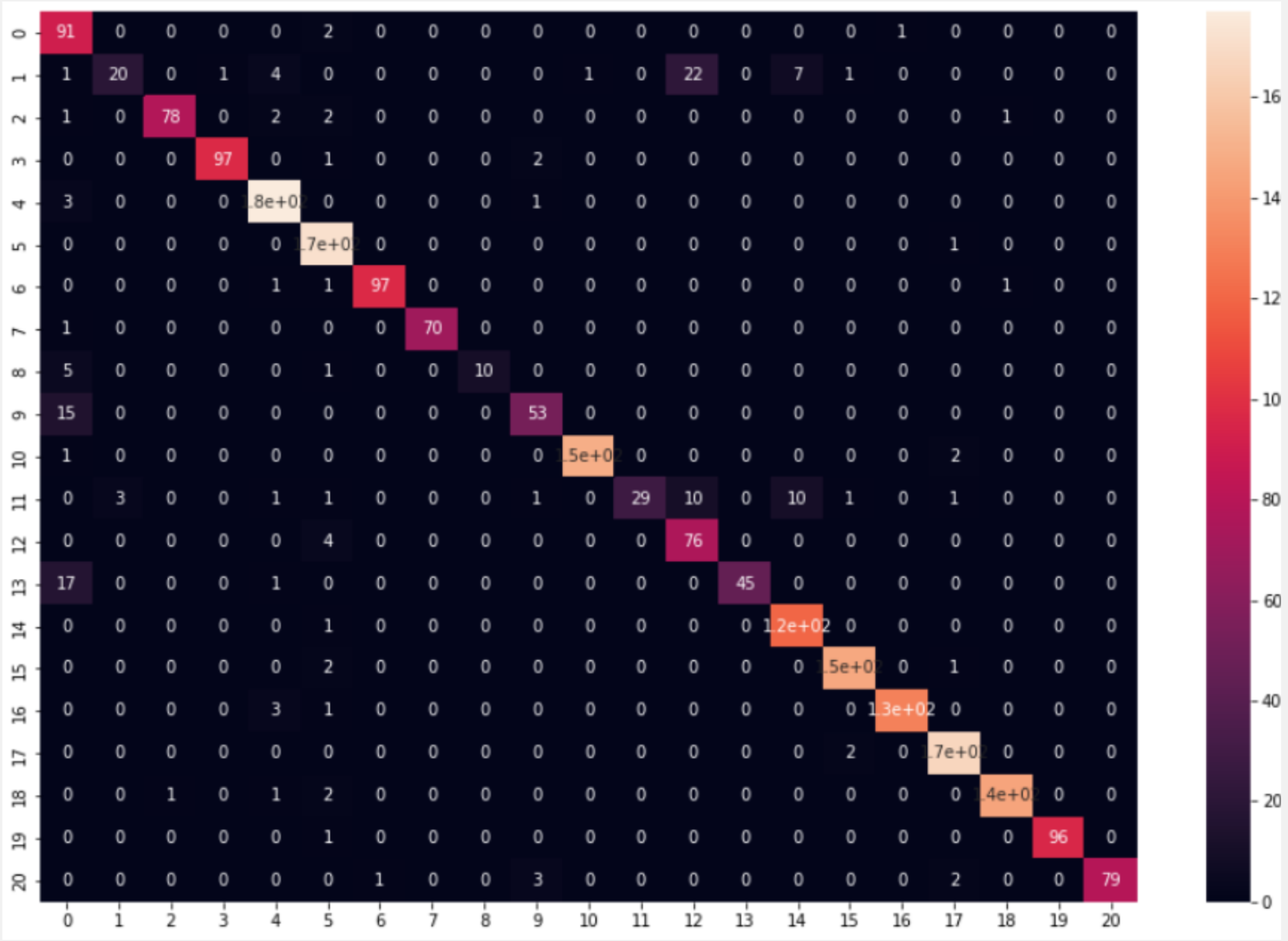
```
       def _likelyhood(self, x, h):
         tmp = []
         for i in range(x.shape[0]):
             tmp.append(self._theta(x[i], i,h))

         return np.prod(tmp)


       def predict(self, X):
         samples, features = X.shape
         self.predict_proba = np.zeros((samples,self.n_classes_))

         for i in range(X.shape[0]):
             joint_likelyhood = np.zeros((self.n_classes_))

             for h in range(self.n_classes_):
                 joint_likelyhood[h]  = self.class_priors_[h] * self._likelyhood(X[i],h)

             denominator = np.sum(joint_likelyhood)

             for h in range(self.n_classes_):
                 numerator = joint_likelyhood[h]
                 self.predict_proba[i,h] = (numerator / denominator)

         indices = np.argmax(self.predict_proba,axis=1)
         return self.classes_[indices]
```

Evaluation



Accuracy is
92.6% using from **scratch**
vs
94.5% using **sklearn**

Confusion Matrix

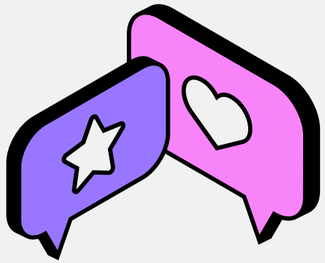


Code

https://colab.research.google.com/drive/1u5iP0tGa-B3AeF6f1iSTUH_3e_9fYKTX#scrollTo=ivWGldxs5v6U

References

https://www.kaggle.com/code/ayushmi77al/language-detection-nlp



Thank you