

## Redes Completamente Conectadas

Uma instituição financeira possui uma base de dados com o histórico de crediário oferecido aos seus clientes. Baseado neste histórico, a instituição deseja criar um modelo de classificação para inferir se um novo cliente que submeteu uma requisição de empréstimo pagará ou não a dívida, caso o banco resolva realizar esse empréstimo. O conjunto de dados possui 1500 exemplos de créditos concedidos aos seus clientes. Esses registros estão contidos no arquivo **credtrain.txt**, que é fornecido juntamente com esse documento. Para cada cliente, são definidos 11 atributos (variáveis, características). Além disso, a última coluna de cada exemplo informa se o cliente honrou ou não o pagamento do empréstimo. Na Tabela abaixo, encontramos a descrição dos atributos.

| Variável | Descrição                    | Tipo       | Domínio         |
|----------|------------------------------|------------|-----------------|
| ESCT     | Estado civil                 | Categórica | 0,1,2,3         |
| NDEP     | Número de dependentes        | Categórica | 0,1,2,3,4,5,6,7 |
| RENDA    | Renda familiar               | Numérica   | 300 - 9765      |
| TIPOR    | Tipo de residência           | Categórica | 0,1             |
| VBEM     | Valor do bem a ser adquirido | Numérica   | 300 - 600       |
| NPARC    | Número de parcelas           | Numérica   | 1 - 24          |
| VPARC    | Valor da parcela             | Numérica   | 50 - 719        |
| TEL      | Se o cliente possui telefone | Categórica | 0,1             |
| IDADE    | Idade do cliente             | Numérica   | 18 - 70         |
| RESMS    | Tempo de moradia (meses)     | Numérica   | 0 - 420         |
| ENTRADA  | Valor da entrada             | Numérica   | 0 - 1300        |
| CLASSE   | =1 se o cliente pagou        | Categórica | 0,1             |

Nesta parte, você deve criar um modelo de classificação, rede neural de múltiplas camadas com propagação do erro (error backpropagation). O objetivo desse modelo de classificação é prever se um novo cliente pagaria ou não uma dívida contraída, tendo como base as características desse novo cliente. Esse modelo deve ser criado com o uso de funções e classes fornecidas pelo Keras.

## Um Exemplo Introdutório

Para servir de exemplo sobre o procedimento de criação de um *Modelo de Classificação*, é relevante que você realize os passos descritos nesta seção. O objetivo é que, ao fim desta seção, tenhamos uma visão geral do processo de criação de um modelo de classificação em um exemplo pequeno e possa aplicá-lo a um exemplo maior (i.e., o conjunto de dados de crédito bancário). A sequência de passos descrita nesta seção representa a **Criação**, **Treinamento** (Aprendizado) e **Teste** de uma *Rede Neural Backpropagation* com um conjunto de dados pequeno armazenado nas matrizes  $P$  e  $T$ . Após realizar esses passos, você deve aplicar o mesmo procedimento sobre o conjunto de dados de crédito (credtrain) fornecido neste trabalho, para finalmente obter o modelo de classificação.

In [163]:

```
import time
import keras
import itertools
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt

from keras.models import Sequential
from keras.layers.core import Dense

from sklearn import svm, datasets
from sklearn.metrics import accuracy_score
from sklearn.metrics import confusion_matrix
from sklearn.model_selection import train_test_split
```

## Declaração das Funções utilizadas

In [164]:

```
def normalizaFeatures(X):
    '''
    Função que normaliza cada elemento, dado um vetor.
    '''

    mu = np.mean(X, axis=0)
    sigma = np.std(X, axis=0)
    X = np.subtract(X, mu)
    X = np.divide(X, sigma)

    return X
```

In [165]:

```
# Função trazida dos exemplos apresentados no scikit-learn
def plot_confusion_matrix(matriz, classes, normalize=False, title='Matriz Confusão'):
    """
    This function prints and plots the confusion matrix.
    Normalization can be applied by setting `normalize=True`.
    """

    cmap = plt.cm.Blues
    CWH = "white"
    BLK = "black"
    CT = "center"

    if normalize:
        matriz = matriz.astype('float') / matriz.sum(axis=1)[:, np.newaxis]
        print("Matriz Confusão Normalizada")
    else:
        print('Matriz Confusão')

    print(matriz)

    plt.imshow(matriz, interpolation='nearest', cmap=cmap)
    plt.title(title)
    plt.colorbar()
    tick_marks = np.arange(len(classes))
    plt.xticks(tick_marks, classes, rotation=45)
    plt.yticks(tick_marks, classes)

    FORMAT = '.2f' if normalize else 'd'
    TRHSD = matriz.max() / 2.

    A = matriz.shape[0]
    B = matriz.shape[1]

    for i, j in itertools.product(range(A), range(B)):
        plt.text(j, i, format(matriz[i, j], FORMAT), horizontalalignment=CT, color=CWH if matriz[i, j] > TRHSD else BLK)

    plt.tight_layout()
    plt.ylabel('Verdadeiro')
    plt.xlabel('Predito')
```

## Procedimento de criação do *Modelo de Classificação*:

**Defina a matriz de padrões.** Note que os padrões são organizados em colunas. Por exemplo, a matriz de padrões abaixo contém cinco padrões de entrada (cada um com quatro características), e o primeiro padrão armazenado na matriz P abaixo é (0.4046, 0.9974, 0.3764, 0.6043).

$$\begin{bmatrix} 0.4046 & 0.3786 & 0.7010 & 0.8608 & 0.5947 \\ 0.9974 & 0.8479 & 0.6201 & 0.4031 & 0.9653 \\ 0.3764 & 0.9214 & 0.9331 & 0.7514 & 0.6914 \\ 0.6043 & 0.3494 & 0.1438 & 0.6035 & 0.4111 \end{bmatrix}$$

In [3]:

```
P = np.array([[0.4046, 0.3786, 0.7010, 0.8608, 0.5947],
              [0.9974, 0.8479, 0.6201, 0.4031, 0.9653],
              [0.3764, 0.9214, 0.9331, 0.7514, 0.6914],
              [0.6043, 0.3494, 0.1438, 0.6035, 0.4111]], "float32")

P = np.transpose(P)
```

In [4]:

```
print(P)
```

```
[[ 0.40459999  0.99739999  0.37639999  0.60430002]
 [ 0.3786      0.84789997  0.92140001  0.34940001]
 [ 0.70099998  0.62010002  0.93309999  0.14380001]
 [ 0.86080003  0.40310001  0.75139999  0.60350001]
 [ 0.59469998  0.96530002  0.69139999  0.4111      ]]
```

**Defina a matriz de alvos. Os valores dessa matriz de alvos são os que a rede deve aprender para cada padrão. Note que a quantidade de colunas na matriz de alvos deve ser sempre igual à quantidade de colunas da matriz de padrões  $T = [0 \ 1 \ 0 \ 1 \ 1]$ .**

$$\begin{bmatrix} 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

In [5]:

```
T = np.array([[0], [1], [0], [1], [1]], "float32")
```

In [6]:

```
print(T)
```

```
[[ 0.]
 [ 1.]
 [ 0.]
 [ 1.]
 [ 1.]]
```

**Crie uma rede neural artificial completamente conectada de uma única camada oculta, com 3 neurônios nessa camada oculta e 1 neurônio na camada de saída. Em ambas as camadas, a função de ativação deve ser a função sigmóide logística.**

In [7]:

```
model = Sequential()  
L1 = Dense(3, input_dim=4, activation='sigmoid')  
model.add(L1)  
L2 = Dense(1, activation='sigmoid')  
model.add(L2)
```

**Realize a configuração da rede recém-criada, conforme instruções a seguir:**

- Quantidade de épocas igual a 100000;
- Função de perda;
- Soma dos erros quadrados;
- Método de otimização: Gradiente Descendente Estocástico.

