

Final Project

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- Class: Deep Learning With Python
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- Date: December 20, 2018

Purpose

The purpose of this project is to train a neural network to recognize thirty words from provided audio files in wav. format. The original project idea can be found in [here](https://www.kaggle.com/c/tensorflow-speech-recognition-challenge/data) (<https://www.kaggle.com/c/tensorflow-speech-recognition-challenge/data>). The thirty words are "Yes", "No", "Up", "Down", "Left", "Right", "On", "Off", "Stop", "Go", "Zero", "One", "Two", "Three", "Four", "Five", "Six", "Seven", "Eight", "Nine", "Bed", "Bird", "Cat", "Dog", "Happy", "House", "Marvin", "Sheila", "Tree", and "Wow". Data was provided from Kaggle website (from the link above). All the data given was separate into different folder by their class (label) and each folder contain more than 1700 wav. files in it and recorded by different people saying the word for the class. Some people recorded the words multiple times and some only recorded once. Each audio file in the folders is in 16-bit little-endian PCM-encoded WAVE file at a 16000 sample rate format, also one audio clip with one second of length.

For this project, due to the limitation of knowledge and time; the outcome may not fit the requirement of the challenge from Kaggle website. This project does not deal with any noise from the audio clips, silence clips and non-defined audio recordings (the word that is not included in the training class). So the trained neural network is not able to be called a "completed" for the challenged, and ***this file is for personal school project purpose ONLY.***

Keep In Mind

This file contains a **certain amount of NOT original work from myself** due to the limited knowledge of pre-processing for audio files and separating them into training data and labels. so you can find the original code [here](https://github.com/manashmnd/DeadSimpleSpeechRecognizer.git) (<https://github.com/manashmnd/DeadSimpleSpeechRecognizer.git>). The Author is **Manash Kumar Mandal from GitHub**. More information will be given when we get into the explanation of the code.

Processing

This project takes the following steps to be completed.

1. Since pre-processing sound data has not been taught in class, I had to research for some similar project online and use the code for pre-processing the data.

Understanding the functions written by *Manash Kumar Mandal* is very important to finish the project and to learn from it, including:

1. How to processing the audio files in to a proper format.
2. How to use directory path to create labels for training data.
3. How to convert the audio into vector with same size before putting into conventional neural network (CNN), because of training data for CNN, data need to be the same length.
4. Put converted data (vectors) in to a file (.npy) for training later, can be downloaded and stored once converted.
5. Testing the trained model to see if the model can recognize the word from the audio file after training.

2. Research on examples online and compare which one is easy to use for my case.

This is a subset of the website I have researched on (please copy the link to the browser to view the link):

1. [AudioRecognition by wikke in GitHub](<https://github.com/wikke/AudioRecognition/blob/master/AudioRecognition.ipynb>)
2. [Keras Audio Data Generator by AhmedImtiazPrio from GitHub] (<https://github.com/AhmedImtiazPrio/Keras-AudioDataGenerator>)
3. [Building an Audio Classifier using Deep Neural Networks by Narayan Srinivasan](<https://www.kdnuggets.com/2017/12/audio-classifier-deep-neural-networks.html>)

3. Setting up the environment for the project

Getting the environment setup is important for the project including:

1. Mounting Google Drive to Google Colab
2. Installing necessary python libraries for data handling, training and saving trained model.

4. Pre-processing the data

Each class from the training data does not contain the fix amount of files, so it is needed to modify the files to easy for processing later

As mentioned, each class does not contain the same amount of files, so I used the subset of all class to be the training data. I used the top 1000 files from each class and store them into a new folder (separated by the class) and the lass one hundred files from each class as validation files . So, the total training data is **30 (classes) x 1000 (files per class) = 30,000 training files, and 30 (classes) x 100 (file per class) = 3,000 validation files. (Notice: the training files and validation files do not duplicate)**

-----*The rest of the steps will will be introduced along with the codes for the project as comments in the code blocks*-----

```

In [2]: '''
Processing step 3: Setting up the environment for the project
Libraries

These imported libraries for keras, tensorflow and for mounting the Google Drive to read training and validating data, also used to save the trained model
'''

'''
Installing libraries needed for audio processing and audio Learning
'''

!pip install -q librosa
!pip install -q scikit-learn
!pip install -q scipy

import os
    # for reading Google drive directory
import numpy as np
    # using np array for 2D CNN
import IPython.display as ipd
    # for audio player to play the audio for testing purpose
import librosa
    # library for pre-processing audio files
import keras
    # using tensorflow Keras backend
from keras import models
    # for training model
from keras import layers
    # for training model
from keras.models import Sequential
    # using sequences (array) to train the 2D CNN model
from keras.layers import Dense, Dropout, Flatten, Conv2D, MaxPooling2D
    # importing properties for training model
from keras.utils import to_categorical
    # due to the purpose of the model is to categorize the words
from sklearn.model_selection import train_test_split
    # splitting data into training and testing data
from tqdm import tqdm
    # process bar for showing progress to convert the audio files in to vector
    and saved as .npy files for training
from IPython.display import Audio
    # play the audio file and test the result for the model
from google.colab import drive
    # mounting Google Drive to Google Colab

#!git clone https://github.com/manashmndL/DeadSimpleSpeechRecognizer.git

```

Using TensorFlow backend.

```
In [3]: '''  
        Processing step 3: Setting up the environment for the project  
        1. Mounting Google Drive to Google Colab  
        2. Set the base directory for reading data files  
        '''  
  
        drive.mount('/gdrive')  
  
        base_dir = '/gdrive/My Drive/final_project/train_1000'
```

Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth?client_id=947318989803-6bn6qk8qdgf4n4g3pfee6491hc0brc4i.apps.googleusercontent.com&redirect_uri=urn%3Aietf%3Awg%3Aoauth%3A2.0%3Aoob&scope=email%20https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fdocs.test%20https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fdrive%20https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fdrive.photos.readonly%20https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fpeopleapi.readonly&response_type=code

Enter your authorization code:

.....

Mounted at /gdrive

```

In [0]: '''
Processing Step 1: Understanding the functions
This block of code is by Manash Kumar Mandal from GitHub has been remodified t
he comments and some code
'''

DATA_PATH = base_dir #set data path to the correct directory

'''
This function get_labels takes the directory files and get their labels as arr
ay for categories -----
'''
def get_labels(path=DATA_PATH):
    labels = os.listdir(path)
    label_indices = np.arange(0, len(labels))
    return labels, label_indices, to_categorical(label_indices)

'''
function ends -----
-----
'''

'''
This function wav2mfcc takes the audio data in the audio and convert into an a
rray, will be called by save_data_to_array function
It makes sure that arries for all files have the same size (length), if not th
ey the array data will padded with "0" (zero) -----
'''

def wav2mfcc(file_path, max_len=11):
    wave, sr = librosa.load(file_path, mono=True, sr=None)
    wave = wave[:3]
    mfcc = librosa.feature.mfcc(wave, sr=16000)

    # If maximum length exceeds mfcc lengths then pad the remaining ones
    if (max_len > mfcc.shape[1]):
        pad_width = max_len - mfcc.shape[1]
        mfcc = np.pad(mfcc, pad_width=((0, 0), (0, pad_width)), mode='constan
t')

    # Else cutoff the remaining parts
    else:
        mfcc = mfcc[:, :max_len]

    return mfcc

'''
function ends -----
-----
'''

```

```

'''

'''
This functioin save_data_to_array get converted audio files (1000 of them for one class) into an vector file as .npy format named after its class-----
Each .npy file contains the 1000 audio files (converted to arries) information for one class
There are thirty .npy files due to thirty classes
'''
def save_data_to_array(path=DATA_PATH, max_len=11):
    labels, _, _ = get_labels(path)

    for label in labels:
        mfcc_vectors = []
        wavfiles = [path + label + '/' + wavfile for wavfile in os.listdir(path + '/' + label)]
        for wavfile in tqdm(wavfiles, "Saving vectors of label - '{}'.format(label)"):
            mfcc = wav2mfcc(wavfile, max_len=max_len)
            mfcc_vectors.append(mfcc)
        np.save(label + '.npy', mfcc_vectors)
    '''
function ends -----
    -----
'''

'''

'''
This function get-train_test
1. calls get_labels function to get the array of labels for all trianing files
2. loads saved .npy files from earlier by save_data_to_array and separate them (as training or validation data) with the train_test_spllit function which im
ported earlier -----
'''
def get_train_test(split_ratio=0.6, random_state=42):
    # Get available labels
    labels, indices, _ = get_labels(DATA_PATH)

    # Getting first arrays
    X = np.load(labels[0] + '.npy')
    y = np.zeros(X.shape[0])

    # Append all of the dataset into one single array, same goes for y
    for i, label in enumerate(labels[1:]):
        x = np.load(label + '.npy')
        X = np.vstack((X, x))
        y = np.append(y, np.full(x.shape[0], fill_value= (i + 1)))

    assert X.shape[0] == len(y)

```

```

    return train_test_split(X, y, test_size= (1 - split_ratio), random_state=r
andom_state, shuffle=True)
'''
function ends -----
-----
'''

'''
This function prepare_dataset
1. make a dictionary called "data" and link the data (arraies in the .npy fil
e) and the labels (from the label array)-----
'''
def prepare_dataset(path=DATA_PATH):
    labels, _, _ = get_labels(path)
    data = {}
    for label in labels:
        data[label] = {}
        data[label]['path'] = [path + label + '/' + wavfile for wavfile in os
.listdir(path + '/' + label)]

        vectors = []

        for wavfile in data[label]['path']:
            wave, sr = librosa.load(wavfile, mono=True, sr=None)
            # Downsampling
            wave = wave[:3]
            mfcc = librosa.feature.mfcc(wave, sr=16000)
            vectors.append(mfcc)

        data[label]['mfcc'] = vectors

    return data
'''
function ends -----
-----
'''

'''
This function reads the dataset from dictionary "data" created by prepare_data
set function -----
'''
def load_dataset(path=DATA_PATH):
    data = prepare_dataset(path)

    dataset = []

    for key in data:
        for mfcc in data[key]['mfcc']:
            dataset.append((key, mfcc))

    return dataset[:100]

```

```

'''
function ends -----
-----
'''

'''
This function is for testing the trained model and return a class name
This function will be called almost at the end of the file
This function call will go along with the audio player and you can see if the
audio file is correctly recognized -----
'''
def predict(filepath, model):
    sample = wav2mfcc(filepath)
    sample_resaped = sample.reshape(1, feature_dim_1, feature_dim_2, 1)
    return get_labels()[0][
        np.argmax(model.predict(sample_resaped))
    ]
'''
function ends -----
-----
'''

```

```

In [0]: '''
Processing Step 5: Preparing with training model
1. This block of code do function call to convert the audio files into .npy fi
les
2. Save the .npy files
3. Get train and test data
4. Shape X-train and X-test into the same shape
5. Set Y-train and Y-test into categorical for training in 2D CNN
'''

# Second dimension of the feature is dim2
feature_dim_2 = 11

# Save data to array file first
#save_data_to_array(max_len=feature_dim_2)

# # Loading train set and test set
X_train, X_test, y_train, y_test = get_train_test()

# # Feature dimension
feature_dim_1 = 20

# Reshaping to perform 2D convolution
X_train = X_train.reshape(X_train.shape[0], feature_dim_1, feature_dim_2, 1)
X_test = X_test.reshape(X_test.shape[0], feature_dim_1, feature_dim_2, 1)

y_train_hot = to_categorical(y_train)
y_test_hot = to_categorical(y_test)

```

```
In [0]: '''  
        Processing Step 5: Preparing with training model  
        This block of code create a model for training  
        Here treat the audio files similar as images we did in the previous assignment  
        s using 2D CNN  
        and with 30 classes  
        '''  
  
        model = Sequential()  
        model.add(Conv2D(64, kernel_size=(2, 2), activation='relu', input_shape=(feature_dim_1, feature_dim_2, 1)))  
        model.add(Conv2D(128, kernel_size=(2, 2), activation='relu'))  
        model.add(Conv2D(512, kernel_size=(2, 2), activation='relu'))  
        model.add(MaxPooling2D(pool_size=(2, 2)))  
        model.add(Dropout(0.8))  
        model.add(Flatten())  
        model.add(Dense(128, activation='relu'))  
        model.add(Dropout(0.25))  
        model.add(Dense(128, activation='relu'))  
        model.add(Dropout(0.4))  
        model.add(Dense(30, activation='softmax'))  
        model.compile(loss=keras.losses.categorical_crossentropy,optimizer=keras.optimizers.Adadelta(),metrics=['accuracy'])
```

```
In [0]: model.summary() #This print out the summay for the model layers which created
        from code above
```

