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Build a Spam Classifier

With deep learning and AI, handling spam content has gotten easier and easier. Over time (and with the aid of direct user feedback) our spam classifier will rarely produce erroneous results.

This is the first part of a multi-part series covering how to:

- Build an AI Model (this one)

- Integrate a NoSQL Database (inference result storing)

- Deploy an AI Model into Production

```
!pip install boto3
# !pip install pandas tensorflow
import boto3
import os
import pathlib
import pandas as pd
```

```python
import pickle

from tensorflow.keras.layers import Dense, Input

from tensorflow.keras.layers import Conv1D, MaxPooling1D, Embedding, LSTM, SpatialDropout1D

from tensorflow.keras.models import Model, Sequential


from tensorflow.keras.preprocessing.text import Tokenizer

from tensorflow.keras.preprocessing.sequence import pad_sequences

EXPORT_DIR = pathlib.Path('/datasets/exports/')
GUIDES_DIR = pathlib.Path("/guides/spam-classifier/")
DATASET_CSV_PATH = EXPORT_DIR / 'spam-dataset.csv'
TRAINING_DATA_PATH = EXPORT_DIR / 'spam-training-data.pkl'
PART_TWO_GUIDE_PATH = GUIDES_DIR / "2 - Convert Dataset into Vectors.ipynb"
```

Prepare Dataset

Creating a dataset rarely happens next to where you run the training. The below cells are a method for us to extract the needed data to perform training against.

```
!mkdir -p "$EXPORT_DIR"

!mkdir -p "$GUIDES_DIR"

!curl "https://raw.githubusercontent.com/codingforentrepreneurs/AI-as-an-API/main/datasets/exports/spam-dataset.csv" -o "$DATASET_CSV_PATH"

!curl "https://raw.githubusercontent.com/codingforentrepreneurs/AI-as-an-API/main/guides/spam-classifier/2%20-%20Convert%20Dataset%20into%20Vectors.ipynb" -o "$PART_TWO_GUIDE_PATH"
```

```
  % Total    % Received % Xferd  Average Speed   Time    Time     Time Current
                                  Dload  Upload   Total   Spent    Left Speed
100  729k  100  729k    0     0  1175k      0 --:--:-- --:--:-- --:----- 1173k
  % Total    % Received % Xferd  Average Speed   Time    Time     Time Current
                                  Dload  Upload   Total   Spent    Left Speed
100 15408  100 15408    0     0  40547      0 --:--:-- --:--:-- --:--:-- 40547
```

Let's review our extracted dataset which combines two different spam datasets as outlined in **this notebook**.

```python
df = pd.read_csv(DATASET_CSV_PATH)

df.head()
```

```
%run "$PART_TWO_GUIDE_PATH"
```

BASE_DIR is /

Random Index 2234

Found 9538 unique tokens.

data = {}

```
with open(TRAINING_DATA_PATH, 'rb') as f:
    data = pickle.load(f)
```

While the above code uses `pickle` to load in data, this data is actually exported via `pickle` when we execute the `%run` only a few steps ago. Since `pickle` can be unsafe to use from third-party downloaded data, we actually generate (again using `%run`) this pickle data and therefore is safe to use

Transform Extracted Dataset

```
CopyCopyX_test = data['X_test']
X_train = data['X_train']
y_test = data['y_test']
y_train = data['y_train']
labels_legend_inverted = data['labels_legend_inverted']
legend = data['legend']
max_sequence = data['max_sequence']
max_words = data['max_words']
tokenizer = data['tokenizer']
```

Create our LSTM Model

```
embed_dim = 128
lstm_out = 196

model = Sequential()
```

```python
model.add(Embedding(MAX_NUM_WORDS, embed_dim, input_length=X_train.shape[1]))

model.add(SpatialDropout1D(0.4))

model.add(LSTM(lstm_out, dropout=0.3, recurrent_dropout=0.3))

model.add(Dense(2, activation='softmax'))

model.compile(loss='categorical_crossentropy', optimizer="adam", metrics=['accuracy'])

print(model.summary())
```

WARNING:tensorflow:Layer lstm will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.

Model: "sequential"

_____

Layer (type)	Output Shape	Param #
===		
embedding (Embedding)	(None, 280, 128)	35840
_____		
spatial_dropout1d (SpatialDr	(None, 280, 128)	0
_____		
lstm (LSTM)	(None, 196)	254800
_____		
dense (Dense)	(None, 2)	394
===		

Total params: 291,034

Trainable params: 291,034

Non-trainable params: 0

_____

None

```python
batch_size = 32

epochs = 5

model.fit(X_train, y_train, validation_data=(X_test, y_test), batch_size=batch_size, verbose=1, epochs=epochs)
```

Epoch 1/5

163/163 [==============================] - 278s 2s/step - loss: 0.2675 - accuracy: 0.8958 - val_loss: 0.1621 - val_accuracy: 0.9446

Epoch 2/5

163/163 [==============================] - 271s 2s/step - loss: 0.1256 - accuracy: 0.9577 - val_loss: 0.1075 - val_accuracy: 0.9664

Epoch 3/5

163/163 [==============================] - 270s 2s/step - loss: 0.1087 - accuracy: 0.9619 - val_loss: 0.1113 - val_accuracy: 0.9610