In [8]:

```
model.compile(loss='mean_squared_error', optimizer='sgd', metrics=['binary_accuracy'])
```

**Treine a rede neural. Esse é o passo em que os pesos e os limiares da rede são ajustados. Esse passo deve ser realizado com a função fit da classe Model. Para chamar essa função, devemos passar a rede, a matriz de padrões e a matriz de alvos.**

Nessa etapa vamos Treinar a rede após os passos descritos acima (item 3 e item 4), representando as etapas de **Configuração e Treinamento** da *Rede Neural*

In [9]:

```
t1 = time.process_time()  
history = model.fit(P, T, epochs=100000, verbose=1)  
t2 = time.process_time()
```

In [21]:

```
print("\n ##### Tempo de Treinamento da Rede Totalmente Conectada #####  
###\n")  
print ("\n\t ----- Computation time = " + str(t2 - t1) + "s -----")  
print("\n #####  
\n")
```

```
##### Tempo de Treinamento da Rede Totalmente Conectada ###  
#####
```

|                                |               |
|--------------------------------|---------------|
| Epoca com Acurácia 60%: 1      | Custo: 0.2481 |
| Epoca com Acurácia 80%: 71337  | Custo: 0.1915 |
| Epoca com Acurácia 100%: 84996 | Custo: 0.1495 |
| Epoca com Acurácia 100%: 99984 | Custo: 0.0839 |

```
----- Computation time = 184.40195599999998s -----
```

```
#####  
##
```

6) Gere gráficos para visualizar o histórico de treinamento. Em particular, gere curvas da precisão e da função de custo contra a quantidade de épocas de treinamento.

### Gráfico agrupado com as Curvas de Treinamento: `binary_accuracy` e `loss`

In [11]:

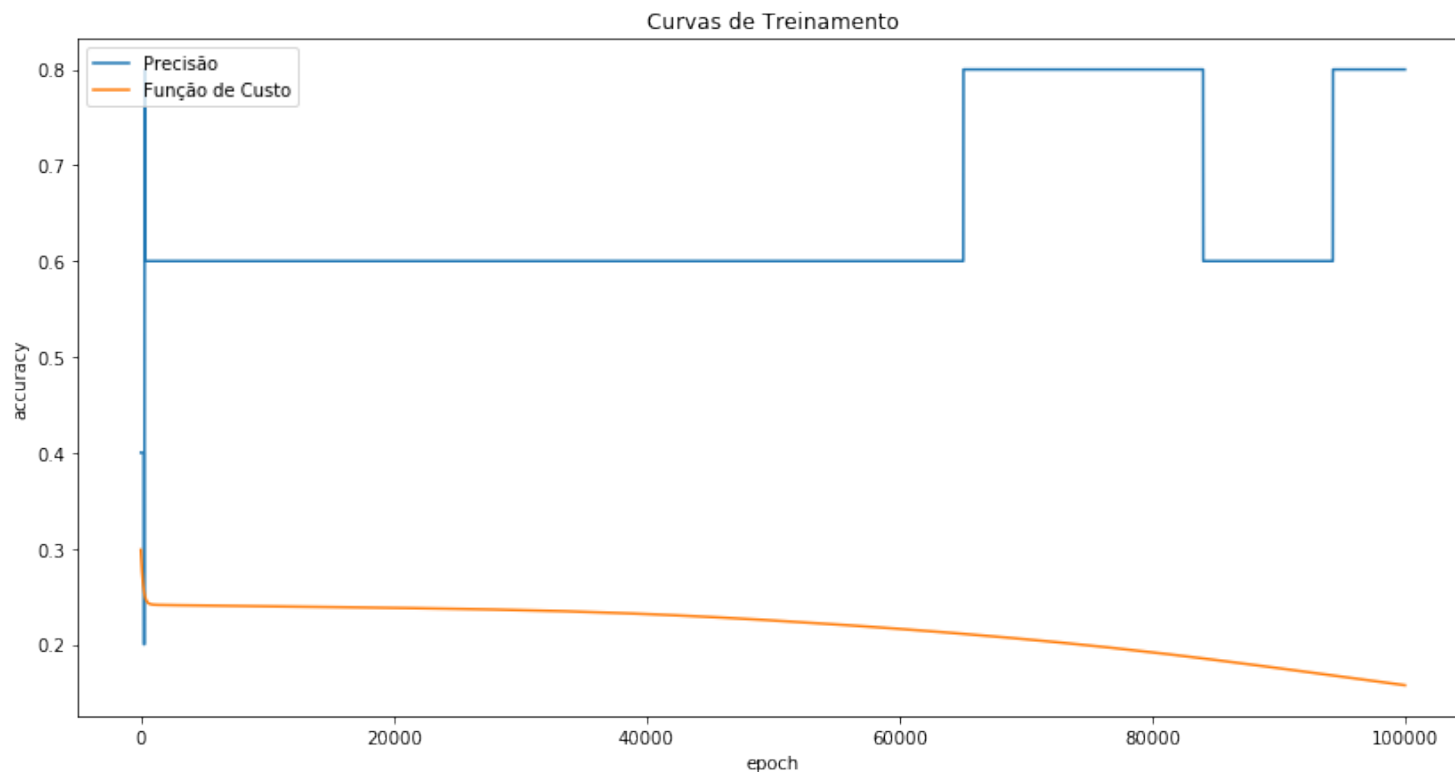
```
# Obtendo as métricas para exibir o Gráfico  
metrics = history.history  
metrics.keys()
```

Out[11]:

```
dict_keys(['loss', 'binary_accuracy'])
```

In [12]:

```
plt.figure(figsize=(14,7))
plt.plot(metrics['binary_accuracy'])
plt.plot(metrics['loss'])
plt.title('Curvas de Treinamento')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.legend(['Precisão', 'Função de Custo'], loc='upper left')
plt.show();
```



## Criação de Modelo de Predição de Crédito

Após realizar os passos descritos acima, você deve ter condições de repetí-los para o conjunto de dados de créditos (credtrain). Uma vez treinada, essa rede poderá inferir se um novo cliente irá ou não honrar um eventual empréstimo.

Inicialmente, você deve carregar o arquivo **credtrain.txt**. Uma vez que os dados estão carregados, você deve criar duas matrizes. A primeira matriz deve ter ordem  $1500 \times 11$  e deve conter os padrões de entrada (valores das variáveis **ESTC**, **NDEP**, **REND**, **TIPOR**, **VBEM**, **NPARC**, **VPARC**, **TEL**, **IDADE**, **RESMS** e **ENTRADA**). A outra matriz deve ter ordem  $1500 \times 1$  e deve conter os valores do atributo **CLASSE**. Vamos chamar essas duas matrizes de  $P$  e  $T$ , respectivamente. A matriz  $P$  é chamada a matriz de treinamento. Já a matriz  $T$  é chamada a matriz de alvo. Diferente do exemplo introdutório, um cuidado adicional que você deve ter é com relação à normalização dos dados de entrada da rede, posto que algumas variáveis possuem ordens de grandeza diferentes.

## Modelo de Classificação *TREINAMENTO*

In [168]:

```
dataTrain = pd.read_csv("am-T3-dados/credtrain.txt", sep='\t', header=None)
dataTrain.head()
```

Out[168]:

|   | 0 | 1 | 2    | 3 | 4   | 5  | 6   | 7 | 8  | 9  | 10 | 11 |
|---|---|---|------|---|-----|----|-----|---|----|----|----|----|
| 0 | 1 | 0 | 360  | 0 | 313 | 9  | 52  | 0 | 25 | 48 | 0  | 1  |
| 1 | 0 | 0 | 350  | 1 | 468 | 10 | 65  | 0 | 33 | 6  | 0  | 1  |
| 2 | 0 | 0 | 1100 | 0 | 829 | 9  | 125 | 0 | 56 | 48 | 0  | 1  |
| 3 | 0 | 0 | 3000 | 0 | 552 | 12 | 76  | 1 | 31 | 60 | 0  | 1  |
| 4 | 1 | 0 | 1000 | 0 | 809 | 12 | 111 | 0 | 24 | 7  | 0  | 1  |

## Criando as matrizes $P$ e $T$

In [169]:

```
P = dataTrain.iloc[:, :11].as_matrix()
Train = dataTrain.iloc[:, 11:].as_matrix()
```

```
P.shape , Train.shape
```

Out[169]:

```
((1500, 11), (1500, 1))
```

In [170]:

```
PTrain = normalizaFeatures(P)
PTrain
```

Out[170]:

```
array([[ 0.73974272, -0.22118458, -0.68989239, ..., -1.22827955,
         0.31287827, -0.34213664],
       [-0.77612351, -0.22118458, -0.7009393 , ..., -0.62212086,
        -0.48492523, -0.34213664],
       [-0.77612351, -0.22118458,  0.12757848, ...,  1.12058535,
         0.31287827, -0.34213664],
       ...,
       [-0.77612351, -0.22118458, -0.45790742, ..., -1.00097004,
         2.13642912, -0.34213664],
       [-0.77612351, -0.22118458, -0.68989239, ..., -0.62212086,
         0.08493441, -0.34213664],
       [-0.77612351,  6.76359162, -0.53413105, ..., -0.31904152,
        -0.48492523, -0.34213664]])
```