Layer (type)	Output Shape	Param #
=====		
conv2d_1 (Conv2D)	(None, 19, 10, 64)	320
conv2d_2 (Conv2D)	(None, 18, 9, 128)	32896
conv2d_3 (Conv2D)	(None, 17, 8, 512)	262656
max_pooling2d_1 (MaxPooling2D)	(None, 8, 4, 512)	0
dropout_1 (Dropout)	(None, 8, 4, 512)	0
flatten_1 (Flatten)	(None, 16384)	0
dense_1 (Dense)	(None, 128)	2097280
dropout_2 (Dropout)	(None, 128)	0
dense_2 (Dense)	(None, 128)	16512
dropout_3 (Dropout)	(None, 128)	0
dense_3 (Dense)	(None, 30)	3870
=====		
Total params: 2,413,534		
Trainable params: 2,413,534		
Non-trainable params: 0		

```
In [0]: '''  
        Processing Step 6: Train the model  
        Start training the model with the training/testing data and label  
        I had done this many times and the first attempt was around 80 percent  
        while in class presentation, it was 94 percent  
        and I have changed the structure the model since presentation day, the accurac  
        y is now up to 97% for 30 classes training in a relatively smalll dataset for  
        audio training  
        '''  
  
        history = model.fit(X_train, y_train_hot, batch_size=250, epochs=1000, verbose  
        =1, validation_data=(X_test, y_test_hot))
```

```
Train on 18000 samples, validate on 12000 samples
Epoch 1/1000
18000/18000 [=====] - 11s 602us/step - loss: 3.5511
- acc: 0.0323 - val_loss: 3.4015 - val_acc: 0.0319
Epoch 2/1000
18000/18000 [=====] - 6s 336us/step - loss: 3.4037 -
acc: 0.0370 - val_loss: 3.3986 - val_acc: 0.0315
Epoch 3/1000
18000/18000 [=====] - 6s 336us/step - loss: 3.3582 -
acc: 0.0478 - val_loss: 3.2464 - val_acc: 0.0741
Epoch 4/1000
18000/18000 [=====] - 6s 336us/step - loss: 3.1770 -
acc: 0.0801 - val_loss: 2.8649 - val_acc: 0.1777
Epoch 5/1000
18000/18000 [=====] - 6s 337us/step - loss: 2.8696 -
acc: 0.1538 - val_loss: 2.4476 - val_acc: 0.3083
Epoch 6/1000
18000/18000 [=====] - 6s 337us/step - loss: 2.5137 -
acc: 0.2468 - val_loss: 2.1445 - val_acc: 0.3620
Epoch 7/1000
18000/18000 [=====] - 6s 336us/step - loss: 2.2023 -
acc: 0.3338 - val_loss: 1.6789 - val_acc: 0.5262
Epoch 8/1000
18000/18000 [=====] - 6s 336us/step - loss: 1.9380 -
acc: 0.4158 - val_loss: 1.3761 - val_acc: 0.6120
Epoch 9/1000
18000/18000 [=====] - 6s 335us/step - loss: 1.7425 -
acc: 0.4696 - val_loss: 1.2154 - val_acc: 0.6562
Epoch 10/1000
18000/18000 [=====] - 6s 337us/step - loss: 1.5930 -
acc: 0.5209 - val_loss: 1.1374 - val_acc: 0.6801
Epoch 11/1000
18000/18000 [=====] - 6s 335us/step - loss: 1.4591 -
acc: 0.5545 - val_loss: 1.0592 - val_acc: 0.7092
Epoch 12/1000
18000/18000 [=====] - 6s 333us/step - loss: 1.3508 -
acc: 0.5923 - val_loss: 0.9478 - val_acc: 0.7398
Epoch 13/1000
18000/18000 [=====] - 6s 334us/step - loss: 1.2588 -
acc: 0.6151 - val_loss: 0.9015 - val_acc: 0.7477
Epoch 14/1000
18000/18000 [=====] - 6s 331us/step - loss: 1.1885 -
acc: 0.6412 - val_loss: 0.8558 - val_acc: 0.7614
Epoch 15/1000
18000/18000 [=====] - 6s 332us/step - loss: 1.0978 -
acc: 0.6638 - val_loss: 0.8158 - val_acc: 0.7679
Epoch 16/1000
18000/18000 [=====] - 6s 332us/step - loss: 1.0734 -
acc: 0.6814 - val_loss: 0.7596 - val_acc: 0.7826
Epoch 17/1000
18000/18000 [=====] - 6s 333us/step - loss: 1.0143 -
acc: 0.6920 - val_loss: 0.7651 - val_acc: 0.7894
Epoch 18/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.9920 -
acc: 0.7001 - val_loss: 0.7356 - val_acc: 0.7962
Epoch 19/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.9256 -
```

```
acc: 0.7197 - val_loss: 0.7317 - val_acc: 0.7927
Epoch 20/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.9118 -
acc: 0.7214 - val_loss: 0.6869 - val_acc: 0.8005
Epoch 21/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.8576 -
acc: 0.7388 - val_loss: 0.7021 - val_acc: 0.7988
Epoch 22/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.8466 -
acc: 0.7453 - val_loss: 0.6614 - val_acc: 0.8123
Epoch 23/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.8030 -
acc: 0.7532 - val_loss: 0.6481 - val_acc: 0.8151
Epoch 24/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.7809 -
acc: 0.7644 - val_loss: 0.6400 - val_acc: 0.8155
Epoch 25/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.7761 -
acc: 0.7639 - val_loss: 0.6343 - val_acc: 0.8177
Epoch 26/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.7506 -
acc: 0.7713 - val_loss: 0.6470 - val_acc: 0.8128
Epoch 27/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.7290 -
acc: 0.7778 - val_loss: 0.6298 - val_acc: 0.8217
Epoch 28/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.7106 -
acc: 0.7839 - val_loss: 0.6030 - val_acc: 0.8263
Epoch 29/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.6930 -
acc: 0.7926 - val_loss: 0.5931 - val_acc: 0.8267
Epoch 30/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.6682 -
acc: 0.7991 - val_loss: 0.5968 - val_acc: 0.8294
Epoch 31/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.6565 -
acc: 0.7991 - val_loss: 0.6085 - val_acc: 0.8229
Epoch 32/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.6357 -
acc: 0.8107 - val_loss: 0.5977 - val_acc: 0.8268
Epoch 33/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.6279 -
acc: 0.8094 - val_loss: 0.5821 - val_acc: 0.8280
Epoch 34/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.6131 -
acc: 0.8103 - val_loss: 0.5824 - val_acc: 0.8323
Epoch 35/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.5939 -
acc: 0.8177 - val_loss: 0.5936 - val_acc: 0.8268
Epoch 36/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.6017 -
acc: 0.8161 - val_loss: 0.5796 - val_acc: 0.8307
Epoch 37/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.5724 -
acc: 0.8259 - val_loss: 0.5722 - val_acc: 0.8342
Epoch 38/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.5771 -
```

```
acc: 0.8224 - val_loss: 0.5616 - val_acc: 0.8343
Epoch 39/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.5643 -
acc: 0.8299 - val_loss: 0.5703 - val_acc: 0.8357
Epoch 40/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.5435 -
acc: 0.8343 - val_loss: 0.5809 - val_acc: 0.8341
Epoch 41/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.5414 -
acc: 0.8324 - val_loss: 0.5508 - val_acc: 0.8432
Epoch 42/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.5277 -
acc: 0.8366 - val_loss: 0.5546 - val_acc: 0.8408
Epoch 43/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.5234 -
acc: 0.8387 - val_loss: 0.5564 - val_acc: 0.8388
Epoch 44/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.5023 -
acc: 0.8429 - val_loss: 0.5441 - val_acc: 0.8421
Epoch 45/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.5038 -
acc: 0.8490 - val_loss: 0.5619 - val_acc: 0.8372
Epoch 46/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.4933 -
acc: 0.8489 - val_loss: 0.5510 - val_acc: 0.8424
Epoch 47/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.4922 -
acc: 0.8494 - val_loss: 0.5471 - val_acc: 0.8437
Epoch 48/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.4915 -
acc: 0.8524 - val_loss: 0.5478 - val_acc: 0.8415
Epoch 49/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.4679 -
acc: 0.8553 - val_loss: 0.5485 - val_acc: 0.8443
Epoch 50/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.4623 -
acc: 0.8578 - val_loss: 0.5493 - val_acc: 0.8414
Epoch 51/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.4622 -
acc: 0.8612 - val_loss: 0.5377 - val_acc: 0.8452
Epoch 52/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.4479 -
acc: 0.8599 - val_loss: 0.5457 - val_acc: 0.8408
Epoch 53/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.4363 -
acc: 0.8656 - val_loss: 0.5388 - val_acc: 0.8481
Epoch 54/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.4347 -
acc: 0.8673 - val_loss: 0.5342 - val_acc: 0.8459
Epoch 55/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.4358 -
acc: 0.8674 - val_loss: 0.5505 - val_acc: 0.8437
Epoch 56/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.4210 -
acc: 0.8714 - val_loss: 0.5491 - val_acc: 0.8454
Epoch 57/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.4368 -
```

```
acc: 0.8661 - val_loss: 0.5522 - val_acc: 0.8395
Epoch 58/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.4171 -
acc: 0.8714 - val_loss: 0.5281 - val_acc: 0.8493
Epoch 59/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.4004 -
acc: 0.8762 - val_loss: 0.5364 - val_acc: 0.8466
Epoch 60/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.4084 -
acc: 0.8753 - val_loss: 0.5259 - val_acc: 0.8483
Epoch 61/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.4042 -
acc: 0.8749 - val_loss: 0.5355 - val_acc: 0.8459
Epoch 62/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.3955 -
acc: 0.8797 - val_loss: 0.5390 - val_acc: 0.8433
Epoch 63/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.3892 -
acc: 0.8792 - val_loss: 0.5396 - val_acc: 0.8482
Epoch 64/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.3906 -
acc: 0.8800 - val_loss: 0.5389 - val_acc: 0.8471
Epoch 65/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.3767 -
acc: 0.8851 - val_loss: 0.5366 - val_acc: 0.8442
Epoch 66/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.3691 -
acc: 0.8889 - val_loss: 0.5256 - val_acc: 0.8483
Epoch 67/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.3729 -
acc: 0.8851 - val_loss: 0.5362 - val_acc: 0.8492
Epoch 68/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.3716 -
acc: 0.8881 - val_loss: 0.5306 - val_acc: 0.8510
Epoch 69/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.3664 -
acc: 0.8861 - val_loss: 0.5493 - val_acc: 0.8502
Epoch 70/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.3500 -
acc: 0.8907 - val_loss: 0.5340 - val_acc: 0.8537
Epoch 71/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.3680 -
acc: 0.8891 - val_loss: 0.5368 - val_acc: 0.8482
Epoch 72/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.3507 -
acc: 0.8913 - val_loss: 0.5363 - val_acc: 0.8515
Epoch 73/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.3291 -
acc: 0.8984 - val_loss: 0.5391 - val_acc: 0.8484
Epoch 74/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.3453 -
acc: 0.8961 - val_loss: 0.5232 - val_acc: 0.8503
Epoch 75/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.3344 -
acc: 0.8987 - val_loss: 0.5386 - val_acc: 0.8528
Epoch 76/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.3337 -
```

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acc: 0.8973 - val_loss: 0.5279 - val_acc: 0.8549
Epoch 77/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.3319 -
acc: 0.8965 - val_loss: 0.5322 - val_acc: 0.8513
Epoch 78/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.3183 -
acc: 0.9017 - val_loss: 0.5440 - val_acc: 0.8491
Epoch 79/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.3399 -
acc: 0.8994 - val_loss: 0.5352 - val_acc: 0.8501
Epoch 80/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.3329 -
acc: 0.8996 - val_loss: 0.5266 - val_acc: 0.8492
Epoch 81/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.3174 -
acc: 0.9012 - val_loss: 0.5416 - val_acc: 0.8486
Epoch 82/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.3389 -
acc: 0.8974 - val_loss: 0.5262 - val_acc: 0.8508
Epoch 83/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.3211 -
acc: 0.8988 - val_loss: 0.5317 - val_acc: 0.8505
Epoch 84/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.3136 -
acc: 0.9032 - val_loss: 0.5209 - val_acc: 0.8578
Epoch 85/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.3001 -
acc: 0.9099 - val_loss: 0.5456 - val_acc: 0.8493
Epoch 86/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.3084 -
acc: 0.9080 - val_loss: 0.5358 - val_acc: 0.8529
Epoch 87/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.3094 -
acc: 0.9054 - val_loss: 0.5357 - val_acc: 0.8538
Epoch 88/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.3097 -
acc: 0.9048 - val_loss: 0.5257 - val_acc: 0.8551
Epoch 89/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2987 -
acc: 0.9081 - val_loss: 0.5638 - val_acc: 0.8477
Epoch 90/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.3125 -
acc: 0.9063 - val_loss: 0.5516 - val_acc: 0.8474
Epoch 91/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2989 -
acc: 0.9047 - val_loss: 0.5313 - val_acc: 0.8543
Epoch 92/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.3107 -
acc: 0.9073 - val_loss: 0.5408 - val_acc: 0.8539
Epoch 93/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2939 -
acc: 0.9084 - val_loss: 0.5348 - val_acc: 0.8537
Epoch 94/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.2909 -
acc: 0.9120 - val_loss: 0.5342 - val_acc: 0.8546
Epoch 95/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.2935 -
```

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acc: 0.9097 - val_loss: 0.5418 - val_acc: 0.8552
Epoch 96/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2823 -
acc: 0.9143 - val_loss: 0.5351 - val_acc: 0.8544
Epoch 97/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2863 -
acc: 0.9122 - val_loss: 0.5291 - val_acc: 0.8522
Epoch 98/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.2803 -
acc: 0.9149 - val_loss: 0.5437 - val_acc: 0.8510
Epoch 99/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2874 -
acc: 0.9115 - val_loss: 0.5257 - val_acc: 0.8560
Epoch 100/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2813 -
acc: 0.9125 - val_loss: 0.5450 - val_acc: 0.8519
Epoch 101/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.2805 -
acc: 0.9164 - val_loss: 0.5377 - val_acc: 0.8524
Epoch 102/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.2696 -
acc: 0.9164 - val_loss: 0.5488 - val_acc: 0.8507
Epoch 103/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.2787 -
acc: 0.9154 - val_loss: 0.5333 - val_acc: 0.8578
Epoch 104/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.2700 -
acc: 0.9180 - val_loss: 0.5315 - val_acc: 0.8569
Epoch 105/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.2717 -
acc: 0.9182 - val_loss: 0.5453 - val_acc: 0.8491
Epoch 106/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.2738 -
acc: 0.9185 - val_loss: 0.5350 - val_acc: 0.8583
Epoch 107/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.2615 -
acc: 0.9201 - val_loss: 0.5462 - val_acc: 0.8541
Epoch 108/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.2533 -
acc: 0.9242 - val_loss: 0.5345 - val_acc: 0.8529
Epoch 109/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.2562 -
acc: 0.9216 - val_loss: 0.5488 - val_acc: 0.8542
Epoch 110/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.2454 -
acc: 0.9222 - val_loss: 0.5458 - val_acc: 0.8553
Epoch 111/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2594 -
acc: 0.9212 - val_loss: 0.5399 - val_acc: 0.8563
Epoch 112/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.2544 -
acc: 0.9238 - val_loss: 0.5460 - val_acc: 0.8554
Epoch 113/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.2543 -
acc: 0.9229 - val_loss: 0.5405 - val_acc: 0.8523
Epoch 114/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2592 -
```

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acc: 0.9205 - val_loss: 0.5409 - val_acc: 0.8553
Epoch 115/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.2538 -
acc: 0.9251 - val_loss: 0.5477 - val_acc: 0.8525
Epoch 116/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2505 -
acc: 0.9236 - val_loss: 0.5358 - val_acc: 0.8561
Epoch 117/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2588 -
acc: 0.9208 - val_loss: 0.5423 - val_acc: 0.8527
Epoch 118/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.2619 -
acc: 0.9213 - val_loss: 0.5475 - val_acc: 0.8525
Epoch 119/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2536 -
acc: 0.9231 - val_loss: 0.5525 - val_acc: 0.8534
Epoch 120/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2452 -
acc: 0.9260 - val_loss: 0.5451 - val_acc: 0.8557
Epoch 121/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2522 -
acc: 0.9222 - val_loss: 0.5536 - val_acc: 0.8552
Epoch 122/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2441 -
acc: 0.9273 - val_loss: 0.5437 - val_acc: 0.8547
Epoch 123/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.2367 -
acc: 0.9268 - val_loss: 0.5595 - val_acc: 0.8532
Epoch 124/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2348 -
acc: 0.9290 - val_loss: 0.5513 - val_acc: 0.8549
Epoch 125/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2388 -
acc: 0.9291 - val_loss: 0.5548 - val_acc: 0.8535
Epoch 126/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2368 -
acc: 0.9287 - val_loss: 0.5441 - val_acc: 0.8557
Epoch 127/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2456 -
acc: 0.9266 - val_loss: 0.5389 - val_acc: 0.8547
Epoch 128/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2257 -
acc: 0.9331 - val_loss: 0.5427 - val_acc: 0.8523
Epoch 129/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2363 -
acc: 0.9267 - val_loss: 0.5443 - val_acc: 0.8537
Epoch 130/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2441 -
acc: 0.9266 - val_loss: 0.5370 - val_acc: 0.8544
Epoch 131/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2327 -
acc: 0.9283 - val_loss: 0.5548 - val_acc: 0.8510
Epoch 132/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2345 -
acc: 0.9303 - val_loss: 0.5341 - val_acc: 0.8574
Epoch 133/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.2320 -
```

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acc: 0.9274 - val_loss: 0.5394 - val_acc: 0.8557
Epoch 134/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2324 -
acc: 0.9312 - val_loss: 0.5587 - val_acc: 0.8547
Epoch 135/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2158 -
acc: 0.9330 - val_loss: 0.5422 - val_acc: 0.8538
Epoch 136/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2329 -
acc: 0.9298 - val_loss: 0.5444 - val_acc: 0.8549
Epoch 137/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2253 -
acc: 0.9323 - val_loss: 0.5506 - val_acc: 0.8562
Epoch 138/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2235 -
acc: 0.9307 - val_loss: 0.5515 - val_acc: 0.8552
Epoch 139/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2258 -
acc: 0.9309 - val_loss: 0.5680 - val_acc: 0.8484
Epoch 140/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2160 -
acc: 0.9327 - val_loss: 0.5555 - val_acc: 0.8523
Epoch 141/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2256 -
acc: 0.9323 - val_loss: 0.5428 - val_acc: 0.8542
Epoch 142/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2179 -
acc: 0.9340 - val_loss: 0.5540 - val_acc: 0.8537
Epoch 143/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2211 -
acc: 0.9326 - val_loss: 0.5585 - val_acc: 0.8538
Epoch 144/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2215 -
acc: 0.9341 - val_loss: 0.5505 - val_acc: 0.8525
Epoch 145/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2177 -
acc: 0.9338 - val_loss: 0.5634 - val_acc: 0.8518
Epoch 146/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2170 -
acc: 0.9322 - val_loss: 0.5403 - val_acc: 0.8563
Epoch 147/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2233 -
acc: 0.9334 - val_loss: 0.5439 - val_acc: 0.8550
Epoch 148/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.2108 -
acc: 0.9349 - val_loss: 0.5414 - val_acc: 0.8593
Epoch 149/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2020 -
acc: 0.9383 - val_loss: 0.5632 - val_acc: 0.8551
Epoch 150/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2164 -
acc: 0.9355 - val_loss: 0.5553 - val_acc: 0.8577
Epoch 151/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.2035 -
acc: 0.9366 - val_loss: 0.5640 - val_acc: 0.8558
Epoch 152/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2096 -
```