Epoch 4/5

163/163 [==============================] - 268s 2s/step - loss: 0.0961 - accuracy: 0.9650 - val_loss: 0.0910 - val_accuracy: 0.9703

Epoch 5/5

163/163 [==============================] - 261s 2s/step - loss: 0.0904 - accuracy: 0.9681 - val_loss: 0.0969 - val_accuracy: 0.9653

<keras.callbacks.History at 0x7ff640316f50>

```python
MODEL_EXPORT_PATH = EXPORT_DIR / 'spam-model.h5'

model.save(str(MODEL_EXPORT_PATH))
```

Predict new data

```python
import numpy as np


def predict(text_str, max_words=280, max_sequence = 280, tokenizer=None):
  if not tokenizer:
    return None
  sequences = tokenizer.texts_to_sequences([text_str])
  x_input = pad_sequences(sequences, maxlen=max_sequence)
  y_output = model.predict(x_input)
  top_y_index = np.argmax(y_output)
  preds = y_output[top_y_index]
  labeled_preds = [{f"{labels_legend_inverted[str(i)]}": x} for i, x in enumerate(preds)]
  return labeled_preds
```

```python
predict("Hello world", max_words=max_words, max_sequence=max_sequence, tokenizer=tokenizer)
```

[{'ham': 0.96744573}, {'spam': 0.032554302}]

Exporting Tokenizer & Metadata

```python
import json

metadata = {
    "labels_legend_inverted": labels_legend_inverted,
    "legend": legend,
    "max_sequence": max_sequence,
    "max_words": max_words,
}


METADATA_EXPORT_PATH = EXPORT_DIR / 'spam-classifer-metadata.json'
METADATA_EXPORT_PATH.write_text(json.dumps(metadata, indent=4))
```

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```python
tokenizer_as_json = tokenizer.to_json()


TOKENIZER_EXPORT_PATH = EXPORT_DIR / 'spam-classifer-tokenizer.json'
TOKENIZER_EXPORT_PATH.write_text(tokenizer_as_json)
```

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We can load `tokenizer_as_json` with `tensorflow.keras.preprocessing.text.tokenizer_from_json` .

Upload Model, Tokenizer, & Metadata to Object Storage

Object Storage options include:

- AWS S3
- Linode Object Storage
- DigitalOcean Spaces

All three of these options can use `boto3` .

```
# AWS S3 Config

ACCESS_KEY = "<your_aws_iam_key_id>"

SECRET_KEY = "<your_aws_iam_secret_key>"


# You should not have to set this

ENDPOINT = None


# Your s3-bucket region

REGION = 'us-west-1'


BUCKET_NAME = '<your_s3_bucket_name>'
```

Linode Object Storage Config

```
ACCESS_KEY = "<your_linode_object_storage_access_key>"

SECRET_KEY = "<your_linode_object_storage_secret_key>"


# Object Storage Endpoint URL

ENDPOINT = "https://cfe3.us-east-1.linodeobjects.com"


# Object Storage Endpoint Region (also in your endpoint url)

REGION = 'us-east-1'


# Set this to a valid slug (without a "/" )

BUCKET_NAME = 'datasets'
```

DigitalOcean Spaces Config

```
ACCESS_KEY = "<your_do_spaces_access_key>"

SECRET_KEY = "<your_do_spaces_secret_key>"


# Space Endpoint URL

ENDPOINT = "https://ai-cfe-1.nyc3.digitaloceanspaces.com"


# Space Region (also in your endpoint url)
```

REGION = 'nyc3'

Set this to a valid slug (without a "/")

BUCKET_NAME = 'datasets'

Perform Upload with Boto3

```
os.environ["AWS_ACCESS_KEY_ID"] = ACCESS_KEY

os.environ["AWS_SECRET_ACCESS_KEY"] = SECRET_KEY

# Upload paths

MODEL_KEY_NAME = f"exports/spam-sms/{MODEL_EXPORT_PATH.name}"

TOKENIZER_KEY_NAME = f"exports/spam-sms/{TOKENIZER_EXPORT_PATH.name}"

METADATA_KEY_NAME = f"exports/spam-sms/{METADATA_EXPORT_PATH.name}"

session = boto3.session.Session()

client = session.client('s3', region_name=REGION, endpoint_url=ENDPOINT)

client.upload_file(str(MODEL_EXPORT_PATH), BUCKET_NAME, MODEL_KEY_NAME)

client.upload_file(str(TOKENIZER_EXPORT_PATH), BUCKET_NAME, TOKENIZER_KEY_NAME)

client.upload_file(str(METADATA_EXPORT_PATH), BUCKET_NAME, METADATA_KEY_NAME)

client.download_file(BUCKET_NAME, MODEL_KEY_NAME, pathlib.Path(MODEL_KEY_NAME).name)

client.download_file(BUCKET_NAME, TOKENIZER_KEY_NAME,
pathlib.Path(TOKENIZER_KEY_NAME).name)

client.download_file(BUCKET_NAME, METADATA_KEY_NAME,
pathlib.Path(METADATA_KEY_NAME).name)
```

conclusion :

By accurately identifying and filtering spam, individuals and organizations can focus on important emails and mitigate potential risks associated with malicious content.