**Construção da Rede Neural *feed – forward* with Neurons = 3 and Activation = sigmoid**



In [171]:

```
model = Sequential()
L1 = Dense(3, input_dim=11, activation='sigmoid')
model.add(L1)
L2 = Dense(1, activation='sigmoid')
model.add(L2)
```

### Configuração da Rede Neural *feed – forward* with Epochs = 2000

In [172]:

```
t1 = time.process_time()
model.compile(loss='mean_squared_error', optimizer='sgd', metrics=['binary_acc
uracy'])
history = model.fit(PTrain, Train, epochs=2000, verbose=1)
t2 = time.process_time()
```

```
Epoch 1/2000
1500/1500 [=====] - 0s - loss: 0.2624 - b
inary_accuracy: 0.4587
Epoch 2/2000
1500/1500 [=====] - 0s - loss: 0.2604 - b
inary_accuracy: 0.4647
Epoch 3/2000
1500/1500 [=====] - 0s - loss: 0.2585 - b
inary_accuracy: 0.4773
Epoch 4/2000
1500/1500 [=====] - 0s - loss: 0.2567 - b
inary_accuracy: 0.4893
Epoch 5/2000
1500/1500 [=====] - 0s - loss: 0.2549 - b
inary_accuracy: 0.5040
Epoch 6/2000
1500/1500 [=====] - 0s - loss: 0.2533 - b
inary_accuracy: 0.5127
Epoch 7/2000
1500/1500 [=====] - 0s - loss: 0.2517 - b
inary_accuracy: 0.5207
Epoch 8/2000
1500/1500 [=====] - 0s - loss: 0.2501 - b
inary_accuracy: 0.5320
Epoch 9/2000
1500/1500 [=====] - 0s - loss: 0.2486 - b
inary_accuracy: 0.5393
Epoch 10/2000
1500/1500 [=====] - 0s - loss: 0.2471 - b
inary_accuracy: 0.5460
Epoch 11/2000
1500/1500 [=====] - 0s - loss: 0.2457 - b
inary_accuracy: 0.5467
Epoch 12/2000
1500/1500 [=====] - 0s - loss: 0.2442 - b
inary_accuracy: 0.5533
Epoch 13/2000
```

1500/1500 [=====] - 0s - loss: 0.2428 - binary\_accuracy: 0.5587  
Epoch 14/2000  
1500/1500 [=====] - 0s - loss: 0.2414 - binary\_accuracy: 0.5687  
Epoch 15/2000  
1500/1500 [=====] - 0s - loss: 0.2401 - binary\_accuracy: 0.5780  
Epoch 16/2000  
1500/1500 [=====] - 0s - loss: 0.2387 - binary\_accuracy: 0.5920  
Epoch 17/2000  
1500/1500 [=====] - 0s - loss: 0.2374 - binary\_accuracy: 0.6027  
Epoch 18/2000  
1500/1500 [=====] - 0s - loss: 0.2361 - binary\_accuracy: 0.6107  
Epoch 19/2000  
1500/1500 [=====] - 0s - loss: 0.2347 - binary\_accuracy: 0.6200  
Epoch 20/2000  
1500/1500 [=====] - 0s - loss: 0.2334 - binary\_accuracy: 0.6280  
Epoch 21/2000  
1500/1500 [=====] - 0s - loss: 0.2321 - binary\_accuracy: 0.6340  
Epoch 22/2000  
1500/1500 [=====] - 0s - loss: 0.2309 - binary\_accuracy: 0.6433  
Epoch 23/2000  
1500/1500 [=====] - 0s - loss: 0.2296 - binary\_accuracy: 0.6500  
Epoch 24/2000  
1500/1500 [=====] - 0s - loss: 0.2283 - binary\_accuracy: 0.6560  
Epoch 25/2000  
1500/1500 [=====] - 0s - loss: 0.2270 - binary\_accuracy: 0.6640  
Epoch 26/2000  
1500/1500 [=====] - 0s - loss: 0.2257 - binary\_accuracy: 0.6727  
Epoch 27/2000  
1500/1500 [=====] - 0s - loss: 0.2245 - binary\_accuracy: 0.6800  
Epoch 28/2000  
1500/1500 [=====] - 0s - loss: 0.2232 - binary\_accuracy: 0.6880  
Epoch 29/2000  
1500/1500 [=====] - 0s - loss: 0.2219 - binary\_accuracy: 0.6967  
Epoch 30/2000  
1500/1500 [=====] - 0s - loss: 0.2207 - binary\_accuracy: 0.7053  
Epoch 31/2000  
1500/1500 [=====] - 0s - loss: 0.2194 - binary\_accuracy: 0.7147  
Epoch 32/2000

1500/1500 [=====] - 0s - loss: 0.2182 - b  
inary\_accuracy: 0.7220  
Epoch 33/2000  
1500/1500 [=====] - 0s - loss: 0.2169 - b  
inary\_accuracy: 0.7287  
Epoch 34/2000  
1500/1500 [=====] - 0s - loss: 0.2156 - b  
inary\_accuracy: 0.7340  
Epoch 35/2000  
1500/1500 [=====] - 0s - loss: 0.2144 - b  
inary\_accuracy: 0.7407  
Epoch 36/2000  
1500/1500 [=====] - 0s - loss: 0.2131 - b  
inary\_accuracy: 0.7467  
Epoch 37/2000  
1500/1500 [=====] - 0s - loss: 0.2119 - b  
inary\_accuracy: 0.7573  
Epoch 38/2000  
1500/1500 [=====] - 0s - loss: 0.2107 - b  
inary\_accuracy: 0.7633  
Epoch 39/2000  
1500/1500 [=====] - 0s - loss: 0.2094 - b  
inary\_accuracy: 0.7707  
Epoch 40/2000  
1500/1500 [=====] - 0s - loss: 0.2082 - b  
inary\_accuracy: 0.7747  
Epoch 41/2000  
1500/1500 [=====] - 0s - loss: 0.2069 - b  
inary\_accuracy: 0.7793 - ETA: 0s - loss: 0.2083 - binary\_accu  
acy: 0.775  
Epoch 42/2000  
1500/1500 [=====] - 0s - loss: 0.2057 - b  
inary\_accuracy: 0.7827  
Epoch 43/2000  
1500/1500 [=====] - 0s - loss: 0.2045 - b  
inary\_accuracy: 0.7867  
Epoch 44/2000  
1500/1500 [=====] - 0s - loss: 0.2033 - b  
inary\_accuracy: 0.7880  
Epoch 45/2000  
1500/1500 [=====] - 0s - loss: 0.2020 - b  
inary\_accuracy: 0.7880  
Epoch 46/2000  
1500/1500 [=====] - 0s - loss: 0.2008 - b  
inary\_accuracy: 0.7920  
Epoch 47/2000  
1500/1500 [=====] - 0s - loss: 0.1996 - b  
inary\_accuracy: 0.7967  
Epoch 48/2000  
1500/1500 [=====] - 0s - loss: 0.1984 - b  
inary\_accuracy: 0.7987  
Epoch 49/2000  
1500/1500 [=====] - 0s - loss: 0.1972 - b  
inary\_accuracy: 0.8033  
Epoch 50/2000  
1500/1500 [=====] - 0s - loss: 0.1960 - b  
inary\_accuracy: 0.8073

Epoch 51/2000  
1500/1500 [=====] - 0s - loss: 0.1948 - binary\_accuracy: 0.8100

Epoch 52/2000  
1500/1500 [=====] - 0s - loss: 0.1936 - binary\_accuracy: 0.8127

Epoch 53/2000  
1500/1500 [=====] - 0s - loss: 0.1924 - binary\_accuracy: 0.8167

Epoch 54/2000  
1500/1500 [=====] - 0s - loss: 0.1912 - binary\_accuracy: 0.8180

Epoch 55/2000  
1500/1500 [=====] - 0s - loss: 0.1901 - binary\_accuracy: 0.8200

Epoch 56/2000  
1500/1500 [=====] - 0s - loss: 0.1889 - binary\_accuracy: 0.8213

Epoch 57/2000  
1500/1500 [=====] - 0s - loss: 0.1878 - binary\_accuracy: 0.8240 - ETA: 0s - loss: 0.1882 - binary\_accuracy: 0.822