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acc: 0.9350 - val_loss: 0.5464 - val_acc: 0.8572
Epoch 153/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.2092 -
acc: 0.9359 - val_loss: 0.5777 - val_acc: 0.8525
Epoch 154/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.2095 -
acc: 0.9364 - val_loss: 0.5562 - val_acc: 0.8517
Epoch 155/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2095 -
acc: 0.9368 - val_loss: 0.5465 - val_acc: 0.8576
Epoch 156/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2006 -
acc: 0.9386 - val_loss: 0.5555 - val_acc: 0.8557
Epoch 157/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1958 -
acc: 0.9412 - val_loss: 0.5545 - val_acc: 0.8547
Epoch 158/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.2015 -
acc: 0.9402 - val_loss: 0.5491 - val_acc: 0.8569
Epoch 159/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2027 -
acc: 0.9393 - val_loss: 0.5571 - val_acc: 0.8567
Epoch 160/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.2005 -
acc: 0.9398 - val_loss: 0.5463 - val_acc: 0.8571
Epoch 161/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1961 -
acc: 0.9393 - val_loss: 0.5537 - val_acc: 0.8589
Epoch 162/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2066 -
acc: 0.9389 - val_loss: 0.5547 - val_acc: 0.8570
Epoch 163/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1988 -
acc: 0.9418 - val_loss: 0.5686 - val_acc: 0.8570
Epoch 164/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2050 -
acc: 0.9362 - val_loss: 0.5561 - val_acc: 0.8564
Epoch 165/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1961 -
acc: 0.9404 - val_loss: 0.5633 - val_acc: 0.8530
Epoch 166/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1929 -
acc: 0.9431 - val_loss: 0.5498 - val_acc: 0.8572
Epoch 167/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.2038 -
acc: 0.9387 - val_loss: 0.5628 - val_acc: 0.8518
Epoch 168/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1896 -
acc: 0.9418 - val_loss: 0.5637 - val_acc: 0.8546
Epoch 169/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2059 -
acc: 0.9375 - val_loss: 0.5608 - val_acc: 0.8529
Epoch 170/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.2039 -
acc: 0.9404 - val_loss: 0.5488 - val_acc: 0.8567
Epoch 171/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1957 -
```

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acc: 0.9433 - val_loss: 0.5803 - val_acc: 0.8567
Epoch 172/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2001 -
acc: 0.9403 - val_loss: 0.5642 - val_acc: 0.8558
Epoch 173/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.2019 -
acc: 0.9385 - val_loss: 0.5603 - val_acc: 0.8559
Epoch 174/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.2002 -
acc: 0.9411 - val_loss: 0.5489 - val_acc: 0.8557
Epoch 175/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1854 -
acc: 0.9435 - val_loss: 0.5702 - val_acc: 0.8521
Epoch 176/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1889 -
acc: 0.9450 - val_loss: 0.5547 - val_acc: 0.8550
Epoch 177/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1823 -
acc: 0.9454 - val_loss: 0.5765 - val_acc: 0.8543
Epoch 178/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1995 -
acc: 0.9412 - val_loss: 0.5747 - val_acc: 0.8537
Epoch 179/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1882 -
acc: 0.9426 - val_loss: 0.5723 - val_acc: 0.8573
Epoch 180/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1951 -
acc: 0.9415 - val_loss: 0.5422 - val_acc: 0.8572
Epoch 181/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1830 -
acc: 0.9455 - val_loss: 0.5678 - val_acc: 0.8562
Epoch 182/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1934 -
acc: 0.9451 - val_loss: 0.5398 - val_acc: 0.8558
Epoch 183/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1970 -
acc: 0.9416 - val_loss: 0.5485 - val_acc: 0.8558
Epoch 184/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1785 -
acc: 0.9438 - val_loss: 0.5663 - val_acc: 0.8550
Epoch 185/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1814 -
acc: 0.9466 - val_loss: 0.5683 - val_acc: 0.8591
Epoch 186/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1792 -
acc: 0.9486 - val_loss: 0.5836 - val_acc: 0.8536
Epoch 187/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1829 -
acc: 0.9458 - val_loss: 0.5760 - val_acc: 0.8523
Epoch 188/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1821 -
acc: 0.9467 - val_loss: 0.5586 - val_acc: 0.8582
Epoch 189/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1907 -
acc: 0.9458 - val_loss: 0.5603 - val_acc: 0.8542
Epoch 190/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1749 -
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acc: 0.9471 - val_loss: 0.5574 - val_acc: 0.8573
Epoch 191/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1944 -
acc: 0.9429 - val_loss: 0.5654 - val_acc: 0.8542
Epoch 192/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1667 -
acc: 0.9496 - val_loss: 0.5643 - val_acc: 0.8601
Epoch 193/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1809 -
acc: 0.9473 - val_loss: 0.5531 - val_acc: 0.8607
Epoch 194/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1804 -
acc: 0.9461 - val_loss: 0.5572 - val_acc: 0.8540
Epoch 195/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1802 -
acc: 0.9462 - val_loss: 0.5661 - val_acc: 0.8576
Epoch 196/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1824 -
acc: 0.9469 - val_loss: 0.6034 - val_acc: 0.8553
Epoch 197/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1753 -
acc: 0.9489 - val_loss: 0.5616 - val_acc: 0.8587
Epoch 198/1000
18000/18000 [=====] - 6s 329us/step - loss: 0.1803 -
acc: 0.9466 - val_loss: 0.5581 - val_acc: 0.8568
Epoch 199/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1797 -
acc: 0.9467 - val_loss: 0.5721 - val_acc: 0.8580
Epoch 200/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1764 -
acc: 0.9492 - val_loss: 0.5639 - val_acc: 0.8558
Epoch 201/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1773 -
acc: 0.9461 - val_loss: 0.5819 - val_acc: 0.8537
Epoch 202/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1670 -
acc: 0.9494 - val_loss: 0.5758 - val_acc: 0.8591
Epoch 203/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1742 -
acc: 0.9477 - val_loss: 0.5664 - val_acc: 0.8573
Epoch 204/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1811 -
acc: 0.9467 - val_loss: 0.5704 - val_acc: 0.8552
Epoch 205/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1847 -
acc: 0.9469 - val_loss: 0.5742 - val_acc: 0.8551
Epoch 206/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1724 -
acc: 0.9496 - val_loss: 0.5710 - val_acc: 0.8584
Epoch 207/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1765 -
acc: 0.9453 - val_loss: 0.5644 - val_acc: 0.8605
Epoch 208/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1811 -
acc: 0.9459 - val_loss: 0.5811 - val_acc: 0.8536
Epoch 209/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1724 -
```

```
acc: 0.9487 - val_loss: 0.5844 - val_acc: 0.8572
Epoch 210/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1785 -
acc: 0.9474 - val_loss: 0.5524 - val_acc: 0.8578
Epoch 211/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1648 -
acc: 0.9518 - val_loss: 0.5607 - val_acc: 0.8587
Epoch 212/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1796 -
acc: 0.9473 - val_loss: 0.5543 - val_acc: 0.8572
Epoch 213/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1650 -
acc: 0.9517 - val_loss: 0.5585 - val_acc: 0.8571
Epoch 214/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1796 -
acc: 0.9486 - val_loss: 0.5787 - val_acc: 0.8543
Epoch 215/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1655 -
acc: 0.9518 - val_loss: 0.5520 - val_acc: 0.8608
Epoch 216/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1686 -
acc: 0.9510 - val_loss: 0.5687 - val_acc: 0.8611
Epoch 217/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1780 -
acc: 0.9486 - val_loss: 0.5576 - val_acc: 0.8572
Epoch 218/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1743 -
acc: 0.9482 - val_loss: 0.5605 - val_acc: 0.8567
Epoch 219/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1696 -
acc: 0.9495 - val_loss: 0.5812 - val_acc: 0.8556
Epoch 220/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1706 -
acc: 0.9495 - val_loss: 0.5618 - val_acc: 0.8586
Epoch 221/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1769 -
acc: 0.9476 - val_loss: 0.5780 - val_acc: 0.8560
Epoch 222/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1649 -
acc: 0.9503 - val_loss: 0.5700 - val_acc: 0.8546
Epoch 223/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1656 -
acc: 0.9509 - val_loss: 0.5903 - val_acc: 0.8575
Epoch 224/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1702 -
acc: 0.9516 - val_loss: 0.5689 - val_acc: 0.8592
Epoch 225/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1684 -
acc: 0.9489 - val_loss: 0.5843 - val_acc: 0.8530
Epoch 226/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1700 -
acc: 0.9504 - val_loss: 0.5986 - val_acc: 0.8537
Epoch 227/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1694 -
acc: 0.9494 - val_loss: 0.5683 - val_acc: 0.8545
Epoch 228/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1609 -
```

```
acc: 0.9508 - val_loss: 0.5865 - val_acc: 0.8562
Epoch 229/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1658 -
acc: 0.9507 - val_loss: 0.5683 - val_acc: 0.8599
Epoch 230/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1600 -
acc: 0.9522 - val_loss: 0.5613 - val_acc: 0.8542
Epoch 231/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1702 -
acc: 0.9493 - val_loss: 0.5848 - val_acc: 0.8573
Epoch 232/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1690 -
acc: 0.9501 - val_loss: 0.5700 - val_acc: 0.8518
Epoch 233/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1556 -
acc: 0.9547 - val_loss: 0.5825 - val_acc: 0.8563
Epoch 234/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1659 -
acc: 0.9512 - val_loss: 0.5609 - val_acc: 0.8587
Epoch 235/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1676 -
acc: 0.9512 - val_loss: 0.5738 - val_acc: 0.8563
Epoch 236/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1616 -
acc: 0.9544 - val_loss: 0.5735 - val_acc: 0.8622
Epoch 237/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1571 -
acc: 0.9533 - val_loss: 0.5676 - val_acc: 0.8577
Epoch 238/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1646 -
acc: 0.9532 - val_loss: 0.5645 - val_acc: 0.8538
Epoch 239/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1669 -
acc: 0.9519 - val_loss: 0.5762 - val_acc: 0.8558
Epoch 240/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1620 -
acc: 0.9514 - val_loss: 0.5661 - val_acc: 0.8562
Epoch 241/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1570 -
acc: 0.9516 - val_loss: 0.5493 - val_acc: 0.8591
Epoch 242/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1538 -
acc: 0.9552 - val_loss: 0.5762 - val_acc: 0.8515
Epoch 243/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1780 -
acc: 0.9487 - val_loss: 0.5612 - val_acc: 0.8577
Epoch 244/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1545 -
acc: 0.9541 - val_loss: 0.5588 - val_acc: 0.8557
Epoch 245/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1571 -
acc: 0.9543 - val_loss: 0.5692 - val_acc: 0.8567
Epoch 246/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1626 -
acc: 0.9526 - val_loss: 0.5621 - val_acc: 0.8609
Epoch 247/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1628 -
```

```
acc: 0.9536 - val_loss: 0.5562 - val_acc: 0.8596
Epoch 248/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1541 -
acc: 0.9536 - val_loss: 0.5483 - val_acc: 0.8579
Epoch 249/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1566 -
acc: 0.9527 - val_loss: 0.5581 - val_acc: 0.8574
Epoch 250/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1653 -
acc: 0.9496 - val_loss: 0.5630 - val_acc: 0.8577
Epoch 251/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1608 -
acc: 0.9524 - val_loss: 0.5640 - val_acc: 0.8567
Epoch 252/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1584 -
acc: 0.9535 - val_loss: 0.5755 - val_acc: 0.8589
Epoch 253/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1600 -
acc: 0.9538 - val_loss: 0.5697 - val_acc: 0.8549
Epoch 254/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1652 -
acc: 0.9509 - val_loss: 0.5644 - val_acc: 0.8583
Epoch 255/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1624 -
acc: 0.9541 - val_loss: 0.5674 - val_acc: 0.8583
Epoch 256/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1514 -
acc: 0.9558 - val_loss: 0.5618 - val_acc: 0.8566
Epoch 257/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1543 -
acc: 0.9552 - val_loss: 0.5798 - val_acc: 0.8560
Epoch 258/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1553 -
acc: 0.9532 - val_loss: 0.5774 - val_acc: 0.8570
Epoch 259/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1542 -
acc: 0.9543 - val_loss: 0.5717 - val_acc: 0.8557
Epoch 260/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1518 -
acc: 0.9548 - val_loss: 0.5655 - val_acc: 0.8592
Epoch 261/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1597 -
acc: 0.9542 - val_loss: 0.5785 - val_acc: 0.8515
Epoch 262/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1478 -
acc: 0.9562 - val_loss: 0.5946 - val_acc: 0.8611
Epoch 263/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1636 -
acc: 0.9529 - val_loss: 0.5820 - val_acc: 0.8577
Epoch 264/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1585 -
acc: 0.9552 - val_loss: 0.5565 - val_acc: 0.8617
Epoch 265/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1544 -
acc: 0.9549 - val_loss: 0.5604 - val_acc: 0.8565
Epoch 266/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1630 -
```

```
acc: 0.9531 - val_loss: 0.5711 - val_acc: 0.8584
Epoch 267/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1524 -
acc: 0.9568 - val_loss: 0.5732 - val_acc: 0.8601
Epoch 268/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1519 -
acc: 0.9539 - val_loss: 0.5882 - val_acc: 0.8578
Epoch 269/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1530 -
acc: 0.9548 - val_loss: 0.5953 - val_acc: 0.8565
Epoch 270/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1547 -
acc: 0.9541 - val_loss: 0.5710 - val_acc: 0.8613
Epoch 271/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1559 -
acc: 0.9546 - val_loss: 0.5890 - val_acc: 0.8597
Epoch 272/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1453 -
acc: 0.9587 - val_loss: 0.5953 - val_acc: 0.8567
Epoch 273/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1514 -
acc: 0.9563 - val_loss: 0.5894 - val_acc: 0.8539
Epoch 274/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1463 -
acc: 0.9571 - val_loss: 0.5816 - val_acc: 0.8558
Epoch 275/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1522 -
acc: 0.9551 - val_loss: 0.5972 - val_acc: 0.8558
Epoch 276/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1419 -
acc: 0.9579 - val_loss: 0.5931 - val_acc: 0.8566
Epoch 277/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1415 -
acc: 0.9564 - val_loss: 0.5706 - val_acc: 0.8576
Epoch 278/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1684 -
acc: 0.9504 - val_loss: 0.5723 - val_acc: 0.8539
Epoch 279/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1462 -
acc: 0.9558 - val_loss: 0.5791 - val_acc: 0.8587
Epoch 280/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1495 -
acc: 0.9568 - val_loss: 0.5910 - val_acc: 0.8568
Epoch 281/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1474 -
acc: 0.9561 - val_loss: 0.5667 - val_acc: 0.8565
Epoch 282/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1478 -
acc: 0.9568 - val_loss: 0.5966 - val_acc: 0.8536
Epoch 283/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1493 -
acc: 0.9559 - val_loss: 0.6014 - val_acc: 0.8561
Epoch 284/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1498 -
acc: 0.9562 - val_loss: 0.5573 - val_acc: 0.8582
Epoch 285/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1476 -
```

```
acc: 0.9573 - val_loss: 0.5616 - val_acc: 0.8609
Epoch 286/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1435 -
acc: 0.9577 - val_loss: 0.5762 - val_acc: 0.8573
Epoch 287/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1465 -
acc: 0.9575 - val_loss: 0.5912 - val_acc: 0.8587
Epoch 288/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1521 -
acc: 0.9569 - val_loss: 0.5805 - val_acc: 0.8597
Epoch 289/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1518 -
acc: 0.9563 - val_loss: 0.5813 - val_acc: 0.8573
Epoch 290/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1438 -
acc: 0.9579 - val_loss: 0.5776 - val_acc: 0.8604
Epoch 291/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1473 -
acc: 0.9576 - val_loss: 0.5779 - val_acc: 0.8609
Epoch 292/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1523 -
acc: 0.9548 - val_loss: 0.5695 - val_acc: 0.8607
Epoch 293/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1458 -
acc: 0.9572 - val_loss: 0.5889 - val_acc: 0.8605
Epoch 294/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1455 -
acc: 0.9559 - val_loss: 0.5828 - val_acc: 0.8565
Epoch 295/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1499 -
acc: 0.9582 - val_loss: 0.5849 - val_acc: 0.8551
Epoch 296/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1542 -
acc: 0.9540 - val_loss: 0.5759 - val_acc: 0.8568
Epoch 297/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1323 -
acc: 0.9627 - val_loss: 0.5810 - val_acc: 0.8583
Epoch 298/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1472 -
acc: 0.9574 - val_loss: 0.6087 - val_acc: 0.8571
Epoch 299/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1465 -
acc: 0.9581 - val_loss: 0.5749 - val_acc: 0.8583
Epoch 300/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1490 -
acc: 0.9561 - val_loss: 0.5845 - val_acc: 0.8563
Epoch 301/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1398 -
acc: 0.9610 - val_loss: 0.5763 - val_acc: 0.8560
Epoch 302/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1453 -
acc: 0.9569 - val_loss: 0.5685 - val_acc: 0.8595
Epoch 303/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1505 -
acc: 0.9600 - val_loss: 0.5812 - val_acc: 0.8599
Epoch 304/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1393 -
```

```
acc: 0.9601 - val_loss: 0.5707 - val_acc: 0.8589
Epoch 305/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1400 -
acc: 0.9599 - val_loss: 0.5881 - val_acc: 0.8577
Epoch 306/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1466 -
acc: 0.9576 - val_loss: 0.5663 - val_acc: 0.8575
Epoch 307/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1432 -
acc: 0.9583 - val_loss: 0.5958 - val_acc: 0.8530
Epoch 308/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1451 -
acc: 0.9569 - val_loss: 0.5677 - val_acc: 0.8611
Epoch 309/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1406 -
acc: 0.9596 - val_loss: 0.5874 - val_acc: 0.8588
Epoch 310/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1378 -
acc: 0.9596 - val_loss: 0.5821 - val_acc: 0.8582
Epoch 311/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1582 -
acc: 0.9558 - val_loss: 0.5887 - val_acc: 0.8583
Epoch 312/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1338 -
acc: 0.9612 - val_loss: 0.5898 - val_acc: 0.8571
Epoch 313/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1412 -
acc: 0.9595 - val_loss: 0.5827 - val_acc: 0.8594
Epoch 314/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1428 -
acc: 0.9586 - val_loss: 0.5912 - val_acc: 0.8598
Epoch 315/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1372 -
acc: 0.9601 - val_loss: 0.5774 - val_acc: 0.8575
Epoch 316/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1460 -
acc: 0.9588 - val_loss: 0.5749 - val_acc: 0.8556
Epoch 317/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1410 -
acc: 0.9584 - val_loss: 0.5803 - val_acc: 0.8609
Epoch 318/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1463 -
acc: 0.9563 - val_loss: 0.5885 - val_acc: 0.8541
Epoch 319/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1461 -
acc: 0.9576 - val_loss: 0.5731 - val_acc: 0.8587
Epoch 320/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1502 -
acc: 0.9566 - val_loss: 0.5651 - val_acc: 0.8599
Epoch 321/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1413 -
acc: 0.9617 - val_loss: 0.5737 - val_acc: 0.8583
Epoch 322/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1437 -
acc: 0.9600 - val_loss: 0.5660 - val_acc: 0.8590
Epoch 323/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1438 -
```

```
acc: 0.9606 - val_loss: 0.5728 - val_acc: 0.8567
Epoch 324/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1319 -
acc: 0.9632 - val_loss: 0.5850 - val_acc: 0.8591
Epoch 325/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1295 -
acc: 0.9621 - val_loss: 0.5853 - val_acc: 0.8579
Epoch 326/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1371 -
acc: 0.9604 - val_loss: 0.5936 - val_acc: 0.8555
Epoch 327/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1437 -
acc: 0.9587 - val_loss: 0.6121 - val_acc: 0.8598
Epoch 328/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1427 -
acc: 0.9573 - val_loss: 0.5684 - val_acc: 0.8555
Epoch 329/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1324 -
acc: 0.9606 - val_loss: 0.5796 - val_acc: 0.8610
Epoch 330/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1410 -
acc: 0.9596 - val_loss: 0.5832 - val_acc: 0.8538
Epoch 331/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1412 -
acc: 0.9573 - val_loss: 0.5922 - val_acc: 0.8575
Epoch 332/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1340 -
acc: 0.9614 - val_loss: 0.5581 - val_acc: 0.8580
Epoch 333/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1334 -
acc: 0.9615 - val_loss: 0.5898 - val_acc: 0.8562
Epoch 334/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1384 -
acc: 0.9606 - val_loss: 0.5906 - val_acc: 0.8587
Epoch 335/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1421 -
acc: 0.9606 - val_loss: 0.5865 - val_acc: 0.8602
Epoch 336/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1442 -
acc: 0.9589 - val_loss: 0.5854 - val_acc: 0.8560
Epoch 337/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1318 -
acc: 0.9602 - val_loss: 0.6043 - val_acc: 0.8531
Epoch 338/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1381 -
acc: 0.9608 - val_loss: 0.6011 - val_acc: 0.8567
Epoch 339/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1327 -
acc: 0.9619 - val_loss: 0.5622 - val_acc: 0.8601
Epoch 340/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1440 -
acc: 0.9592 - val_loss: 0.5794 - val_acc: 0.8576
Epoch 341/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1329 -
acc: 0.9615 - val_loss: 0.5888 - val_acc: 0.8577
Epoch 342/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1398 -
```

```
acc: 0.9598 - val_loss: 0.5810 - val_acc: 0.8594
Epoch 343/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1374 -
acc: 0.9616 - val_loss: 0.5832 - val_acc: 0.8624
Epoch 344/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1459 -
acc: 0.9600 - val_loss: 0.5774 - val_acc: 0.8603
Epoch 345/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1334 -
acc: 0.9621 - val_loss: 0.5989 - val_acc: 0.8567
Epoch 346/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1318 -
acc: 0.9621 - val_loss: 0.6006 - val_acc: 0.8585
Epoch 347/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1215 -
acc: 0.9657 - val_loss: 0.5804 - val_acc: 0.8564
Epoch 348/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1422 -
acc: 0.9592 - val_loss: 0.5848 - val_acc: 0.8610
Epoch 349/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1371 -
acc: 0.9599 - val_loss: 0.5971 - val_acc: 0.8592
Epoch 350/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1375 -
acc: 0.9618 - val_loss: 0.5773 - val_acc: 0.8602
Epoch 351/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1408 -
acc: 0.9598 - val_loss: 0.5965 - val_acc: 0.8610
Epoch 352/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1368 -
acc: 0.9597 - val_loss: 0.5691 - val_acc: 0.8606
Epoch 353/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1364 -
acc: 0.9607 - val_loss: 0.5938 - val_acc: 0.8502
Epoch 354/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1377 -
acc: 0.9617 - val_loss: 0.6024 - val_acc: 0.8544
Epoch 355/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1430 -
acc: 0.9604 - val_loss: 0.5853 - val_acc: 0.8573
Epoch 356/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1385 -
acc: 0.9619 - val_loss: 0.5740 - val_acc: 0.8588
Epoch 357/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1324 -
acc: 0.9628 - val_loss: 0.6045 - val_acc: 0.8589
Epoch 358/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1378 -
acc: 0.9616 - val_loss: 0.5742 - val_acc: 0.8579
Epoch 359/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1422 -
acc: 0.9602 - val_loss: 0.5669 - val_acc: 0.8592
Epoch 360/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1364 -
acc: 0.9599 - val_loss: 0.5881 - val_acc: 0.8578
Epoch 361/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1320 -
```

```
acc: 0.9619 - val_loss: 0.6068 - val_acc: 0.8577
Epoch 362/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1251 -
acc: 0.9644 - val_loss: 0.6012 - val_acc: 0.8594
Epoch 363/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1348 -
acc: 0.9626 - val_loss: 0.5635 - val_acc: 0.8617
Epoch 364/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1307 -
acc: 0.9638 - val_loss: 0.5844 - val_acc: 0.8596
Epoch 365/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1307 -
acc: 0.9610 - val_loss: 0.5864 - val_acc: 0.8497
Epoch 366/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1301 -
acc: 0.9638 - val_loss: 0.5967 - val_acc: 0.8589
Epoch 367/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1345 -
acc: 0.9597 - val_loss: 0.6068 - val_acc: 0.8533
Epoch 368/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1339 -
acc: 0.9617 - val_loss: 0.5913 - val_acc: 0.8572
Epoch 369/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1338 -
acc: 0.9616 - val_loss: 0.5909 - val_acc: 0.8564
Epoch 370/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1391 -
acc: 0.9607 - val_loss: 0.5827 - val_acc: 0.8623
Epoch 371/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1425 -
acc: 0.9602 - val_loss: 0.5877 - val_acc: 0.8541
Epoch 372/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1343 -
acc: 0.9606 - val_loss: 0.5737 - val_acc: 0.8627
Epoch 373/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1346 -
acc: 0.9606 - val_loss: 0.5739 - val_acc: 0.8645
Epoch 374/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1228 -
acc: 0.9649 - val_loss: 0.5878 - val_acc: 0.8536
Epoch 375/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1244 -
acc: 0.9629 - val_loss: 0.5847 - val_acc: 0.8602
Epoch 376/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1195 -
acc: 0.9661 - val_loss: 0.5855 - val_acc: 0.8606
Epoch 377/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1397 -
acc: 0.9614 - val_loss: 0.5888 - val_acc: 0.8566
Epoch 378/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1318 -
acc: 0.9634 - val_loss: 0.5824 - val_acc: 0.8620
Epoch 379/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1370 -
acc: 0.9624 - val_loss: 0.5913 - val_acc: 0.8587
Epoch 380/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1271 -
```

```
acc: 0.9622 - val_loss: 0.5833 - val_acc: 0.8602
Epoch 381/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1273 -
acc: 0.9642 - val_loss: 0.6082 - val_acc: 0.8562
Epoch 382/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1366 -
acc: 0.9612 - val_loss: 0.5918 - val_acc: 0.8616
Epoch 383/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1267 -
acc: 0.9652 - val_loss: 0.5914 - val_acc: 0.8593
Epoch 384/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1411 -
acc: 0.9596 - val_loss: 0.5841 - val_acc: 0.8577
Epoch 385/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1269 -
acc: 0.9628 - val_loss: 0.5980 - val_acc: 0.8607
Epoch 386/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1291 -
acc: 0.9646 - val_loss: 0.5887 - val_acc: 0.8602
Epoch 387/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1330 -
acc: 0.9613 - val_loss: 0.5837 - val_acc: 0.8598
Epoch 388/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1392 -
acc: 0.9618 - val_loss: 0.5811 - val_acc: 0.8617
Epoch 389/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1322 -
acc: 0.9639 - val_loss: 0.6018 - val_acc: 0.8566
Epoch 390/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1271 -
acc: 0.9641 - val_loss: 0.5927 - val_acc: 0.8596
Epoch 391/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1321 -
acc: 0.9638 - val_loss: 0.5798 - val_acc: 0.8572
Epoch 392/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1309 -
acc: 0.9637 - val_loss: 0.5849 - val_acc: 0.8608
Epoch 393/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1363 -
acc: 0.9611 - val_loss: 0.5991 - val_acc: 0.8557
Epoch 394/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1397 -
acc: 0.9610 - val_loss: 0.5828 - val_acc: 0.8581
Epoch 395/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1191 -
acc: 0.9656 - val_loss: 0.5951 - val_acc: 0.8578
Epoch 396/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1374 -
acc: 0.9619 - val_loss: 0.5732 - val_acc: 0.8562
Epoch 397/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1293 -
acc: 0.9623 - val_loss: 0.5794 - val_acc: 0.8616
Epoch 398/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1321 -
acc: 0.9628 - val_loss: 0.5814 - val_acc: 0.8601
Epoch 399/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1323 -
```

```
acc: 0.9644 - val_loss: 0.5810 - val_acc: 0.8558
Epoch 400/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1253 -
acc: 0.9639 - val_loss: 0.5806 - val_acc: 0.8607
Epoch 401/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1244 -
acc: 0.9644 - val_loss: 0.5735 - val_acc: 0.8580
Epoch 402/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1297 -
acc: 0.9627 - val_loss: 0.5898 - val_acc: 0.8588
Epoch 403/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1186 -
acc: 0.9659 - val_loss: 0.5993 - val_acc: 0.8573
Epoch 404/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1354 -
acc: 0.9618 - val_loss: 0.5902 - val_acc: 0.8574
Epoch 405/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1312 -
acc: 0.9639 - val_loss: 0.5602 - val_acc: 0.8584
Epoch 406/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1307 -
acc: 0.9626 - val_loss: 0.5705 - val_acc: 0.8601
Epoch 407/1000
18000/18000 [=====] - 6s 329us/step - loss: 0.1288 -
acc: 0.9635 - val_loss: 0.5743 - val_acc: 0.8608
Epoch 408/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1243 -
acc: 0.9637 - val_loss: 0.5988 - val_acc: 0.8612
Epoch 409/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1432 -
acc: 0.9607 - val_loss: 0.5938 - val_acc: 0.8582
Epoch 410/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1288 -
acc: 0.9631 - val_loss: 0.5932 - val_acc: 0.8638
Epoch 411/1000
18000/18000 [=====] - 6s 329us/step - loss: 0.1294 -
acc: 0.9643 - val_loss: 0.5657 - val_acc: 0.8601
Epoch 412/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1235 -
acc: 0.9631 - val_loss: 0.5958 - val_acc: 0.8594
Epoch 413/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1288 -
acc: 0.9629 - val_loss: 0.5740 - val_acc: 0.8597
Epoch 414/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1285 -
acc: 0.9630 - val_loss: 0.5676 - val_acc: 0.8613
Epoch 415/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1258 -
acc: 0.9643 - val_loss: 0.6171 - val_acc: 0.8590
Epoch 416/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1205 -
acc: 0.9654 - val_loss: 0.5738 - val_acc: 0.8592
Epoch 417/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1322 -
acc: 0.9621 - val_loss: 0.5862 - val_acc: 0.8580
Epoch 418/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1259 -
```

```
acc: 0.9643 - val_loss: 0.5855 - val_acc: 0.8559
Epoch 419/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1236 -
acc: 0.9654 - val_loss: 0.5835 - val_acc: 0.8604
Epoch 420/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1252 -
acc: 0.9638 - val_loss: 0.5659 - val_acc: 0.8591
Epoch 421/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1197 -
acc: 0.9653 - val_loss: 0.5918 - val_acc: 0.8576
Epoch 422/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1280 -
acc: 0.9634 - val_loss: 0.6002 - val_acc: 0.8618
Epoch 423/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1259 -
acc: 0.9658 - val_loss: 0.5872 - val_acc: 0.8523
Epoch 424/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1102 -
acc: 0.9669 - val_loss: 0.6116 - val_acc: 0.8589
Epoch 425/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1268 -
acc: 0.9647 - val_loss: 0.5883 - val_acc: 0.8552
Epoch 426/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1297 -
acc: 0.9638 - val_loss: 0.5921 - val_acc: 0.8608
Epoch 427/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1244 -
acc: 0.9641 - val_loss: 0.6034 - val_acc: 0.8608
Epoch 428/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1243 -
acc: 0.9647 - val_loss: 0.5859 - val_acc: 0.8637
Epoch 429/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1235 -
acc: 0.9646 - val_loss: 0.5883 - val_acc: 0.8634
Epoch 430/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1203 -
acc: 0.9668 - val_loss: 0.6144 - val_acc: 0.8592
Epoch 431/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1265 -
acc: 0.9663 - val_loss: 0.5716 - val_acc: 0.8638
Epoch 432/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1260 -
acc: 0.9656 - val_loss: 0.6120 - val_acc: 0.8634
Epoch 433/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1291 -
acc: 0.9648 - val_loss: 0.5865 - val_acc: 0.8563
Epoch 434/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1294 -
acc: 0.9633 - val_loss: 0.5882 - val_acc: 0.8597
Epoch 435/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1163 -
acc: 0.9675 - val_loss: 0.5881 - val_acc: 0.8579
Epoch 436/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1187 -
acc: 0.9672 - val_loss: 0.6226 - val_acc: 0.8608
Epoch 437/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1260 -
```

```
acc: 0.9642 - val_loss: 0.5837 - val_acc: 0.8600
Epoch 438/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1172 -
acc: 0.9674 - val_loss: 0.5911 - val_acc: 0.8597
Epoch 439/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1251 -
acc: 0.9638 - val_loss: 0.6057 - val_acc: 0.8626
Epoch 440/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1228 -
acc: 0.9648 - val_loss: 0.6146 - val_acc: 0.8597
Epoch 441/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1256 -
acc: 0.9633 - val_loss: 0.6236 - val_acc: 0.8568
Epoch 442/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1280 -
acc: 0.9644 - val_loss: 0.6076 - val_acc: 0.8580
Epoch 443/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1261 -
acc: 0.9653 - val_loss: 0.5834 - val_acc: 0.8590
Epoch 444/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1136 -
acc: 0.9677 - val_loss: 0.5908 - val_acc: 0.8621
Epoch 445/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1319 -
acc: 0.9641 - val_loss: 0.5744 - val_acc: 0.8605
Epoch 446/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1234 -
acc: 0.9648 - val_loss: 0.5918 - val_acc: 0.8593
Epoch 447/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1278 -
acc: 0.9647 - val_loss: 0.5768 - val_acc: 0.8582
Epoch 448/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1225 -
acc: 0.9647 - val_loss: 0.5897 - val_acc: 0.8592
Epoch 449/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1219 -
acc: 0.9644 - val_loss: 0.5943 - val_acc: 0.8591
Epoch 450/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1165 -
acc: 0.9658 - val_loss: 0.5836 - val_acc: 0.8572
Epoch 451/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1131 -
acc: 0.9680 - val_loss: 0.5797 - val_acc: 0.8592
Epoch 452/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1231 -
acc: 0.9653 - val_loss: 0.5738 - val_acc: 0.8577
Epoch 453/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1170 -
acc: 0.9668 - val_loss: 0.6013 - val_acc: 0.8582
Epoch 454/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1168 -
acc: 0.9672 - val_loss: 0.6086 - val_acc: 0.8574
Epoch 455/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1247 -
acc: 0.9652 - val_loss: 0.5938 - val_acc: 0.8613
Epoch 456/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1155 -
```

```
acc: 0.9673 - val_loss: 0.6248 - val_acc: 0.8606
Epoch 457/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1263 -
acc: 0.9647 - val_loss: 0.5979 - val_acc: 0.8572
Epoch 458/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1235 -
acc: 0.9656 - val_loss: 0.5779 - val_acc: 0.8592
Epoch 459/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1281 -
acc: 0.9639 - val_loss: 0.6021 - val_acc: 0.8568
Epoch 460/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1228 -
acc: 0.9663 - val_loss: 0.5752 - val_acc: 0.8622
Epoch 461/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1279 -
acc: 0.9638 - val_loss: 0.5771 - val_acc: 0.8524
Epoch 462/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1132 -
acc: 0.9678 - val_loss: 0.5949 - val_acc: 0.8594
Epoch 463/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1224 -
acc: 0.9668 - val_loss: 0.5907 - val_acc: 0.8576
Epoch 464/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1281 -
acc: 0.9636 - val_loss: 0.5927 - val_acc: 0.8578
Epoch 465/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1189 -
acc: 0.9657 - val_loss: 0.5898 - val_acc: 0.8570
Epoch 466/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1254 -
acc: 0.9642 - val_loss: 0.5855 - val_acc: 0.8638
Epoch 467/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1214 -
acc: 0.9661 - val_loss: 0.5916 - val_acc: 0.8612
Epoch 468/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1164 -
acc: 0.9672 - val_loss: 0.5944 - val_acc: 0.8637
Epoch 469/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1200 -
acc: 0.9652 - val_loss: 0.5935 - val_acc: 0.8617
Epoch 470/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1209 -
acc: 0.9662 - val_loss: 0.6173 - val_acc: 0.8609
Epoch 471/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1227 -
acc: 0.9651 - val_loss: 0.6028 - val_acc: 0.8577
Epoch 472/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1118 -
acc: 0.9692 - val_loss: 0.6149 - val_acc: 0.8542
Epoch 473/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1232 -
acc: 0.9662 - val_loss: 0.6059 - val_acc: 0.8618
Epoch 474/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1203 -
acc: 0.9665 - val_loss: 0.6051 - val_acc: 0.8603
Epoch 475/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1220 -
```

```
acc: 0.9662 - val_loss: 0.5847 - val_acc: 0.8586
Epoch 476/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1241 -
acc: 0.9643 - val_loss: 0.5834 - val_acc: 0.8608
Epoch 477/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1134 -
acc: 0.9676 - val_loss: 0.5809 - val_acc: 0.8588
Epoch 478/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1294 -
acc: 0.9632 - val_loss: 0.5961 - val_acc: 0.8603
Epoch 479/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1186 -
acc: 0.9672 - val_loss: 0.5881 - val_acc: 0.8601
Epoch 480/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1140 -
acc: 0.9679 - val_loss: 0.5921 - val_acc: 0.8593
Epoch 481/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1178 -
acc: 0.9679 - val_loss: 0.5996 - val_acc: 0.8592
Epoch 482/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1115 -
acc: 0.9683 - val_loss: 0.6201 - val_acc: 0.8592
Epoch 483/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1305 -
acc: 0.9658 - val_loss: 0.5755 - val_acc: 0.8609
Epoch 484/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1151 -
acc: 0.9678 - val_loss: 0.6137 - val_acc: 0.8605
Epoch 485/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1123 -
acc: 0.9688 - val_loss: 0.5806 - val_acc: 0.8625
Epoch 486/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1143 -
acc: 0.9681 - val_loss: 0.5802 - val_acc: 0.8605
Epoch 487/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1207 -
acc: 0.9656 - val_loss: 0.6101 - val_acc: 0.8567
Epoch 488/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1256 -
acc: 0.9649 - val_loss: 0.6245 - val_acc: 0.8619
Epoch 489/1000
18000/18000 [=====] - 6s 329us/step - loss: 0.1211 -
acc: 0.9673 - val_loss: 0.5645 - val_acc: 0.8600
Epoch 490/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1207 -
acc: 0.9668 - val_loss: 0.5811 - val_acc: 0.8603
Epoch 491/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1236 -
acc: 0.9658 - val_loss: 0.5875 - val_acc: 0.8631
Epoch 492/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1185 -
acc: 0.9669 - val_loss: 0.6004 - val_acc: 0.8633
Epoch 493/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1200 -
acc: 0.9656 - val_loss: 0.6056 - val_acc: 0.8617
Epoch 494/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1267 -
```

```
acc: 0.9651 - val_loss: 0.6028 - val_acc: 0.8553
Epoch 495/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1199 -
acc: 0.9652 - val_loss: 0.6112 - val_acc: 0.8587
Epoch 496/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1126 -
acc: 0.9692 - val_loss: 0.6192 - val_acc: 0.8594
Epoch 497/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1255 -
acc: 0.9659 - val_loss: 0.5853 - val_acc: 0.8562
Epoch 498/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1227 -
acc: 0.9660 - val_loss: 0.5934 - val_acc: 0.8578
Epoch 499/1000
18000/18000 [=====] - 6s 329us/step - loss: 0.1120 -
acc: 0.9691 - val_loss: 0.6019 - val_acc: 0.8588
Epoch 500/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1180 -
acc: 0.9664 - val_loss: 0.6132 - val_acc: 0.8531
Epoch 501/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1176 -
acc: 0.9672 - val_loss: 0.5860 - val_acc: 0.8557
Epoch 502/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1096 -
acc: 0.9674 - val_loss: 0.6159 - val_acc: 0.8615
Epoch 503/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1209 -
acc: 0.9658 - val_loss: 0.6142 - val_acc: 0.8531
Epoch 504/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1151 -
acc: 0.9666 - val_loss: 0.6140 - val_acc: 0.8614
Epoch 505/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1178 -
acc: 0.9681 - val_loss: 0.6282 - val_acc: 0.8529
Epoch 506/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1170 -
acc: 0.9670 - val_loss: 0.5847 - val_acc: 0.8610
Epoch 507/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1321 -
acc: 0.9644 - val_loss: 0.6044 - val_acc: 0.8538
Epoch 508/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1236 -
acc: 0.9664 - val_loss: 0.6003 - val_acc: 0.8609
Epoch 509/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1104 -
acc: 0.9686 - val_loss: 0.5967 - val_acc: 0.8573
Epoch 510/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1151 -
acc: 0.9667 - val_loss: 0.6103 - val_acc: 0.8580
Epoch 511/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1202 -
acc: 0.9679 - val_loss: 0.5965 - val_acc: 0.8607
Epoch 512/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1203 -
acc: 0.9687 - val_loss: 0.5958 - val_acc: 0.8582
Epoch 513/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1114 -
```

```
acc: 0.9701 - val_loss: 0.6304 - val_acc: 0.8611
Epoch 514/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1124 -
acc: 0.9688 - val_loss: 0.6027 - val_acc: 0.8585
Epoch 515/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1194 -
acc: 0.9669 - val_loss: 0.5901 - val_acc: 0.8601
Epoch 516/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1166 -
acc: 0.9663 - val_loss: 0.5915 - val_acc: 0.8616
Epoch 517/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1241 -
acc: 0.9651 - val_loss: 0.6087 - val_acc: 0.8540
Epoch 518/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1096 -
acc: 0.9673 - val_loss: 0.6044 - val_acc: 0.8636
Epoch 519/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1070 -
acc: 0.9706 - val_loss: 0.5923 - val_acc: 0.8652
Epoch 520/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1145 -
acc: 0.9678 - val_loss: 0.6121 - val_acc: 0.8609
Epoch 521/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1215 -
acc: 0.9672 - val_loss: 0.5905 - val_acc: 0.8589
Epoch 522/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1080 -
acc: 0.9711 - val_loss: 0.6138 - val_acc: 0.8583
Epoch 523/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1189 -
acc: 0.9662 - val_loss: 0.6302 - val_acc: 0.8612
Epoch 524/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1234 -
acc: 0.9674 - val_loss: 0.6192 - val_acc: 0.8547
Epoch 525/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1109 -
acc: 0.9681 - val_loss: 0.6041 - val_acc: 0.8616
Epoch 526/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1139 -
acc: 0.9674 - val_loss: 0.6042 - val_acc: 0.8563
Epoch 527/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1301 -
acc: 0.9647 - val_loss: 0.5894 - val_acc: 0.8582
Epoch 528/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1178 -
acc: 0.9674 - val_loss: 0.5968 - val_acc: 0.8617
Epoch 529/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1228 -
acc: 0.9662 - val_loss: 0.5935 - val_acc: 0.8587
Epoch 530/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1036 -
acc: 0.9699 - val_loss: 0.5996 - val_acc: 0.8620
Epoch 531/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1238 -
acc: 0.9653 - val_loss: 0.6084 - val_acc: 0.8609
Epoch 532/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1177 -
```

```
acc: 0.9677 - val_loss: 0.6043 - val_acc: 0.8594
Epoch 533/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1178 -
acc: 0.9668 - val_loss: 0.5909 - val_acc: 0.8582
Epoch 534/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1082 -
acc: 0.9691 - val_loss: 0.6116 - val_acc: 0.8630
Epoch 535/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1200 -
acc: 0.9674 - val_loss: 0.5927 - val_acc: 0.8605
Epoch 536/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1116 -
acc: 0.9693 - val_loss: 0.5907 - val_acc: 0.8633
Epoch 537/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1143 -
acc: 0.9678 - val_loss: 0.5871 - val_acc: 0.8602
Epoch 538/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1228 -
acc: 0.9661 - val_loss: 0.5907 - val_acc: 0.8587
Epoch 539/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1192 -
acc: 0.9668 - val_loss: 0.5747 - val_acc: 0.8572
Epoch 540/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1054 -
acc: 0.9701 - val_loss: 0.6143 - val_acc: 0.8606
Epoch 541/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1119 -
acc: 0.9671 - val_loss: 0.5852 - val_acc: 0.8591
Epoch 542/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1086 -
acc: 0.9703 - val_loss: 0.6072 - val_acc: 0.8628
Epoch 543/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1107 -
acc: 0.9699 - val_loss: 0.5907 - val_acc: 0.8598
Epoch 544/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1157 -
acc: 0.9672 - val_loss: 0.6053 - val_acc: 0.8607
Epoch 545/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1161 -
acc: 0.9676 - val_loss: 0.6010 - val_acc: 0.8658
Epoch 546/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1103 -
acc: 0.9686 - val_loss: 0.5792 - val_acc: 0.8607
Epoch 547/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1056 -
acc: 0.9697 - val_loss: 0.6084 - val_acc: 0.8616
Epoch 548/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1147 -
acc: 0.9686 - val_loss: 0.5760 - val_acc: 0.8616
Epoch 549/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1161 -
acc: 0.9676 - val_loss: 0.6184 - val_acc: 0.8593
Epoch 550/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1185 -
acc: 0.9685 - val_loss: 0.6038 - val_acc: 0.8591
Epoch 551/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1119 -
```

```
acc: 0.9689 - val_loss: 0.6187 - val_acc: 0.8624
Epoch 552/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1181 -
acc: 0.9686 - val_loss: 0.6029 - val_acc: 0.8554
Epoch 553/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1279 -
acc: 0.9662 - val_loss: 0.6051 - val_acc: 0.8579
Epoch 554/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1172 -
acc: 0.9673 - val_loss: 0.5862 - val_acc: 0.8603
Epoch 555/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1066 -
acc: 0.9700 - val_loss: 0.6109 - val_acc: 0.8644
Epoch 556/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1104 -
acc: 0.9709 - val_loss: 0.5720 - val_acc: 0.8587
Epoch 557/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1185 -
acc: 0.9682 - val_loss: 0.5973 - val_acc: 0.8618
Epoch 558/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1103 -
acc: 0.9684 - val_loss: 0.6126 - val_acc: 0.8611
Epoch 559/1000
18000/18000 [=====] - 6s 336us/step - loss: 0.1147 -
acc: 0.9673 - val_loss: 0.5849 - val_acc: 0.8613
Epoch 560/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1130 -
acc: 0.9684 - val_loss: 0.5907 - val_acc: 0.8563
Epoch 561/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1154 -
acc: 0.9704 - val_loss: 0.6180 - val_acc: 0.8602
Epoch 562/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1167 -
acc: 0.9676 - val_loss: 0.5930 - val_acc: 0.8616
Epoch 563/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1105 -
acc: 0.9707 - val_loss: 0.6199 - val_acc: 0.8592
Epoch 564/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1249 -
acc: 0.9677 - val_loss: 0.6073 - val_acc: 0.8621
Epoch 565/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1110 -
acc: 0.9684 - val_loss: 0.5807 - val_acc: 0.8613
Epoch 566/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1054 -
acc: 0.9706 - val_loss: 0.5836 - val_acc: 0.8642
Epoch 567/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1067 -
acc: 0.9706 - val_loss: 0.6196 - val_acc: 0.8630
Epoch 568/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1094 -
acc: 0.9697 - val_loss: 0.6151 - val_acc: 0.8607
Epoch 569/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1068 -
acc: 0.9685 - val_loss: 0.6056 - val_acc: 0.8657
Epoch 570/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1108 -
```

```
acc: 0.9698 - val_loss: 0.5897 - val_acc: 0.8586
Epoch 571/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1183 -
acc: 0.9664 - val_loss: 0.6007 - val_acc: 0.8642
Epoch 572/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1053 -
acc: 0.9701 - val_loss: 0.5857 - val_acc: 0.8579
Epoch 573/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1164 -
acc: 0.9677 - val_loss: 0.5855 - val_acc: 0.8565
Epoch 574/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1153 -
acc: 0.9693 - val_loss: 0.6010 - val_acc: 0.8623
Epoch 575/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1132 -
acc: 0.9689 - val_loss: 0.6137 - val_acc: 0.8609
Epoch 576/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1132 -
acc: 0.9682 - val_loss: 0.6516 - val_acc: 0.8588
Epoch 577/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1165 -
acc: 0.9686 - val_loss: 0.5932 - val_acc: 0.8602
Epoch 578/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1120 -
acc: 0.9686 - val_loss: 0.6146 - val_acc: 0.8565
Epoch 579/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1119 -
acc: 0.9680 - val_loss: 0.6109 - val_acc: 0.8577
Epoch 580/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1047 -
acc: 0.9702 - val_loss: 0.5942 - val_acc: 0.8587
Epoch 581/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1029 -
acc: 0.9708 - val_loss: 0.6049 - val_acc: 0.8555
Epoch 582/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1161 -
acc: 0.9694 - val_loss: 0.6273 - val_acc: 0.8572
Epoch 583/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1189 -
acc: 0.9691 - val_loss: 0.6069 - val_acc: 0.8594
Epoch 584/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1124 -
acc: 0.9695 - val_loss: 0.6005 - val_acc: 0.8571
Epoch 585/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1241 -
acc: 0.9678 - val_loss: 0.6000 - val_acc: 0.8593
Epoch 586/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1100 -
acc: 0.9695 - val_loss: 0.6201 - val_acc: 0.8619
Epoch 587/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1129 -
acc: 0.9695 - val_loss: 0.6094 - val_acc: 0.8582
Epoch 588/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1138 -
acc: 0.9682 - val_loss: 0.6199 - val_acc: 0.8538
Epoch 589/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1003 -
```

```
acc: 0.9707 - val_loss: 0.5979 - val_acc: 0.8601
Epoch 590/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1187 -
acc: 0.9671 - val_loss: 0.6000 - val_acc: 0.8610
Epoch 591/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1146 -
acc: 0.9682 - val_loss: 0.5840 - val_acc: 0.8551
Epoch 592/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.0985 -
acc: 0.9720 - val_loss: 0.5818 - val_acc: 0.8627
Epoch 593/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1101 -
acc: 0.9687 - val_loss: 0.6045 - val_acc: 0.8618
Epoch 594/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1005 -
acc: 0.9709 - val_loss: 0.6027 - val_acc: 0.8605
Epoch 595/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1115 -
acc: 0.9688 - val_loss: 0.5863 - val_acc: 0.8614
Epoch 596/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1125 -
acc: 0.9697 - val_loss: 0.6055 - val_acc: 0.8637
Epoch 597/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1152 -
acc: 0.9683 - val_loss: 0.6047 - val_acc: 0.8652
Epoch 598/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1233 -
acc: 0.9671 - val_loss: 0.5979 - val_acc: 0.8638
Epoch 599/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1112 -
acc: 0.9682 - val_loss: 0.5841 - val_acc: 0.8522
Epoch 600/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1180 -
acc: 0.9668 - val_loss: 0.6203 - val_acc: 0.8584
Epoch 601/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1102 -
acc: 0.9698 - val_loss: 0.6128 - val_acc: 0.8595
Epoch 602/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1119 -
acc: 0.9689 - val_loss: 0.6000 - val_acc: 0.8556
Epoch 603/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1085 -
acc: 0.9694 - val_loss: 0.5938 - val_acc: 0.8583
Epoch 604/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1018 -
acc: 0.9721 - val_loss: 0.6221 - val_acc: 0.8558
Epoch 605/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1076 -
acc: 0.9693 - val_loss: 0.6221 - val_acc: 0.8598
Epoch 606/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1096 -
acc: 0.9708 - val_loss: 0.6019 - val_acc: 0.8571
Epoch 607/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1140 -
acc: 0.9688 - val_loss: 0.6282 - val_acc: 0.8559
Epoch 608/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1131 -
```

```
acc: 0.9679 - val_loss: 0.6226 - val_acc: 0.8526
Epoch 609/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1189 -
acc: 0.9686 - val_loss: 0.5969 - val_acc: 0.8559
Epoch 610/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1085 -
acc: 0.9694 - val_loss: 0.6140 - val_acc: 0.8561
Epoch 611/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1137 -
acc: 0.9698 - val_loss: 0.5967 - val_acc: 0.8590
Epoch 612/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1084 -
acc: 0.9689 - val_loss: 0.6107 - val_acc: 0.8538
Epoch 613/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1133 -
acc: 0.9673 - val_loss: 0.6037 - val_acc: 0.8604
Epoch 614/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1269 -
acc: 0.9677 - val_loss: 0.6040 - val_acc: 0.8537
Epoch 615/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1208 -
acc: 0.9674 - val_loss: 0.6237 - val_acc: 0.8598
Epoch 616/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1057 -
acc: 0.9701 - val_loss: 0.6161 - val_acc: 0.8592
Epoch 617/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1134 -
acc: 0.9698 - val_loss: 0.5935 - val_acc: 0.8572
Epoch 618/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1108 -
acc: 0.9691 - val_loss: 0.5952 - val_acc: 0.8572
Epoch 619/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1045 -
acc: 0.9721 - val_loss: 0.6068 - val_acc: 0.8623
Epoch 620/1000
18000/18000 [=====] - 6s 329us/step - loss: 0.1095 -
acc: 0.9691 - val_loss: 0.5920 - val_acc: 0.8615
Epoch 621/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1156 -
acc: 0.9687 - val_loss: 0.6054 - val_acc: 0.8562
Epoch 622/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1073 -
acc: 0.9702 - val_loss: 0.6028 - val_acc: 0.8551
Epoch 623/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1081 -
acc: 0.9707 - val_loss: 0.6057 - val_acc: 0.8607
Epoch 624/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1023 -
acc: 0.9719 - val_loss: 0.6107 - val_acc: 0.8610
Epoch 625/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1093 -
acc: 0.9694 - val_loss: 0.6036 - val_acc: 0.8537
Epoch 626/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1079 -
acc: 0.9697 - val_loss: 0.6088 - val_acc: 0.8562
Epoch 627/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1210 -
```

```
acc: 0.9692 - val_loss: 0.6138 - val_acc: 0.8553
Epoch 628/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1024 -
acc: 0.9712 - val_loss: 0.6220 - val_acc: 0.8550
Epoch 629/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1149 -
acc: 0.9678 - val_loss: 0.6064 - val_acc: 0.8512
Epoch 630/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0983 -
acc: 0.9728 - val_loss: 0.5911 - val_acc: 0.8603
Epoch 631/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1040 -
acc: 0.9703 - val_loss: 0.6277 - val_acc: 0.8570
Epoch 632/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1076 -
acc: 0.9703 - val_loss: 0.5946 - val_acc: 0.8568
Epoch 633/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1135 -
acc: 0.9689 - val_loss: 0.6228 - val_acc: 0.8594
Epoch 634/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1039 -
acc: 0.9724 - val_loss: 0.6364 - val_acc: 0.8528
Epoch 635/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1095 -
acc: 0.9707 - val_loss: 0.5923 - val_acc: 0.8549
Epoch 636/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1035 -
acc: 0.9714 - val_loss: 0.6068 - val_acc: 0.8572
Epoch 637/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1096 -
acc: 0.9698 - val_loss: 0.6228 - val_acc: 0.8554
Epoch 638/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1094 -
acc: 0.9719 - val_loss: 0.6106 - val_acc: 0.8553
Epoch 639/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1079 -
acc: 0.9702 - val_loss: 0.6268 - val_acc: 0.8609
Epoch 640/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1133 -
acc: 0.9682 - val_loss: 0.5894 - val_acc: 0.8596
Epoch 641/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1081 -
acc: 0.9698 - val_loss: 0.5977 - val_acc: 0.8618
Epoch 642/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1078 -
acc: 0.9706 - val_loss: 0.5864 - val_acc: 0.8637
Epoch 643/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1045 -
acc: 0.9711 - val_loss: 0.6045 - val_acc: 0.8537
Epoch 644/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1119 -
acc: 0.9688 - val_loss: 0.6068 - val_acc: 0.8522
Epoch 645/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1062 -
acc: 0.9693 - val_loss: 0.6027 - val_acc: 0.8592
Epoch 646/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1054 -
```

```
acc: 0.9704 - val_loss: 0.6012 - val_acc: 0.8602
Epoch 647/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1090 -
acc: 0.9709 - val_loss: 0.6453 - val_acc: 0.8601
Epoch 648/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1060 -
acc: 0.9718 - val_loss: 0.6168 - val_acc: 0.8624
Epoch 649/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1158 -
acc: 0.9702 - val_loss: 0.5833 - val_acc: 0.8585
Epoch 650/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1154 -
acc: 0.9706 - val_loss: 0.6118 - val_acc: 0.8563
Epoch 651/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1049 -
acc: 0.9717 - val_loss: 0.6348 - val_acc: 0.8586
Epoch 652/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1133 -
acc: 0.9693 - val_loss: 0.6347 - val_acc: 0.8593
Epoch 653/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1146 -
acc: 0.9695 - val_loss: 0.6293 - val_acc: 0.8577
Epoch 654/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1104 -
acc: 0.9704 - val_loss: 0.6235 - val_acc: 0.8532
Epoch 655/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1131 -
acc: 0.9709 - val_loss: 0.6236 - val_acc: 0.8570
Epoch 656/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1123 -
acc: 0.9705 - val_loss: 0.6062 - val_acc: 0.8617
Epoch 657/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1129 -
acc: 0.9705 - val_loss: 0.5878 - val_acc: 0.8516
Epoch 658/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1132 -
acc: 0.9692 - val_loss: 0.5930 - val_acc: 0.8604
Epoch 659/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1075 -
acc: 0.9711 - val_loss: 0.5951 - val_acc: 0.8585
Epoch 660/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1167 -
acc: 0.9679 - val_loss: 0.6161 - val_acc: 0.8579
Epoch 661/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1032 -
acc: 0.9715 - val_loss: 0.6372 - val_acc: 0.8627
Epoch 662/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1122 -
acc: 0.9714 - val_loss: 0.5996 - val_acc: 0.8599
Epoch 663/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1119 -
acc: 0.9693 - val_loss: 0.6280 - val_acc: 0.8566
Epoch 664/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1051 -
acc: 0.9713 - val_loss: 0.6210 - val_acc: 0.8600
Epoch 665/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1083 -
```