Epoch 58/2000  
1500/1500 [=====] - 0s - loss: 0.1866 - binary\_accuracy: 0.8253

Epoch 59/2000  
1500/1500 [=====] - 0s - loss: 0.1855 - binary\_accuracy: 0.8260

Epoch 60/2000  
1500/1500 [=====] - 0s - loss: 0.1843 - binary\_accuracy: 0.8280

Epoch 61/2000  
1500/1500 [=====] - 0s - loss: 0.1832 - binary\_accuracy: 0.8293

Epoch 62/2000  
1500/1500 [=====] - 0s - loss: 0.1821 - binary\_accuracy: 0.8320

Epoch 63/2000  
1500/1500 [=====] - 0s - loss: 0.1810 - binary\_accuracy: 0.8327

Epoch 64/2000  
1500/1500 [=====] - 0s - loss: 0.1799 - binary\_accuracy: 0.8340

Epoch 65/2000  
1500/1500 [=====] - 0s - loss: 0.1788 - binary\_accuracy: 0.8373

Epoch 66/2000  
1500/1500 [=====] - 0s - loss: 0.1777 - binary\_accuracy: 0.8380

Epoch 67/2000  
1500/1500 [=====] - 0s - loss: 0.1767 - binary\_accuracy: 0.8400

Epoch 68/2000  
1500/1500 [=====] - 0s - loss: 0.1756 - binary\_accuracy: 0.8407

Epoch 69/2000  
1500/1500 [=====] - 0s - loss: 0.1746 - binary\_accuracy: 0.8414

```
inary_accuracy: 0.8440
Epoch 70/2000
1500/1500 [=====] - 0s - loss: 0.1735 - b
inary_accuracy: 0.8440
Epoch 71/2000
1500/1500 [=====] - 0s - loss: 0.1725 - b
inary_accuracy: 0.8460
Epoch 72/2000
1500/1500 [=====] - 0s - loss: 0.1715 - b
inary_accuracy: 0.8460
Epoch 73/2000
1500/1500 [=====] - 0s - loss: 0.1705 - b
inary_accuracy: 0.8480
Epoch 74/2000
1500/1500 [=====] - 0s - loss: 0.1695 - b
inary_accuracy: 0.8487
Epoch 75/2000
1500/1500 [=====] - 0s - loss: 0.1685 - b
inary_accuracy: 0.8493
Epoch 76/2000
1500/1500 [=====] - 0s - loss: 0.1675 - b
inary_accuracy: 0.8487
Epoch 77/2000
1500/1500 [=====] - 0s - loss: 0.1665 - b
inary_accuracy: 0.8513
Epoch 78/2000
1500/1500 [=====] - 0s - loss: 0.1656 - b
inary_accuracy: 0.8520
Epoch 79/2000
1500/1500 [=====] - 0s - loss: 0.1646 - b
inary_accuracy: 0.8527
Epoch 80/2000
1500/1500 [=====] - 0s - loss: 0.1637 - b
inary_accuracy: 0.8547
Epoch 81/2000
1500/1500 [=====] - 0s - loss: 0.1628 - b
inary_accuracy: 0.8553
Epoch 82/2000
1500/1500 [=====] - 0s - loss: 0.1619 - b
inary_accuracy: 0.8567
Epoch 83/2000
1500/1500 [=====] - 0s - loss: 0.1610 - b
inary_accuracy: 0.8573
Epoch 84/2000
1500/1500 [=====] - 0s - loss: 0.1601 - b
inary_accuracy: 0.8580
Epoch 85/2000
1500/1500 [=====] - 0s - loss: 0.1592 - b
inary_accuracy: 0.8593
Epoch 86/2000
1500/1500 [=====] - 0s - loss: 0.1583 - b
inary_accuracy: 0.8600
Epoch 87/2000
1500/1500 [=====] - 0s - loss: 0.1575 - b
inary_accuracy: 0.8607
Epoch 88/2000
1500/1500 [=====] - 0s - loss: 0.1566 - b
```

inary\_accuracy: 0.8607  
Epoch 89/2000  
1500/1500 [=====] - 0s - loss: 0.1558 - b  
inary\_accuracy: 0.8607  
Epoch 90/2000  
1500/1500 [=====] - 0s - loss: 0.1549 - b  
inary\_accuracy: 0.8613  
Epoch 91/2000  
1500/1500 [=====] - 0s - loss: 0.1541 - b  
inary\_accuracy: 0.8613  
Epoch 92/2000  
1500/1500 [=====] - 0s - loss: 0.1533 - b  
inary\_accuracy: 0.8620  
Epoch 93/2000  
1500/1500 [=====] - 0s - loss: 0.1525 - b  
inary\_accuracy: 0.8627  
Epoch 94/2000  
1500/1500 [=====] - 0s - loss: 0.1517 - b  
inary\_accuracy: 0.8633  
Epoch 95/2000  
1500/1500 [=====] - 0s - loss: 0.1509 - b  
inary\_accuracy: 0.8640  
Epoch 96/2000  
1500/1500 [=====] - 0s - loss: 0.1502 - b  
inary\_accuracy: 0.8647  
Epoch 97/2000  
1500/1500 [=====] - 0s - loss: 0.1494 - b  
inary\_accuracy: 0.8653  
Epoch 98/2000  
1500/1500 [=====] - 0s - loss: 0.1487 - b  
inary\_accuracy: 0.8660  
Epoch 99/2000  
1500/1500 [=====] - 0s - loss: 0.1479 - b  
inary\_accuracy: 0.8673  
Epoch 100/2000  
1500/1500 [=====] - 0s - loss: 0.1472 - b  
inary\_accuracy: 0.8667  
Epoch 101/2000  
1500/1500 [=====] - 0s - loss: 0.1465 - b  
inary\_accuracy: 0.8680  
Epoch 102/2000  
1500/1500 [=====] - 0s - loss: 0.1457 - b  
inary\_accuracy: 0.8687  
Epoch 103/2000  
1500/1500 [=====] - 0s - loss: 0.1450 - b  
inary\_accuracy: 0.8693  
Epoch 104/2000  
1500/1500 [=====] - 0s - loss: 0.1443 - b  
inary\_accuracy: 0.8713  
Epoch 105/2000  
1500/1500 [=====] - 0s - loss: 0.1437 - b  
inary\_accuracy: 0.8720  
Epoch 106/2000  
1500/1500 [=====] - 0s - loss: 0.1430 - b  
inary\_accuracy: 0.8727  
Epoch 107/2000  
1500/1500 [=====] - 0s - loss: 0.1423 - b

inary\_accuracy: 0.8727  
Epoch 108/2000  
1500/1500 [=====] - 0s - loss: 0.1417 - b  
inary\_accuracy: 0.8733  
Epoch 109/2000  
1500/1500 [=====] - 0s - loss: 0.1410 - b  
inary\_accuracy: 0.8740  
Epoch 110/2000  
1500/1500 [=====] - 0s - loss: 0.1404 - b  
inary\_accuracy: 0.8740  
Epoch 111/2000  
1500/1500 [=====] - 0s - loss: 0.1397 - b  
inary\_accuracy: 0.8740  
Epoch 112/2000  
1500/1500 [=====] - 0s - loss: 0.1391 - b  
inary\_accuracy: 0.8740  
Epoch 113/2000  
1500/1500 [=====] - 0s - loss: 0.1385 - b  
inary\_accuracy: 0.8747  
Epoch 114/2000  
1500/1500 [=====] - 0s - loss: 0.1379 - b  
inary\_accuracy: 0.8747  
Epoch 115/2000  
1500/1500 [=====] - 0s - loss: 0.1373 - b  
inary\_accuracy: 0.8747  
Epoch 116/2000  
1500/1500 [=====] - 0s - loss: 0.1367 - b  
inary\_accuracy: 0.8747  
Epoch 117/2000  
1500/1500 [=====] - 0s - loss: 0.1361 - b  
inary\_accuracy: 0.8747  
Epoch 118/2000  
1500/1500 [=====] - 0s - loss: 0.1355 - b  
inary\_accuracy: 0.8747  
Epoch 119/2000  
1500/1500 [=====] - 0s - loss: 0.1350 - b  
inary\_accuracy: 0.8740  
Epoch 120/2000  
1500/1500 [=====] - 0s - loss: 0.1344 - b  
inary\_accuracy: 0.8753  
Epoch 121/2000  
1500/1500 [=====] - 0s - loss: 0.1338 - b  
inary\_accuracy: 0.8753  
Epoch 122/2000  
1500/1500 [=====] - 0s - loss: 0.1333 - b  
inary\_accuracy: 0.8760  
Epoch 123/2000  
1500/1500 [=====] - 0s - loss: 0.1328 - b  
inary\_accuracy: 0.8760  
Epoch 124/2000  
1500/1500 [=====] - 0s - loss: 0.1322 - b  
inary\_accuracy: 0.8767  
Epoch 125/2000  
1500/1500 [=====] - 0s - loss: 0.1317 - b  
inary\_accuracy: 0.8760  
Epoch 126/2000  
1500/1500 [=====] - 0s - loss: 0.1312 - b

inary\_accuracy: 0.8767  
Epoch 127/2000  
1500/1500 [=====] - 0s - loss: 0.1307 - b  
inary\_accuracy: 0.8773  
Epoch 128/2000  
1500/1500 [=====] - 0s - loss: 0.1302 - b  
inary\_accuracy: 0.8773  
Epoch 129/2000  
1500/1500 [=====] - 0s - loss: 0.1297 - b  
inary\_accuracy: 0.8773  
Epoch 130/2000  
1500/1500 [=====] - 0s - loss: 0.1292 - b  
inary\_accuracy: 0.8773  
Epoch 131/2000  
1500/1500 [=====] - 0s - loss: 0.1287 - b  
inary\_accuracy: 0.8773  
Epoch 132/2000  
1500/1500 [=====] - 0s - loss: 0.1282 - b  
inary\_accuracy: 0.8767  
Epoch 133/2000  
1500/1500 [=====] - 0s - loss: 0.1277 - b  
inary\_accuracy: 0.8767  
Epoch 134/2000  
1500/1500 [=====] - 0s - loss: 0.1273 - b  
inary\_accuracy: 0.8773  
Epoch 135/2000  
1500/1500 [=====] - 0s - loss: 0.1268 - b  
inary\_accuracy: 0.8780  
Epoch 136/2000  
1500/1500 [=====] - 0s - loss: 0.1264 - b  
inary\_accuracy: 0.8787  
Epoch 137/2000  
1500/1500 [=====] - 0s - loss: 0.1259 - b  
inary\_accuracy: 0.8780  
Epoch 138/2000  
1500/1500 [=====] - 0s - loss: 0.1255 - b  
inary\_accuracy: 0.8780  
Epoch 139/2000  
1500/1500 [=====] - 0s - loss: 0.1251 - b  
inary\_accuracy: 0.8787  
Epoch 140/2000  
1500/1500 [=====] - 0s - loss: 0.1246 - b  
inary\_accuracy: 0.8787  
Epoch 141/2000  
1500/1500 [=====] - 0s - loss: 0.1242 - b  
inary\_accuracy: 0.8793  
Epoch 142/2000  
1500/1500 [=====] - 0s - loss: 0.1238 - b  
inary\_accuracy: 0.8793  
Epoch 143/2000  
1500/1500 [=====] - 0s - loss: 0.1234 - b  
inary\_accuracy: 0.8793  
Epoch 144/2000  
1500/1500 [=====] - 0s - loss: 0.1230 - b  
inary\_accuracy: 0.8800  
Epoch 145/2000  
1500/1500 [=====] - 0s - loss: 0.1226 - b



inary\_accuracy: 0.8800  
Epoch 146/2000  
1500/1500 [=====] - 0s - loss: 0.1222 - b  
inary\_accuracy: 0.8807  
Epoch 147/2000  
1500/1500 [=====] - 0s - loss: 0.1218 - b  
inary\_accuracy: 0.8807  
Epoch 148/2000  
1500/1500 [=====] - 0s - loss: 0.1214 - b  
inary\_accuracy: 0.8807  
Epoch 149/2000  
1500/1500 [=====] - 0s - loss: 0.1210 - b  
inary\_accuracy: 0.8807  
Epoch 150/2000  
1500/1500 [=====] - 0s - loss: 0.1206 - b  
inary\_accuracy: 0.8807  
Epoch 151/2000  
1500/1500 [=====] - 0s - loss: 0.1203 - b  
inary\_accuracy: 0.8813  
Epoch 152/2000  
1500/1500 [=====] - 0s - loss: 0.1199 - b  
inary\_accuracy: 0.8820  
Epoch 153/2000  
1500/1500 [=====] - 0s - loss: 0.1196 - b  
inary\_accuracy: 0.8820  
Epoch 154/2000  
1500/1500 [=====] - 0s - loss: 0.1192 - b  
inary\_accuracy: 0.8820  
Epoch 155/2000  
1500/1500 [=====] - 0s - loss: 0.1189 - b  
inary\_accuracy: 0.8820  
Epoch 156/2000  
1500/1500 [=====] - 0s - loss: 0.1185 - b  
inary\_accuracy: 0.8820  
Epoch 157/2000  
1500/1500 [=====] - 0s - loss: 0.1182 - b  
inary\_accuracy: 0.8820  
Epoch 158/2000  
1500/1500 [=====] - 0s - loss: 0.1178 - b  
inary\_accuracy: 0.8820  
Epoch 159/2000  
1500/1500 [=====] - 0s - loss: 0.1175 - b  
inary\_accuracy: 0.8813  
Epoch 160/2000  
1500/1500 [=====] - 0s - loss: 0.1172 - b  
inary\_accuracy: 0.8813  
Epoch 161/2000  
1500/1500 [=====] - 0s - loss: 0.1169 - b  
inary\_accuracy: 0.8813  
Epoch 162/2000  
1500/1500 [=====] - 0s - loss: 0.1165 - b  
inary\_accuracy: 0.8813  
Epoch 163/2000  
1500/1500 [=====] - 0s - loss: 0.1162 - b  
inary\_accuracy: 0.8813  
Epoch 164/2000  
1500/1500 [=====] - 0s - loss: 0.1159 - b

inary\_accuracy: 0.8813  
Epoch 165/2000  
1500/1500 [=====] - 0s - loss: 0.1156 - b  
inary\_accuracy: 0.8820  
Epoch 166/2000  
1500/1500 [=====] - 0s - loss: 0.1153 - b  
inary\_accuracy: 0.8827  
Epoch 167/2000  
1500/1500 [=====] - 0s - loss: 0.1150 - b  
inary\_accuracy: 0.8833  
Epoch 168/2000  
1500/1500 [=====] - 0s - loss: 0.1147 - b  
inary\_accuracy: 0.8847  
Epoch 169/2000  
1500/1500 [=====] - 0s - loss: 0.1144 - b  
inary\_accuracy: 0.8847  
Epoch 170/2000  
1500/1500 [=====] - 0s - loss: 0.1141 - b  
inary\_accuracy: 0.8853  
Epoch 171/2000  
1500/1500 [=====] - 0s - loss: 0.1139 - b  
inary\_accuracy: 0.8847  
Epoch 172/2000  
1500/1500 [=====] - 0s - loss: 0.1136 - b  
inary\_accuracy: 0.8867  
Epoch 173/2000  
1500/1500 [=====] - 0s - loss: 0.1133 - b  
inary\_accuracy: 0.8867  
Epoch 174/2000  
1500/1500 [=====] - 0s - loss: 0.1130 - b  
inary\_accuracy: 0.8873  
Epoch 175/2000  
1500/1500 [=====] - 0s - loss: 0.1128 - b  
inary\_accuracy: 0.8873  
Epoch 176/2000  
1500/1500 [=====] - 0s - loss: 0.1125 - b  
inary\_accuracy: 0.8873  
Epoch 177/2000  
1500/1500 [=====] - 0s - loss: 0.1122 - b  
inary\_accuracy: 0.8873  
Epoch 178/2000  
1500/1500 [=====] - 0s - loss: 0.1120 - b  
inary\_accuracy: 0.8873  
Epoch 179/2000  
1500/1500 [=====] - 0s - loss: 0.1117 - b  
inary\_accuracy: 0.8873  
Epoch 180/2000  
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inary\_accuracy: 0.8867  
Epoch 181/2000  
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inary\_accuracy: 0.8867  
Epoch 182/2000  
1500/1500 [=====] - 0s - loss: 0.1110 - b  
inary\_accuracy: 0.8873  
Epoch 183/2000  
1500/1500 [=====] - 0s - loss: 0.1107 - b