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acc: 0.9695 - val_loss: 0.6007 - val_acc: 0.8571
Epoch 666/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1039 -
acc: 0.9706 - val_loss: 0.6308 - val_acc: 0.8633
Epoch 667/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1005 -
acc: 0.9712 - val_loss: 0.6184 - val_acc: 0.8592
Epoch 668/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1080 -
acc: 0.9710 - val_loss: 0.6354 - val_acc: 0.8578
Epoch 669/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1029 -
acc: 0.9719 - val_loss: 0.6160 - val_acc: 0.8621
Epoch 670/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.0967 -
acc: 0.9731 - val_loss: 0.6189 - val_acc: 0.8558
Epoch 671/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1025 -
acc: 0.9720 - val_loss: 0.6094 - val_acc: 0.8549
Epoch 672/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1112 -
acc: 0.9701 - val_loss: 0.6235 - val_acc: 0.8600
Epoch 673/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1062 -
acc: 0.9732 - val_loss: 0.6171 - val_acc: 0.8605
Epoch 674/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1026 -
acc: 0.9715 - val_loss: 0.6160 - val_acc: 0.8571
Epoch 675/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1088 -
acc: 0.9697 - val_loss: 0.6061 - val_acc: 0.8597
Epoch 676/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1056 -
acc: 0.9707 - val_loss: 0.6119 - val_acc: 0.8573
Epoch 677/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1126 -
acc: 0.9692 - val_loss: 0.6135 - val_acc: 0.8596
Epoch 678/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1113 -
acc: 0.9690 - val_loss: 0.6115 - val_acc: 0.8635
Epoch 679/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1062 -
acc: 0.9725 - val_loss: 0.6018 - val_acc: 0.8573
Epoch 680/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1047 -
acc: 0.9706 - val_loss: 0.6085 - val_acc: 0.8602
Epoch 681/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1039 -
acc: 0.9708 - val_loss: 0.5979 - val_acc: 0.8571
Epoch 682/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1135 -
acc: 0.9688 - val_loss: 0.6079 - val_acc: 0.8607
Epoch 683/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1149 -
acc: 0.9697 - val_loss: 0.6050 - val_acc: 0.8577
Epoch 684/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1019 -
```

```
acc: 0.9731 - val_loss: 0.6020 - val_acc: 0.8573
Epoch 685/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1075 -
acc: 0.9702 - val_loss: 0.5926 - val_acc: 0.8598
Epoch 686/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1107 -
acc: 0.9714 - val_loss: 0.5963 - val_acc: 0.8596
Epoch 687/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1070 -
acc: 0.9702 - val_loss: 0.5873 - val_acc: 0.8591
Epoch 688/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1076 -
acc: 0.9717 - val_loss: 0.6164 - val_acc: 0.8577
Epoch 689/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1014 -
acc: 0.9711 - val_loss: 0.5911 - val_acc: 0.8630
Epoch 690/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1053 -
acc: 0.9710 - val_loss: 0.6319 - val_acc: 0.8602
Epoch 691/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1020 -
acc: 0.9737 - val_loss: 0.6173 - val_acc: 0.8559
Epoch 692/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1040 -
acc: 0.9726 - val_loss: 0.6141 - val_acc: 0.8553
Epoch 693/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1081 -
acc: 0.9716 - val_loss: 0.6166 - val_acc: 0.8598
Epoch 694/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1037 -
acc: 0.9726 - val_loss: 0.6212 - val_acc: 0.8584
Epoch 695/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1174 -
acc: 0.9681 - val_loss: 0.5942 - val_acc: 0.8574
Epoch 696/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.0923 -
acc: 0.9742 - val_loss: 0.6252 - val_acc: 0.8602
Epoch 697/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1002 -
acc: 0.9718 - val_loss: 0.6084 - val_acc: 0.8505
Epoch 698/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1133 -
acc: 0.9697 - val_loss: 0.6065 - val_acc: 0.8580
Epoch 699/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1125 -
acc: 0.9701 - val_loss: 0.5993 - val_acc: 0.8584
Epoch 700/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1059 -
acc: 0.9707 - val_loss: 0.6166 - val_acc: 0.8563
Epoch 701/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1087 -
acc: 0.9702 - val_loss: 0.6069 - val_acc: 0.8613
Epoch 702/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1024 -
acc: 0.9738 - val_loss: 0.6273 - val_acc: 0.8597
Epoch 703/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1053 -
```