inary\_accuracy: 0.8867  
Epoch 184/2000  
1500/1500 [=====] - 0s - loss: 0.1105 - b  
inary\_accuracy: 0.8873  
Epoch 185/2000  
1500/1500 [=====] - 0s - loss: 0.1103 - b  
inary\_accuracy: 0.8867  
Epoch 186/2000  
1500/1500 [=====] - 0s - loss: 0.1100 - b  
inary\_accuracy: 0.8873  
Epoch 187/2000  
1500/1500 [=====] - 0s - loss: 0.1098 - b  
inary\_accuracy: 0.8873  
Epoch 188/2000  
1500/1500 [=====] - 0s - loss: 0.1096 - b  
inary\_accuracy: 0.8873  
Epoch 189/2000  
1500/1500 [=====] - 0s - loss: 0.1094 - b  
inary\_accuracy: 0.8873  
Epoch 190/2000  
1500/1500 [=====] - 0s - loss: 0.1091 - b  
inary\_accuracy: 0.8873  
Epoch 191/2000  
1500/1500 [=====] - 0s - loss: 0.1089 - b  
inary\_accuracy: 0.8867  
Epoch 192/2000  
1500/1500 [=====] - 0s - loss: 0.1087 - b  
inary\_accuracy: 0.8867  
Epoch 193/2000  
1500/1500 [=====] - 0s - loss: 0.1085 - b  
inary\_accuracy: 0.8873  
Epoch 194/2000  
1500/1500 [=====] - 0s - loss: 0.1083 - b  
inary\_accuracy: 0.8873  
Epoch 195/2000  
1500/1500 [=====] - 0s - loss: 0.1081 - b  
inary\_accuracy: 0.8873  
Epoch 196/2000  
1500/1500 [=====] - 0s - loss: 0.1079 - b  
inary\_accuracy: 0.8880  
Epoch 197/2000  
1500/1500 [=====] - 0s - loss: 0.1077 - b  
inary\_accuracy: 0.8873  
Epoch 198/2000  
1500/1500 [=====] - 0s - loss: 0.1075 - b  
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Epoch 199/2000  
1500/1500 [=====] - 0s - loss: 0.1073 - b  
inary\_accuracy: 0.8880  
Epoch 200/2000  
1500/1500 [=====] - 0s - loss: 0.1071 - b  
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Epoch 201/2000  
1500/1500 [=====] - 0s - loss: 0.1069 - b  
inary\_accuracy: 0.8880  
Epoch 202/2000  
1500/1500 [=====] - 0s - loss: 0.1067 - b

inary\_accuracy: 0.8880  
Epoch 203/2000  
1500/1500 [=====] - 0s - loss: 0.1065 - b  
inary\_accuracy: 0.8887  
Epoch 204/2000  
1500/1500 [=====] - 0s - loss: 0.1063 - b  
inary\_accuracy: 0.8887  
Epoch 205/2000  
1500/1500 [=====] - 0s - loss: 0.1061 - b  
inary\_accuracy: 0.8887  
Epoch 206/2000  
1500/1500 [=====] - 0s - loss: 0.1059 - b  
inary\_accuracy: 0.8887  
Epoch 207/2000  
1500/1500 [=====] - 0s - loss: 0.1058 - b  
inary\_accuracy: 0.8887  
Epoch 208/2000  
1500/1500 [=====] - 0s - loss: 0.1056 - b  
inary\_accuracy: 0.8887  
Epoch 209/2000  
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inary\_accuracy: 0.8887  
Epoch 210/2000  
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Epoch 211/2000  
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Epoch 212/2000  
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inary\_accuracy: 0.8887  
Epoch 213/2000  
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inary\_accuracy: 0.8887  
Epoch 214/2000  
1500/1500 [=====] - 0s - loss: 0.1046 - b  
inary\_accuracy: 0.8887  
Epoch 215/2000  
1500/1500 [=====] - 0s - loss: 0.1044 - b  
inary\_accuracy: 0.8887  
Epoch 216/2000  
1500/1500 [=====] - 0s - loss: 0.1042 - b  
inary\_accuracy: 0.8887  
Epoch 217/2000  
1500/1500 [=====] - 0s - loss: 0.1041 - b  
inary\_accuracy: 0.8887  
Epoch 218/2000  
1500/1500 [=====] - 0s - loss: 0.1039 - b  
inary\_accuracy: 0.8887  
Epoch 219/2000  
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Epoch 220/2000  
1500/1500 [=====] - 0s - loss: 0.1036 - b  
inary\_accuracy: 0.8880  
Epoch 221/2000  
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inary\_accuracy: 0.8887  
Epoch 222/2000  
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inary\_accuracy: 0.8880  
Epoch 223/2000  
1500/1500 [=====] - 0s - loss: 0.1032 - b  
inary\_accuracy: 0.8880  
Epoch 224/2000  
1500/1500 [=====] - 0s - loss: 0.1030 - b  
inary\_accuracy: 0.8873  
Epoch 225/2000  
1500/1500 [=====] - 0s - loss: 0.1029 - b  
inary\_accuracy: 0.8880  
Epoch 226/2000  
1500/1500 [=====] - 0s - loss: 0.1027 - b  
inary\_accuracy: 0.8880  
Epoch 227/2000  
1500/1500 [=====] - 0s - loss: 0.1026 - b  
inary\_accuracy: 0.8880  
Epoch 228/2000  
1500/1500 [=====] - 0s - loss: 0.1024 - b  
inary\_accuracy: 0.8887  
Epoch 229/2000  
1500/1500 [=====] - 0s - loss: 0.1023 - b  
inary\_accuracy: 0.8887  
Epoch 230/2000  
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inary\_accuracy: 0.8887  
Epoch 231/2000  
1500/1500 [=====] - 0s - loss: 0.1020 - b  
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Epoch 232/2000  
1500/1500 [=====] - 0s - loss: 0.1019 - b  
inary\_accuracy: 0.8887  
Epoch 233/2000  
1500/1500 [=====] - 0s - loss: 0.1017 - b  
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Epoch 234/2000  
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Epoch 235/2000  
1500/1500 [=====] - 0s - loss: 0.1015 - b  
inary\_accuracy: 0.8887  
Epoch 236/2000  
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inary\_accuracy: 0.8887  
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inary\_accuracy: 0.8887  
Epoch 238/2000  
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inary\_accuracy: 0.8887  
Epoch 239/2000  
1500/1500 [=====] - 0s - loss: 0.1010 - b  
inary\_accuracy: 0.8887  
Epoch 240/2000  
1500/1500 [=====] - 0s - loss: 0.1008 - b

inary\_accuracy: 0.8887  
Epoch 241/2000  
1500/1500 [=====] - 0s - loss: 0.1007 - b  
inary\_accuracy: 0.8887  
Epoch 242/2000  
1500/1500 [=====] - 0s - loss: 0.1006 - b  
inary\_accuracy: 0.8887  
Epoch 243/2000  
1500/1500 [=====] - 0s - loss: 0.1005 - b  
inary\_accuracy: 0.8887  
Epoch 244/2000  
1500/1500 [=====] - 0s - loss: 0.1004 - b  
inary\_accuracy: 0.8900  
Epoch 245/2000  
1500/1500 [=====] - 0s - loss: 0.1002 - b  
inary\_accuracy: 0.8893  
Epoch 246/2000  
1500/1500 [=====] - 0s - loss: 0.1001 - b  
inary\_accuracy: 0.8900  
Epoch 247/2000  
1500/1500 [=====] - 0s - loss: 0.1000 - b  
inary\_accuracy: 0.8900  
Epoch 248/2000  
1500/1500 [=====] - 0s - loss: 0.0999 - b  
inary\_accuracy: 0.8907  
Epoch 249/2000  
1500/1500 [=====] - 0s - loss: 0.0998 - b  
inary\_accuracy: 0.8907  
Epoch 250/2000  
1500/1500 [=====] - 0s - loss: 0.0997 - b  
inary\_accuracy: 0.8907  
Epoch 251/2000  
1500/1500 [=====] - 0s - loss: 0.0996 - b  
inary\_accuracy: 0.8900  
Epoch 252/2000  
1500/1500 [=====] - 0s - loss: 0.0995 - b  
inary\_accuracy: 0.8900  
Epoch 253/2000  
1500/1500 [=====] - 0s - loss: 0.0993 - b  
inary\_accuracy: 0.8907  
Epoch 254/2000  
1500/1500 [=====] - 0s - loss: 0.0992 - b  
inary\_accuracy: 0.8900  
Epoch 255/2000  
1500/1500 [=====] - 0s - loss: 0.0991 - b  
inary\_accuracy: 0.8900  
Epoch 256/2000  
1500/1500 [=====] - 0s - loss: 0.0990 - b  
inary\_accuracy: 0.8900  
Epoch 257/2000  
1500/1500 [=====] - 0s - loss: 0.0989 - b  
inary\_accuracy: 0.8907  
Epoch 258/2000  
1500/1500 [=====] - 0s - loss: 0.0988 - b  
inary\_accuracy: 0.8913  
Epoch 259/2000  
1500/1500 [=====] - 0s - loss: 0.0987 - b