```
acc: 0.9721 - val_loss: 0.6200 - val_acc: 0.8571
Epoch 704/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1033 -
acc: 0.9723 - val_loss: 0.6044 - val_acc: 0.8617
Epoch 705/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1079 -
acc: 0.9706 - val_loss: 0.6159 - val_acc: 0.8593
Epoch 706/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1126 -
acc: 0.9681 - val_loss: 0.5911 - val_acc: 0.8616
Epoch 707/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1062 -
acc: 0.9706 - val_loss: 0.5957 - val_acc: 0.8599
Epoch 708/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1067 -
acc: 0.9710 - val_loss: 0.6032 - val_acc: 0.8611
Epoch 709/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1096 -
acc: 0.9689 - val_loss: 0.6083 - val_acc: 0.8597
Epoch 710/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0987 -
acc: 0.9724 - val_loss: 0.6104 - val_acc: 0.8557
Epoch 711/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1111 -
acc: 0.9711 - val_loss: 0.6266 - val_acc: 0.8567
Epoch 712/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1020 -
acc: 0.9719 - val_loss: 0.5932 - val_acc: 0.8548
Epoch 713/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1039 -
acc: 0.9716 - val_loss: 0.6032 - val_acc: 0.8606
Epoch 714/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1044 -
acc: 0.9717 - val_loss: 0.6031 - val_acc: 0.8590
Epoch 715/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1094 -
acc: 0.9695 - val_loss: 0.6073 - val_acc: 0.8655
Epoch 716/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1039 -
acc: 0.9711 - val_loss: 0.6196 - val_acc: 0.8612
Epoch 717/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1073 -
acc: 0.9701 - val_loss: 0.6068 - val_acc: 0.8583
Epoch 718/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1009 -
acc: 0.9731 - val_loss: 0.5946 - val_acc: 0.8600
Epoch 719/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1079 -
acc: 0.9705 - val_loss: 0.6062 - val_acc: 0.8608
Epoch 720/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1074 -
acc: 0.9718 - val_loss: 0.6004 - val_acc: 0.8588
Epoch 721/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0982 -
acc: 0.9725 - val_loss: 0.6099 - val_acc: 0.8619
Epoch 722/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1043 -
```

```
acc: 0.9728 - val_loss: 0.6162 - val_acc: 0.8606
Epoch 723/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1056 -
acc: 0.9714 - val_loss: 0.6027 - val_acc: 0.8571
Epoch 724/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1027 -
acc: 0.9726 - val_loss: 0.6016 - val_acc: 0.8618
Epoch 725/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1042 -
acc: 0.9724 - val_loss: 0.6026 - val_acc: 0.8594
Epoch 726/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.0997 -
acc: 0.9712 - val_loss: 0.6131 - val_acc: 0.8610
Epoch 727/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.0989 -
acc: 0.9726 - val_loss: 0.6346 - val_acc: 0.8617
Epoch 728/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1102 -
acc: 0.9701 - val_loss: 0.6059 - val_acc: 0.8558
Epoch 729/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1035 -
acc: 0.9716 - val_loss: 0.6396 - val_acc: 0.8592
Epoch 730/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1125 -
acc: 0.9705 - val_loss: 0.5955 - val_acc: 0.8581
Epoch 731/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.0976 -
acc: 0.9744 - val_loss: 0.6308 - val_acc: 0.8552
Epoch 732/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1001 -
acc: 0.9731 - val_loss: 0.5864 - val_acc: 0.8585
Epoch 733/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1007 -
acc: 0.9719 - val_loss: 0.5904 - val_acc: 0.8588
Epoch 734/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1083 -
acc: 0.9704 - val_loss: 0.5988 - val_acc: 0.8558
Epoch 735/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1113 -
acc: 0.9684 - val_loss: 0.5910 - val_acc: 0.8592
Epoch 736/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1080 -
acc: 0.9699 - val_loss: 0.6009 - val_acc: 0.8527
Epoch 737/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1023 -
acc: 0.9731 - val_loss: 0.6247 - val_acc: 0.8582
Epoch 738/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1099 -
acc: 0.9697 - val_loss: 0.6163 - val_acc: 0.8597
Epoch 739/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1027 -
acc: 0.9729 - val_loss: 0.5972 - val_acc: 0.8648
Epoch 740/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1030 -
acc: 0.9716 - val_loss: 0.5947 - val_acc: 0.8609
Epoch 741/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.0997 -
```

```
acc: 0.9718 - val_loss: 0.6509 - val_acc: 0.8632
Epoch 742/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1034 -
acc: 0.9714 - val_loss: 0.5892 - val_acc: 0.8600
Epoch 743/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1062 -
acc: 0.9713 - val_loss: 0.6073 - val_acc: 0.8602
Epoch 744/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1013 -
acc: 0.9730 - val_loss: 0.6078 - val_acc: 0.8552
Epoch 745/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1098 -
acc: 0.9707 - val_loss: 0.5998 - val_acc: 0.8552
Epoch 746/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1012 -
acc: 0.9724 - val_loss: 0.5936 - val_acc: 0.8527
Epoch 747/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1084 -
acc: 0.9704 - val_loss: 0.6206 - val_acc: 0.8583
Epoch 748/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1081 -
acc: 0.9718 - val_loss: 0.5954 - val_acc: 0.8624
Epoch 749/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1007 -
acc: 0.9717 - val_loss: 0.6318 - val_acc: 0.8582
Epoch 750/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1026 -
acc: 0.9722 - val_loss: 0.6225 - val_acc: 0.8567
Epoch 751/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1031 -
acc: 0.9729 - val_loss: 0.6103 - val_acc: 0.8605
Epoch 752/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1076 -
acc: 0.9731 - val_loss: 0.5938 - val_acc: 0.8572
Epoch 753/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1133 -
acc: 0.9695 - val_loss: 0.6220 - val_acc: 0.8599
Epoch 754/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1049 -
acc: 0.9720 - val_loss: 0.6456 - val_acc: 0.8557
Epoch 755/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1059 -
acc: 0.9715 - val_loss: 0.6029 - val_acc: 0.8579
Epoch 756/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1016 -
acc: 0.9712 - val_loss: 0.6119 - val_acc: 0.8590
Epoch 757/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1162 -
acc: 0.9696 - val_loss: 0.6101 - val_acc: 0.8581
Epoch 758/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1101 -
acc: 0.9701 - val_loss: 0.6269 - val_acc: 0.8568
Epoch 759/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1061 -
acc: 0.9713 - val_loss: 0.6440 - val_acc: 0.8573
Epoch 760/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1131 -
```