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Epoch 260/2000  
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inary\_accuracy: 0.8920  
Epoch 262/2000  
1500/1500 [=====] - 0s - loss: 0.0984 - b  
inary\_accuracy: 0.8920  
Epoch 263/2000  
1500/1500 [=====] - 0s - loss: 0.0983 - b  
inary\_accuracy: 0.8920  
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inary\_accuracy: 0.8920  
Epoch 265/2000  
1500/1500 [=====] - 0s - loss: 0.0981 - b  
inary\_accuracy: 0.8920  
Epoch 266/2000  
1500/1500 [=====] - 0s - loss: 0.0980 - b  
inary\_accuracy: 0.8920  
Epoch 267/2000  
1500/1500 [=====] - 0s - loss: 0.0979 - b  
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Epoch 268/2000  
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1500/1500 [=====] - 0s - loss: 0.0974 - b  
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Epoch 274/2000  
1500/1500 [=====] - 0s - loss: 0.0973 - b  
inary\_accuracy: 0.8920  
Epoch 275/2000  
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Epoch 277/2000  
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Epoch 278/2000  
1500/1500 [=====] - 0s - loss: 0.0970 - b

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Epoch 279/2000  
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1500/1500 [=====] - 0s - loss: 0.0966 - b  
inary\_accuracy: 0.8920  
Epoch 283/2000  
1500/1500 [=====] - 0s - loss: 0.0965 - b  
inary\_accuracy: 0.8927  
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1500/1500 [=====] - 0s - loss: 0.0964 - b  
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Epoch 286/2000  
1500/1500 [=====] - 0s - loss: 0.0963 - b  
inary\_accuracy: 0.8927  
Epoch 287/2000  
1500/1500 [=====] - 0s - loss: 0.0962 - b  
inary\_accuracy: 0.8927  
Epoch 288/2000  
1500/1500 [=====] - 0s - loss: 0.0962 - b  
inary\_accuracy: 0.8927  
Epoch 289/2000  
1500/1500 [=====] - 0s - loss: 0.0961 - b  
inary\_accuracy: 0.8927  
Epoch 290/2000  
1500/1500 [=====] - 0s - loss: 0.0960 - b  
inary\_accuracy: 0.8927  
Epoch 291/2000  
1500/1500 [=====] - 0s - loss: 0.0959 - b  
inary\_accuracy: 0.8927  
Epoch 292/2000  
1500/1500 [=====] - 0s - loss: 0.0959 - b  
inary\_accuracy: 0.8927  
Epoch 293/2000  
1500/1500 [=====] - 0s - loss: 0.0958 - b  
inary\_accuracy: 0.8927  
Epoch 294/2000  
1500/1500 [=====] - 0s - loss: 0.0957 - b  
inary\_accuracy: 0.8927  
Epoch 295/2000  
1500/1500 [=====] - 0s - loss: 0.0956 - b  
inary\_accuracy: 0.8927  
Epoch 296/2000  
1500/1500 [=====] - 0s - loss: 0.0956 - b  
inary\_accuracy: 0.8927  
Epoch 297/2000  
1500/1500 [=====] - 0s - loss: 0.0955 - b



inary\_accuracy: 0.8927  
Epoch 298/2000  
1500/1500 [=====] - 0s - loss: 0.0954 - b  
inary\_accuracy: 0.8927  
Epoch 299/2000  
1500/1500 [=====] - 0s - loss: 0.0953 - b  
inary\_accuracy: 0.8927  
Epoch 300/2000  
1500/1500 [=====] - 0s - loss: 0.0953 - b  
inary\_accuracy: 0.8927  
Epoch 301/2000  
1500/1500 [=====] - 0s - loss: 0.0952 - b  
inary\_accuracy: 0.8927  
Epoch 302/2000  
1500/1500 [=====] - 0s - loss: 0.0951 - b  
inary\_accuracy: 0.8927  
Epoch 303/2000  
1500/1500 [=====] - 0s - loss: 0.0951 - b  
inary\_accuracy: 0.8933  
Epoch 304/2000  
1500/1500 [=====] - 0s - loss: 0.0950 - b  
inary\_accuracy: 0.8933  
Epoch 305/2000  
1500/1500 [=====] - 0s - loss: 0.0949 - b  
inary\_accuracy: 0.8933  
Epoch 306/2000  
1500/1500 [=====] - 0s - loss: 0.0949 - b  
inary\_accuracy: 0.8940  
Epoch 307/2000  
1500/1500 [=====] - 0s - loss: 0.0948 - b  
inary\_accuracy: 0.8940  
Epoch 308/2000  
1500/1500 [=====] - 0s - loss: 0.0947 - b  
inary\_accuracy: 0.8940  
Epoch 309/2000  
1500/1500 [=====] - 0s - loss: 0.0947 - b  
inary\_accuracy: 0.8947  
Epoch 310/2000  
1500/1500 [=====] - 0s - loss: 0.0946 - b  
inary\_accuracy: 0.8940  
Epoch 311/2000  
1500/1500 [=====] - 0s - loss: 0.0946 - b  
inary\_accuracy: 0.8947  
Epoch 312/2000  
1500/1500 [=====] - 0s - loss: 0.0945 - b  
inary\_accuracy: 0.8947  
Epoch 313/2000  
1500/1500 [=====] - 0s - loss: 0.0944 - b  
inary\_accuracy: 0.8947  
Epoch 314/2000  
1500/1500 [=====] - 0s - loss: 0.0944 - b  
inary\_accuracy: 0.8947  
Epoch 315/2000  
1500/1500 [=====] - 0s - loss: 0.0943 - b  
inary\_accuracy: 0.8947  
Epoch 316/2000  
1500/1500 [=====] - 0s - loss: 0.0942 - b

inary\_accuracy: 0.8947  
Epoch 317/2000  
1500/1500 [=====] - 0s - loss: 0.0942 - b  
inary\_accuracy: 0.8947  
Epoch 318/2000  
1500/1500 [=====] - 0s - loss: 0.0941 - b  
inary\_accuracy: 0.8947  
Epoch 319/2000  
1500/1500 [=====] - 0s - loss: 0.0941 - b  
inary\_accuracy: 0.8947  
Epoch 320/2000  
1500/1500 [=====] - 0s - loss: 0.0940 - b  
inary\_accuracy: 0.8947  
Epoch 321/2000  
1500/1500 [=====] - 0s - loss: 0.0940 - b  
inary\_accuracy: 0.8947  
Epoch 322/2000  
1500/1500 [=====] - 0s - loss: 0.0939 - b  
inary\_accuracy: 0.8947  
Epoch 323/2000  
1500/1500 [=====] - 0s - loss: 0.0938 - b  
inary\_accuracy: 0.8947  
Epoch 324/2000  
1500/1500 [=====] - 0s - loss: 0.0938 - b  
inary\_accuracy: 0.8953  
Epoch 325/2000  
1500/1500 [=====] - 0s - loss: 0.0937 - b  
inary\_accuracy: 0.8953  
Epoch 326/2000  
1500/1500 [=====] - 0s - loss: 0.0937 - b  
inary\_accuracy: 0.8953  
Epoch 327/2000  
1500/1500 [=====] - 0s - loss: 0.0936 - b  
inary\_accuracy: 0.8953  
Epoch 328/2000  
1500/1500 [=====] - 0s - loss: 0.0936 - b  
inary\_accuracy: 0.8953  
Epoch 329/2000  
1500/1500 [=====] - 0s - loss: 0.0935 - b  
inary\_accuracy: 0.8953  
Epoch 330/2000  
1500/1500 [=====] - 0s - loss: 0.0935 - b  
inary\_accuracy: 0.8953  
Epoch 331/2000  
1500/1500 [=====] - 0s - loss: 0.0934 - b  
inary\_accuracy: 0.8953  
Epoch 332/2000  
1500/1500 [=====] - 0s - loss: 0.0933 - b  
inary\_accuracy: 0.8953  
Epoch 333/2000  
1500/1500 [=====] - 0s - loss: 0.0933 - b  
inary\_accuracy: 0.8953  
Epoch 334/2000  
1500/1500 [=====] - 0s - loss: 0.0932 - b  
inary\_accuracy: 0.8953  
Epoch 335/2000  
1500/1500 [=====] - 0s - loss: 0.0932 - b