```
acc: 0.9700 - val_loss: 0.6059 - val_acc: 0.8580
Epoch 761/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.0963 -
acc: 0.9726 - val_loss: 0.6039 - val_acc: 0.8562
Epoch 762/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1060 -
acc: 0.9713 - val_loss: 0.6012 - val_acc: 0.8577
Epoch 763/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1104 -
acc: 0.9709 - val_loss: 0.6184 - val_acc: 0.8535
Epoch 764/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1060 -
acc: 0.9709 - val_loss: 0.6110 - val_acc: 0.8569
Epoch 765/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1008 -
acc: 0.9711 - val_loss: 0.6306 - val_acc: 0.8586
Epoch 766/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1196 -
acc: 0.9701 - val_loss: 0.5853 - val_acc: 0.8590
Epoch 767/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1031 -
acc: 0.9711 - val_loss: 0.6368 - val_acc: 0.8565
Epoch 768/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1135 -
acc: 0.9706 - val_loss: 0.5951 - val_acc: 0.8581
Epoch 769/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0975 -
acc: 0.9724 - val_loss: 0.6118 - val_acc: 0.8620
Epoch 770/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1013 -
acc: 0.9718 - val_loss: 0.6201 - val_acc: 0.8589
Epoch 771/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1068 -
acc: 0.9722 - val_loss: 0.6358 - val_acc: 0.8626
Epoch 772/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0993 -
acc: 0.9737 - val_loss: 0.6357 - val_acc: 0.8597
Epoch 773/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1036 -
acc: 0.9732 - val_loss: 0.6027 - val_acc: 0.8619
Epoch 774/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1070 -
acc: 0.9718 - val_loss: 0.5923 - val_acc: 0.8549
Epoch 775/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1000 -
acc: 0.9714 - val_loss: 0.6336 - val_acc: 0.8561
Epoch 776/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1167 -
acc: 0.9701 - val_loss: 0.6113 - val_acc: 0.8606
Epoch 777/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0964 -
acc: 0.9729 - val_loss: 0.6186 - val_acc: 0.8577
Epoch 778/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1097 -
acc: 0.9719 - val_loss: 0.6103 - val_acc: 0.8534
Epoch 779/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0987 -
```

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acc: 0.9739 - val_loss: 0.6327 - val_acc: 0.8596
Epoch 780/1000
18000/18000 [=====] - 6s 329us/step - loss: 0.1008 -
acc: 0.9722 - val_loss: 0.6454 - val_acc: 0.8613
Epoch 781/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1013 -
acc: 0.9724 - val_loss: 0.6172 - val_acc: 0.8537
Epoch 782/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1009 -
acc: 0.9742 - val_loss: 0.6022 - val_acc: 0.8598
Epoch 783/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1031 -
acc: 0.9707 - val_loss: 0.6164 - val_acc: 0.8607
Epoch 784/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0938 -
acc: 0.9737 - val_loss: 0.6305 - val_acc: 0.8571
Epoch 785/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1024 -
acc: 0.9720 - val_loss: 0.6126 - val_acc: 0.8614
Epoch 786/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0894 -
acc: 0.9753 - val_loss: 0.6333 - val_acc: 0.8602
Epoch 787/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0970 -
acc: 0.9734 - val_loss: 0.6369 - val_acc: 0.8649
Epoch 788/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1026 -
acc: 0.9723 - val_loss: 0.6186 - val_acc: 0.8607
Epoch 789/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1063 -
acc: 0.9729 - val_loss: 0.6188 - val_acc: 0.8603
Epoch 790/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1169 -
acc: 0.9698 - val_loss: 0.6582 - val_acc: 0.8517
Epoch 791/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1121 -
acc: 0.9718 - val_loss: 0.6113 - val_acc: 0.8547
Epoch 792/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1061 -
acc: 0.9736 - val_loss: 0.6107 - val_acc: 0.8581
Epoch 793/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1028 -
acc: 0.9718 - val_loss: 0.6315 - val_acc: 0.8606
Epoch 794/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1108 -
acc: 0.9714 - val_loss: 0.6038 - val_acc: 0.8594
Epoch 795/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1004 -
acc: 0.9734 - val_loss: 0.6314 - val_acc: 0.8582
Epoch 796/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1108 -
acc: 0.9705 - val_loss: 0.6123 - val_acc: 0.8603
Epoch 797/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1077 -
acc: 0.9709 - val_loss: 0.6136 - val_acc: 0.8572
Epoch 798/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1045 -
```

```
acc: 0.9721 - val_loss: 0.6131 - val_acc: 0.8599
Epoch 799/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0952 -
acc: 0.9747 - val_loss: 0.6270 - val_acc: 0.8616
Epoch 800/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1014 -
acc: 0.9738 - val_loss: 0.6468 - val_acc: 0.8613
Epoch 801/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1127 -
acc: 0.9704 - val_loss: 0.6564 - val_acc: 0.8525
Epoch 802/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1105 -
acc: 0.9711 - val_loss: 0.6606 - val_acc: 0.8563
Epoch 803/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0990 -
acc: 0.9738 - val_loss: 0.6241 - val_acc: 0.8603
Epoch 804/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1024 -
acc: 0.9710 - val_loss: 0.6421 - val_acc: 0.8595
Epoch 805/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1006 -
acc: 0.9743 - val_loss: 0.6304 - val_acc: 0.8619
Epoch 806/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1108 -
acc: 0.9696 - val_loss: 0.6276 - val_acc: 0.8583
Epoch 807/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1096 -
acc: 0.9720 - val_loss: 0.6274 - val_acc: 0.8534
Epoch 808/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1043 -
acc: 0.9733 - val_loss: 0.6095 - val_acc: 0.8579
Epoch 809/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0980 -
acc: 0.9721 - val_loss: 0.6200 - val_acc: 0.8567
Epoch 810/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1048 -
acc: 0.9723 - val_loss: 0.6221 - val_acc: 0.8584
Epoch 811/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.0986 -
acc: 0.9741 - val_loss: 0.6392 - val_acc: 0.8590
Epoch 812/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1015 -
acc: 0.9735 - val_loss: 0.6407 - val_acc: 0.8532
Epoch 813/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1140 -
acc: 0.9695 - val_loss: 0.6228 - val_acc: 0.8538
Epoch 814/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1050 -
acc: 0.9712 - val_loss: 0.5993 - val_acc: 0.8574
Epoch 815/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1133 -
acc: 0.9706 - val_loss: 0.6046 - val_acc: 0.8543
Epoch 816/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1054 -
acc: 0.9723 - val_loss: 0.5903 - val_acc: 0.8525
Epoch 817/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1073 -
```

```
acc: 0.9723 - val_loss: 0.6277 - val_acc: 0.8566
Epoch 818/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1025 -
acc: 0.9732 - val_loss: 0.6382 - val_acc: 0.8570
Epoch 819/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0982 -
acc: 0.9744 - val_loss: 0.6020 - val_acc: 0.8552
Epoch 820/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1060 -
acc: 0.9707 - val_loss: 0.6015 - val_acc: 0.8592
Epoch 821/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1003 -
acc: 0.9726 - val_loss: 0.6186 - val_acc: 0.8580
Epoch 822/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1085 -
acc: 0.9704 - val_loss: 0.6345 - val_acc: 0.8457
Epoch 823/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1095 -
acc: 0.9707 - val_loss: 0.6296 - val_acc: 0.8572
Epoch 824/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1046 -
acc: 0.9712 - val_loss: 0.6006 - val_acc: 0.8559
Epoch 825/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1069 -
acc: 0.9716 - val_loss: 0.6436 - val_acc: 0.8581
Epoch 826/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1080 -
acc: 0.9714 - val_loss: 0.6197 - val_acc: 0.8571
Epoch 827/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1023 -
acc: 0.9715 - val_loss: 0.6349 - val_acc: 0.8583
Epoch 828/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1056 -
acc: 0.9721 - val_loss: 0.6116 - val_acc: 0.8534
Epoch 829/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1077 -
acc: 0.9707 - val_loss: 0.6285 - val_acc: 0.8592
Epoch 830/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0948 -
acc: 0.9736 - val_loss: 0.6159 - val_acc: 0.8587
Epoch 831/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1063 -
acc: 0.9707 - val_loss: 0.6428 - val_acc: 0.8605
Epoch 832/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1047 -
acc: 0.9726 - val_loss: 0.6179 - val_acc: 0.8548
Epoch 833/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0992 -
acc: 0.9745 - val_loss: 0.6273 - val_acc: 0.8588
Epoch 834/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0947 -
acc: 0.9733 - val_loss: 0.6335 - val_acc: 0.8545
Epoch 835/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1002 -
acc: 0.9743 - val_loss: 0.6269 - val_acc: 0.8571
Epoch 836/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1088 -
```

```
acc: 0.9702 - val_loss: 0.6120 - val_acc: 0.8540
Epoch 837/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1035 -
acc: 0.9729 - val_loss: 0.6307 - val_acc: 0.8612
Epoch 838/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1052 -
acc: 0.9713 - val_loss: 0.6144 - val_acc: 0.8546
Epoch 839/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1084 -
acc: 0.9716 - val_loss: 0.6213 - val_acc: 0.8593
Epoch 840/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1043 -
acc: 0.9723 - val_loss: 0.6057 - val_acc: 0.8581
Epoch 841/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1045 -
acc: 0.9710 - val_loss: 0.5977 - val_acc: 0.8535
Epoch 842/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1129 -
acc: 0.9707 - val_loss: 0.5985 - val_acc: 0.8577
Epoch 843/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1078 -
acc: 0.9718 - val_loss: 0.6245 - val_acc: 0.8618
Epoch 844/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0943 -
acc: 0.9742 - val_loss: 0.6111 - val_acc: 0.8584
Epoch 845/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1022 -
acc: 0.9731 - val_loss: 0.6131 - val_acc: 0.8542
Epoch 846/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0909 -
acc: 0.9744 - val_loss: 0.6308 - val_acc: 0.8597
Epoch 847/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1071 -
acc: 0.9707 - val_loss: 0.6146 - val_acc: 0.8611
Epoch 848/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1106 -
acc: 0.9707 - val_loss: 0.6396 - val_acc: 0.8607
Epoch 849/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1093 -
acc: 0.9706 - val_loss: 0.6120 - val_acc: 0.8600
Epoch 850/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1130 -
acc: 0.9707 - val_loss: 0.6064 - val_acc: 0.8576
Epoch 851/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.0994 -
acc: 0.9723 - val_loss: 0.6666 - val_acc: 0.8623
Epoch 852/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1064 -
acc: 0.9714 - val_loss: 0.6089 - val_acc: 0.8611
Epoch 853/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1018 -
acc: 0.9728 - val_loss: 0.6232 - val_acc: 0.8586
Epoch 854/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1034 -
acc: 0.9722 - val_loss: 0.6049 - val_acc: 0.8570
Epoch 855/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0999 -
```

```
acc: 0.9714 - val_loss: 0.6335 - val_acc: 0.8549
Epoch 856/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1100 -
acc: 0.9715 - val_loss: 0.6114 - val_acc: 0.8632
Epoch 857/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1038 -
acc: 0.9732 - val_loss: 0.6178 - val_acc: 0.8609
Epoch 858/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1040 -
acc: 0.9713 - val_loss: 0.6200 - val_acc: 0.8589
Epoch 859/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1001 -
acc: 0.9724 - val_loss: 0.6016 - val_acc: 0.8537
Epoch 860/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0963 -
acc: 0.9740 - val_loss: 0.6422 - val_acc: 0.8603
Epoch 861/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0973 -
acc: 0.9736 - val_loss: 0.6251 - val_acc: 0.8607
Epoch 862/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1034 -
acc: 0.9726 - val_loss: 0.6434 - val_acc: 0.8602
Epoch 863/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0966 -
acc: 0.9758 - val_loss: 0.6312 - val_acc: 0.8598
Epoch 864/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1039 -
acc: 0.9719 - val_loss: 0.6135 - val_acc: 0.8573
Epoch 865/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0994 -
acc: 0.9744 - val_loss: 0.6428 - val_acc: 0.8585
Epoch 866/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0949 -
acc: 0.9752 - val_loss: 0.6272 - val_acc: 0.8622
Epoch 867/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1062 -
acc: 0.9717 - val_loss: 0.6228 - val_acc: 0.8539
Epoch 868/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0979 -
acc: 0.9747 - val_loss: 0.6309 - val_acc: 0.8623
Epoch 869/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1024 -
acc: 0.9722 - val_loss: 0.6312 - val_acc: 0.8543
Epoch 870/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1084 -
acc: 0.9712 - val_loss: 0.6135 - val_acc: 0.8576
Epoch 871/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1022 -
acc: 0.9723 - val_loss: 0.6122 - val_acc: 0.8617
Epoch 872/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1051 -
acc: 0.9717 - val_loss: 0.6256 - val_acc: 0.8560
Epoch 873/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1014 -
acc: 0.9729 - val_loss: 0.6105 - val_acc: 0.8620
Epoch 874/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0965 -
```

```
acc: 0.9749 - val_loss: 0.6066 - val_acc: 0.8574
Epoch 875/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0965 -
acc: 0.9736 - val_loss: 0.6291 - val_acc: 0.8557
Epoch 876/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1033 -
acc: 0.9711 - val_loss: 0.6165 - val_acc: 0.8591
Epoch 877/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0978 -
acc: 0.9741 - val_loss: 0.6344 - val_acc: 0.8643
Epoch 878/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0979 -
acc: 0.9735 - val_loss: 0.6742 - val_acc: 0.8615
Epoch 879/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1009 -
acc: 0.9733 - val_loss: 0.6136 - val_acc: 0.8587
Epoch 880/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0991 -
acc: 0.9728 - val_loss: 0.6475 - val_acc: 0.8597
Epoch 881/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1042 -
acc: 0.9728 - val_loss: 0.6098 - val_acc: 0.8571
Epoch 882/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0974 -
acc: 0.9741 - val_loss: 0.6402 - val_acc: 0.8621
Epoch 883/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1059 -
acc: 0.9710 - val_loss: 0.6140 - val_acc: 0.8586
Epoch 884/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1029 -
acc: 0.9721 - val_loss: 0.6485 - val_acc: 0.8576
Epoch 885/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0979 -
acc: 0.9732 - val_loss: 0.6404 - val_acc: 0.8642
Epoch 886/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1034 -
acc: 0.9724 - val_loss: 0.6269 - val_acc: 0.8589
Epoch 887/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1027 -
acc: 0.9731 - val_loss: 0.6855 - val_acc: 0.8632
Epoch 888/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1072 -
acc: 0.9706 - val_loss: 0.6206 - val_acc: 0.8551
Epoch 889/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0942 -
acc: 0.9742 - val_loss: 0.6449 - val_acc: 0.8562
Epoch 890/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0936 -
acc: 0.9747 - val_loss: 0.6132 - val_acc: 0.8590
Epoch 891/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0907 -
acc: 0.9743 - val_loss: 0.6506 - val_acc: 0.8618
Epoch 892/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0942 -
acc: 0.9758 - val_loss: 0.6435 - val_acc: 0.8568
Epoch 893/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.0992 -
```

```
acc: 0.9745 - val_loss: 0.6302 - val_acc: 0.8628
Epoch 894/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1044 -
acc: 0.9721 - val_loss: 0.6332 - val_acc: 0.8612
Epoch 895/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1005 -
acc: 0.9736 - val_loss: 0.5987 - val_acc: 0.8592
Epoch 896/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0997 -
acc: 0.9736 - val_loss: 0.6289 - val_acc: 0.8530
Epoch 897/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1024 -
acc: 0.9737 - val_loss: 0.6238 - val_acc: 0.8601
Epoch 898/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0931 -
acc: 0.9749 - val_loss: 0.6215 - val_acc: 0.8640
Epoch 899/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1064 -
acc: 0.9718 - val_loss: 0.6386 - val_acc: 0.8638
Epoch 900/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0961 -
acc: 0.9729 - val_loss: 0.6140 - val_acc: 0.8596
Epoch 901/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1040 -
acc: 0.9730 - val_loss: 0.6107 - val_acc: 0.8622
Epoch 902/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0961 -
acc: 0.9756 - val_loss: 0.6412 - val_acc: 0.8563
Epoch 903/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0962 -
acc: 0.9746 - val_loss: 0.6535 - val_acc: 0.8576
Epoch 904/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1059 -
acc: 0.9741 - val_loss: 0.6282 - val_acc: 0.8613
Epoch 905/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1011 -
acc: 0.9734 - val_loss: 0.6275 - val_acc: 0.8613
Epoch 906/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1060 -
acc: 0.9717 - val_loss: 0.6054 - val_acc: 0.8613
Epoch 907/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.0953 -
acc: 0.9748 - val_loss: 0.6256 - val_acc: 0.8581
Epoch 908/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1011 -
acc: 0.9723 - val_loss: 0.6744 - val_acc: 0.8579
Epoch 909/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1039 -
acc: 0.9733 - val_loss: 0.6455 - val_acc: 0.8588
Epoch 910/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1031 -
acc: 0.9733 - val_loss: 0.6169 - val_acc: 0.8601
Epoch 911/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1030 -
acc: 0.9721 - val_loss: 0.6390 - val_acc: 0.8658
Epoch 912/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1029 -
```

```
acc: 0.9732 - val_loss: 0.6450 - val_acc: 0.8618
Epoch 913/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0985 -
acc: 0.9742 - val_loss: 0.6147 - val_acc: 0.8616
Epoch 914/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0976 -
acc: 0.9749 - val_loss: 0.6195 - val_acc: 0.8597
Epoch 915/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1067 -
acc: 0.9716 - val_loss: 0.6311 - val_acc: 0.8598
Epoch 916/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0967 -
acc: 0.9739 - val_loss: 0.6025 - val_acc: 0.8552
Epoch 917/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1047 -
acc: 0.9725 - val_loss: 0.6232 - val_acc: 0.8602
Epoch 918/1000
18000/18000 [=====] - 6s 329us/step - loss: 0.1044 -
acc: 0.9714 - val_loss: 0.6261 - val_acc: 0.8627
Epoch 919/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1018 -
acc: 0.9742 - val_loss: 0.6291 - val_acc: 0.8581
Epoch 920/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0992 -
acc: 0.9748 - val_loss: 0.6040 - val_acc: 0.8577
Epoch 921/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0943 -
acc: 0.9749 - val_loss: 0.6469 - val_acc: 0.8585
Epoch 922/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1055 -
acc: 0.9708 - val_loss: 0.6300 - val_acc: 0.8606
Epoch 923/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1031 -
acc: 0.9721 - val_loss: 0.6453 - val_acc: 0.8540
Epoch 924/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1061 -
acc: 0.9724 - val_loss: 0.6096 - val_acc: 0.8523
Epoch 925/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1066 -
acc: 0.9719 - val_loss: 0.6100 - val_acc: 0.8579
Epoch 926/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0958 -
acc: 0.9739 - val_loss: 0.6409 - val_acc: 0.8602
Epoch 927/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1065 -
acc: 0.9731 - val_loss: 0.6340 - val_acc: 0.8594
Epoch 928/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0920 -
acc: 0.9749 - val_loss: 0.6316 - val_acc: 0.8600
Epoch 929/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0921 -
acc: 0.9766 - val_loss: 0.6534 - val_acc: 0.8652
Epoch 930/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1014 -
acc: 0.9741 - val_loss: 0.6070 - val_acc: 0.8607
Epoch 931/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0972 -
```

```
acc: 0.9734 - val_loss: 0.6156 - val_acc: 0.8601
Epoch 932/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1060 -
acc: 0.9713 - val_loss: 0.6675 - val_acc: 0.8599
Epoch 933/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0968 -
acc: 0.9746 - val_loss: 0.6344 - val_acc: 0.8578
Epoch 934/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1008 -
acc: 0.9726 - val_loss: 0.6544 - val_acc: 0.8614
Epoch 935/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1012 -
acc: 0.9744 - val_loss: 0.6254 - val_acc: 0.8576
Epoch 936/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1017 -
acc: 0.9732 - val_loss: 0.6072 - val_acc: 0.8591
Epoch 937/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.0954 -
acc: 0.9739 - val_loss: 0.6252 - val_acc: 0.8575
Epoch 938/1000
18000/18000 [=====] - 6s 334us/step - loss: 0.1005 -
acc: 0.9742 - val_loss: 0.6356 - val_acc: 0.8575
Epoch 939/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1073 -
acc: 0.9726 - val_loss: 0.6445 - val_acc: 0.8607
Epoch 940/1000
18000/18000 [=====] - 6s 335us/step - loss: 0.1186 -
acc: 0.9704 - val_loss: 0.6110 - val_acc: 0.8603
Epoch 941/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0931 -
acc: 0.9756 - val_loss: 0.6141 - val_acc: 0.8574
Epoch 942/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.0936 -
acc: 0.9757 - val_loss: 0.6077 - val_acc: 0.8532
Epoch 943/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0970 -
acc: 0.9744 - val_loss: 0.5928 - val_acc: 0.8538
Epoch 944/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1074 -
acc: 0.9726 - val_loss: 0.6363 - val_acc: 0.8568
Epoch 945/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.0993 -
acc: 0.9736 - val_loss: 0.6003 - val_acc: 0.8627
Epoch 946/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0963 -
acc: 0.9731 - val_loss: 0.6471 - val_acc: 0.8577
Epoch 947/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1144 -
acc: 0.9707 - val_loss: 0.6201 - val_acc: 0.8597
Epoch 948/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0946 -
acc: 0.9747 - val_loss: 0.6508 - val_acc: 0.8617
Epoch 949/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0908 -
acc: 0.9751 - val_loss: 0.6368 - val_acc: 0.8600
Epoch 950/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0943 -
```

```
acc: 0.9744 - val_loss: 0.6195 - val_acc: 0.8620
Epoch 951/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0988 -
acc: 0.9743 - val_loss: 0.6241 - val_acc: 0.8560
Epoch 952/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0951 -
acc: 0.9751 - val_loss: 0.6315 - val_acc: 0.8590
Epoch 953/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0988 -
acc: 0.9743 - val_loss: 0.6197 - val_acc: 0.8588
Epoch 954/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1047 -
acc: 0.9722 - val_loss: 0.6110 - val_acc: 0.8582
Epoch 955/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1054 -
acc: 0.9722 - val_loss: 0.6266 - val_acc: 0.8582
Epoch 956/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1066 -
acc: 0.9715 - val_loss: 0.6237 - val_acc: 0.8615
Epoch 957/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0898 -
acc: 0.9752 - val_loss: 0.6287 - val_acc: 0.8577
Epoch 958/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1099 -
acc: 0.9712 - val_loss: 0.5964 - val_acc: 0.8583
Epoch 959/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1031 -
acc: 0.9738 - val_loss: 0.6269 - val_acc: 0.8564
Epoch 960/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1105 -
acc: 0.9721 - val_loss: 0.6440 - val_acc: 0.8551
Epoch 961/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1047 -
acc: 0.9725 - val_loss: 0.6206 - val_acc: 0.8575
Epoch 962/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0972 -
acc: 0.9747 - val_loss: 0.5967 - val_acc: 0.8558
Epoch 963/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0962 -
acc: 0.9744 - val_loss: 0.6050 - val_acc: 0.8598
Epoch 964/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1032 -
acc: 0.9718 - val_loss: 0.6582 - val_acc: 0.8564
Epoch 965/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1051 -
acc: 0.9724 - val_loss: 0.6211 - val_acc: 0.8536
Epoch 966/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1017 -
acc: 0.9734 - val_loss: 0.6162 - val_acc: 0.8599
Epoch 967/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1022 -
acc: 0.9717 - val_loss: 0.6111 - val_acc: 0.8591
Epoch 968/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0963 -
acc: 0.9750 - val_loss: 0.6353 - val_acc: 0.8588
Epoch 969/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1000 -
```

```
acc: 0.9735 - val_loss: 0.6342 - val_acc: 0.8557
Epoch 970/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1014 -
acc: 0.9749 - val_loss: 0.6228 - val_acc: 0.8637
Epoch 971/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1020 -
acc: 0.9733 - val_loss: 0.6103 - val_acc: 0.8608
Epoch 972/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1005 -
acc: 0.9745 - val_loss: 0.6428 - val_acc: 0.8577
Epoch 973/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1076 -
acc: 0.9717 - val_loss: 0.6314 - val_acc: 0.8581
Epoch 974/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1026 -
acc: 0.9741 - val_loss: 0.6041 - val_acc: 0.8543
Epoch 975/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1004 -
acc: 0.9742 - val_loss: 0.6129 - val_acc: 0.8597
Epoch 976/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0939 -
acc: 0.9760 - val_loss: 0.6376 - val_acc: 0.8612
Epoch 977/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0974 -
acc: 0.9739 - val_loss: 0.6177 - val_acc: 0.8571
Epoch 978/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0913 -
acc: 0.9747 - val_loss: 0.6237 - val_acc: 0.8537
Epoch 979/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1039 -
acc: 0.9727 - val_loss: 0.6241 - val_acc: 0.8607
Epoch 980/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0929 -
acc: 0.9742 - val_loss: 0.6504 - val_acc: 0.8625
Epoch 981/1000
18000/18000 [=====] - 6s 329us/step - loss: 0.0988 -
acc: 0.9737 - val_loss: 0.6290 - val_acc: 0.8504
Epoch 982/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0988 -
acc: 0.9734 - val_loss: 0.6469 - val_acc: 0.8594
Epoch 983/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0970 -
acc: 0.9748 - val_loss: 0.6360 - val_acc: 0.8564
Epoch 984/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1035 -
acc: 0.9723 - val_loss: 0.6108 - val_acc: 0.8606
Epoch 985/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.1016 -
acc: 0.9734 - val_loss: 0.6230 - val_acc: 0.8598
Epoch 986/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0972 -
acc: 0.9734 - val_loss: 0.6063 - val_acc: 0.8598
Epoch 987/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.0933 -
acc: 0.9749 - val_loss: 0.6082 - val_acc: 0.8557
Epoch 988/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.0971 -
```

```
acc: 0.9742 - val_loss: 0.6605 - val_acc: 0.8529
Epoch 989/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.0895 -
acc: 0.9768 - val_loss: 0.6307 - val_acc: 0.8562
Epoch 990/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.0956 -
acc: 0.9743 - val_loss: 0.6575 - val_acc: 0.8593
Epoch 991/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.1010 -
acc: 0.9743 - val_loss: 0.6608 - val_acc: 0.8595
Epoch 992/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.1087 -
acc: 0.9726 - val_loss: 0.6451 - val_acc: 0.8624
Epoch 993/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0916 -
acc: 0.9752 - val_loss: 0.6697 - val_acc: 0.8596
Epoch 994/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.0931 -
acc: 0.9754 - val_loss: 0.6470 - val_acc: 0.8558
Epoch 995/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0950 -
acc: 0.9737 - val_loss: 0.6523 - val_acc: 0.8577
Epoch 996/1000
18000/18000 [=====] - 6s 333us/step - loss: 0.0889 -
acc: 0.9765 - val_loss: 0.6291 - val_acc: 0.8516
Epoch 997/1000
18000/18000 [=====] - 6s 338us/step - loss: 0.1054 -
acc: 0.9708 - val_loss: 0.6236 - val_acc: 0.8613
Epoch 998/1000
18000/18000 [=====] - 6s 331us/step - loss: 0.0992 -
acc: 0.9736 - val_loss: 0.6273 - val_acc: 0.8573
Epoch 999/1000
18000/18000 [=====] - 6s 332us/step - loss: 0.0922 -
acc: 0.9750 - val_loss: 0.6436 - val_acc: 0.8574
Epoch 1000/1000
18000/18000 [=====] - 6s 330us/step - loss: 0.1030 -
acc: 0.9736 - val_loss: 0.6277 - val_acc: 0.8546
```

```
In [0]: '''
Processing Step 7: Viewing result
This graph the result and performance for progress of training the model

As the graph, the validation accuracy almost stays constant around 85 to 90% while the training accuracy stays around 90 to 95%.

As the second graph, in around epoch 400 the model slightly to have over-fitting, but this is the best I can train for the model.
because increasing dropout rate can cause the drop of training accuracy as well, so i decided to leave it like it is.
'''

import matplotlib.pyplot as plt
acc = history.history['acc']
val_acc = history.history['val_acc']
loss = history.history['loss']
val_loss = history.history['val_loss']

epochs = range(len(acc))

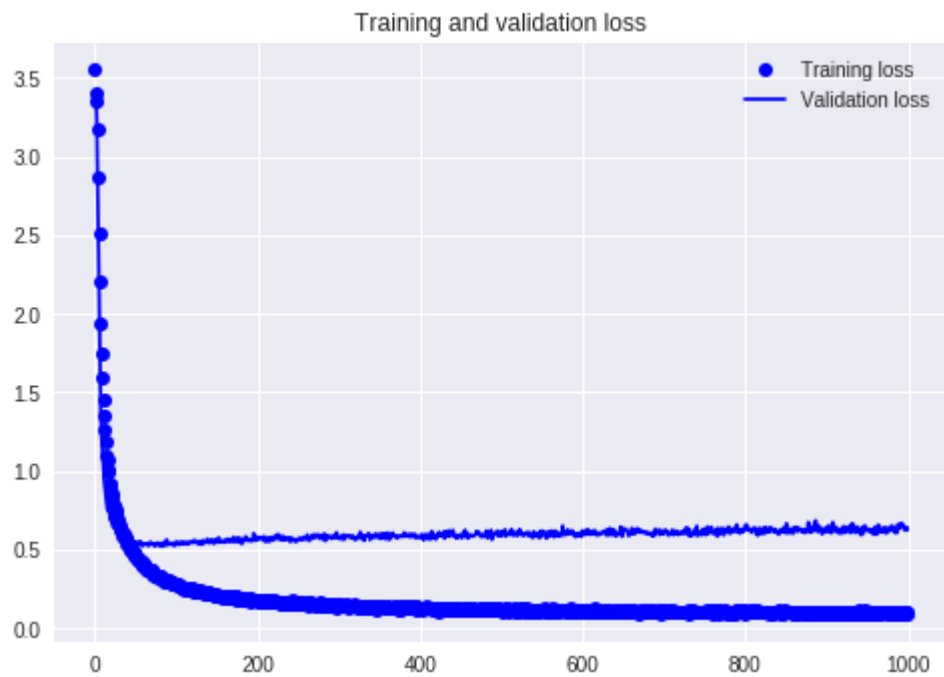
plt.plot(epochs, acc, 'bo', label='Training acc')
plt.plot(epochs, val_acc, 'b', label='Validation acc')
plt.title('Training and validation accuracy')
plt.legend()

plt.figure()

plt.plot(epochs, loss, 'bo', label='Training loss')
plt.plot(epochs, val_loss, 'b', label='Validation loss')

plt.title('Training and validation loss')
plt.legend()

plt.show()
```



```
In [0]: '''
Processing Step 8: Testing the model
1. I have randomly copied some test file from the gieven dataset (they are not
   included in the training nor validation set)
2. set the testing directory and assign into file name
3. BE WARE!!!! This project does not deal with noise nor slience case with th
   is training, so it is expected that not all files can give 97% accuracy result
   (Because within the test files, there are some slience files and some with ext
   reme noise, those may not prodicted correctly)
'''

test_dir = '/gdrive/My Drive/final_project/test/'
filename = os.listdir(test_dir)[:10]

for i in range (0,len(filename)):
    filename[i] = os.path.join(test_dir,filename[i])

filename
```

```
Out[0]: ['/gdrive/My Drive/final_project/test/clip_00b2e1b3c.wav',
'/gdrive/My Drive/final_project/test/clip_00aef6b10.wav',
'/gdrive/My Drive/final_project/test/clip_00ae6199e.wav',
'/gdrive/My Drive/final_project/test/clip_00af0781d.wav',
'/gdrive/My Drive/final_project/test/clip_00b4a66dc.wav',
'/gdrive/My Drive/final_project/test/clip_00b0e0800.wav',
'/gdrive/My Drive/final_project/test/clip_00ae5577f.wav',
'/gdrive/My Drive/final_project/test/clip_00b1c346e.wav',
'/gdrive/My Drive/final_project/test/clip_00aeb58bf.wav',
'/gdrive/My Drive/final_project/test/clip_00af31505.wav']
```

Processing Step 8: Testing

The Foilowing blocks are the tests for the trained model, you can play the audio by pressing the play button on the player and see if the model predicted correctly.

```
In [0]: Audio(filename[1],rate=16000)
```

```
Out[0]:
0:00 / 0:01
```

```
In [0]: print(predict(filename[1], model=model))

down
```

```
In [0]: Audio(filename[2],rate=16000)
```

```
Out[0]:  
0:00 / 0:01
```

```
In [0]: print(predict(filename[2], model=model))
```

```
cat
```

```
In [0]: Audio(filename[3],rate=16000)
```

```
Out[0]:  
0:00 / 0:01
```

```
In [0]: print(predict(filename[3], model=model))
```

```
on
```

```
In [0]: '''  
This block is for my use only, to save the structure and trained model and dow  
nload to local harddrive for my computer  
'''
```

```
from google.colab import files  
# serialize model to JSON  
model_json = model.to_json()  
with open("/gdrive/My Drive/final_project/model/model.json", "w") as json_file  
:  
    json_file.write(model_json)  
# serialize weights to HDF5  
model.save_weights("/gdrive/My Drive/final_project/model/model_weight.h5")  
print("Saved model to disk")  
  
files.download( "/gdrive/My Drive/final_project/model/model.json" )  
files.download( "/gdrive/My Drive/final_project/model/model_weight.h5" )  
# later...
```

```
Saved model to disk
```

Conclusion

I am glad that I am the first one working on audio training in my college. Although i was not able to do the data processing part of the project, but I have learn that there are so many ways to treat complicated data into the easier form such as from audio data to numpy array. There are many libraries that i did not hear of and without those libararies, this project cannot be done.

There were so many difficulties for doing this project. From trying to find the way to import from Github to trying to play audio in colab, I spent the most time on different websites and testing everyone of them. Since the code I referenced from only trian three classes and I am trianing thirty classes, I would say that my moel is slightly better than his even though my accuracy is not 99% like his.