inary\_accuracy: 0.8953  
Epoch 336/2000  
1500/1500 [=====] - 0s - loss: 0.0931 - b  
inary\_accuracy: 0.8953  
Epoch 337/2000  
1500/1500 [=====] - 0s - loss: 0.0931 - b  
inary\_accuracy: 0.8953  
Epoch 338/2000  
1500/1500 [=====] - 0s - loss: 0.0930 - b  
inary\_accuracy: 0.8953  
Epoch 339/2000  
1500/1500 [=====] - 0s - loss: 0.0930 - b  
inary\_accuracy: 0.8960  
Epoch 340/2000  
1500/1500 [=====] - 0s - loss: 0.0929 - b  
inary\_accuracy: 0.8960  
Epoch 341/2000  
1500/1500 [=====] - 0s - loss: 0.0929 - b  
inary\_accuracy: 0.8960  
Epoch 342/2000  
1500/1500 [=====] - 0s - loss: 0.0928 - b  
inary\_accuracy: 0.8960  
Epoch 343/2000  
1500/1500 [=====] - 0s - loss: 0.0928 - b  
inary\_accuracy: 0.8967  
Epoch 344/2000  
1500/1500 [=====] - 0s - loss: 0.0927 - b  
inary\_accuracy: 0.8967  
Epoch 345/2000  
1500/1500 [=====] - 0s - loss: 0.0927 - b  
inary\_accuracy: 0.8967  
Epoch 346/2000  
1500/1500 [=====] - 0s - loss: 0.0927 - b  
inary\_accuracy: 0.8967  
Epoch 347/2000  
1500/1500 [=====] - 0s - loss: 0.0926 - b  
inary\_accuracy: 0.8967  
Epoch 348/2000  
1500/1500 [=====] - 0s - loss: 0.0926 - b  
inary\_accuracy: 0.8967  
Epoch 349/2000  
1500/1500 [=====] - 0s - loss: 0.0925 - b  
inary\_accuracy: 0.8967  
Epoch 350/2000  
1500/1500 [=====] - 0s - loss: 0.0925 - b  
inary\_accuracy: 0.8967  
Epoch 351/2000  
1500/1500 [=====] - 0s - loss: 0.0924 - b  
inary\_accuracy: 0.8967  
Epoch 352/2000  
1500/1500 [=====] - 0s - loss: 0.0924 - b  
inary\_accuracy: 0.8967  
Epoch 353/2000  
1500/1500 [=====] - 0s - loss: 0.0923 - b  
inary\_accuracy: 0.8967  
Epoch 354/2000  
1500/1500 [=====] - 0s - loss: 0.0923 - b

inary\_accuracy: 0.8967  
Epoch 355/2000  
1500/1500 [=====] - 0s - loss: 0.0922 - b  
inary\_accuracy: 0.8967  
Epoch 356/2000  
1500/1500 [=====] - 0s - loss: 0.0922 - b  
inary\_accuracy: 0.8967  
Epoch 357/2000  
1500/1500 [=====] - 0s - loss: 0.0922 - b  
inary\_accuracy: 0.8967  
Epoch 358/2000  
1500/1500 [=====] - 0s - loss: 0.0921 - b  
inary\_accuracy: 0.8967  
Epoch 359/2000  
1500/1500 [=====] - 0s - loss: 0.0921 - b  
inary\_accuracy: 0.8967  
Epoch 360/2000  
1500/1500 [=====] - 0s - loss: 0.0920 - b  
inary\_accuracy: 0.8967  
Epoch 361/2000  
1500/1500 [=====] - 0s - loss: 0.0920 - b  
inary\_accuracy: 0.8967  
Epoch 362/2000  
1500/1500 [=====] - 0s - loss: 0.0920 - b  
inary\_accuracy: 0.8967  
Epoch 363/2000  
1500/1500 [=====] - 0s - loss: 0.0919 - b  
inary\_accuracy: 0.8967  
Epoch 364/2000  
1500/1500 [=====] - 0s - loss: 0.0919 - b  
inary\_accuracy: 0.8967  
Epoch 365/2000  
1500/1500 [=====] - 0s - loss: 0.0918 - b  
inary\_accuracy: 0.8967  
Epoch 366/2000  
1500/1500 [=====] - 0s - loss: 0.0918 - b  
inary\_accuracy: 0.8967  
Epoch 367/2000  
1500/1500 [=====] - 0s - loss: 0.0917 - b  
inary\_accuracy: 0.8967  
Epoch 368/2000  
1500/1500 [=====] - 0s - loss: 0.0917 - b  
inary\_accuracy: 0.8967  
Epoch 369/2000  
1500/1500 [=====] - 0s - loss: 0.0917 - b  
inary\_accuracy: 0.8967  
Epoch 370/2000  
1500/1500 [=====] - 0s - loss: 0.0916 - b  
inary\_accuracy: 0.8967  
Epoch 371/2000  
1500/1500 [=====] - 0s - loss: 0.0916 - b  
inary\_accuracy: 0.8960  
Epoch 372/2000  
1500/1500 [=====] - 0s - loss: 0.0916 - b  
inary\_accuracy: 0.8960  
Epoch 373/2000  
1500/1500 [=====] - 0s - loss: 0.0915 - b

inary\_accuracy: 0.8960  
Epoch 374/2000  
1500/1500 [=====] - 0s - loss: 0.0915 - b  
inary\_accuracy: 0.8967  
Epoch 375/2000  
1500/1500 [=====] - 0s - loss: 0.0914 - b  
inary\_accuracy: 0.8960  
Epoch 376/2000  
1500/1500 [=====] - 0s - loss: 0.0914 - b  
inary\_accuracy: 0.8967  
Epoch 377/2000  
1500/1500 [=====] - 0s - loss: 0.0914 - b  
inary\_accuracy: 0.8960  
Epoch 378/2000  
1500/1500 [=====] - 0s - loss: 0.0913 - b  
inary\_accuracy: 0.8960  
Epoch 379/2000  
1500/1500 [=====] - 0s - loss: 0.0913 - b  
inary\_accuracy: 0.8960  
Epoch 380/2000  
1500/1500 [=====] - 0s - loss: 0.0913 - b  
inary\_accuracy: 0.8960  
Epoch 381/2000  
1500/1500 [=====] - 0s - loss: 0.0912 - b  
inary\_accuracy: 0.8960  
Epoch 382/2000  
1500/1500 [=====] - 0s - loss: 0.0912 - b  
inary\_accuracy: 0.8967  
Epoch 383/2000  
1500/1500 [=====] - 0s - loss: 0.0912 - b  
inary\_accuracy: 0.8960  
Epoch 384/2000  
1500/1500 [=====] - 0s - loss: 0.0911 - b  
inary\_accuracy: 0.8960  
Epoch 385/2000  
1500/1500 [=====] - 0s - loss: 0.0911 - b  
inary\_accuracy: 0.8960  
Epoch 386/2000  
1500/1500 [=====] - 0s - loss: 0.0911 - b  
inary\_accuracy: 0.8960  
Epoch 387/2000  
1500/1500 [=====] - 0s - loss: 0.0910 - b  
inary\_accuracy: 0.8960  
Epoch 388/2000  
1500/1500 [=====] - 0s - loss: 0.0910 - b  
inary\_accuracy: 0.8967  
Epoch 389/2000  
1500/1500 [=====] - 0s - loss: 0.0909 - b  
inary\_accuracy: 0.8960  
Epoch 390/2000  
1500/1500 [=====] - 0s - loss: 0.0909 - b  
inary\_accuracy: 0.8967  
Epoch 391/2000  
1500/1500 [=====] - 0s - loss: 0.0909 - b  
inary\_accuracy: 0.8960  
Epoch 392/2000  
1500/1500 [=====] - 0s - loss: 0.0908 - b

inary\_accuracy: 0.8960  
Epoch 393/2000  
1500/1500 [=====] - 0s - loss: 0.0908 - b  
inary\_accuracy: 0.8960  
Epoch 394/2000  
1500/1500 [=====] - 0s - loss: 0.0908 - b  
inary\_accuracy: 0.8960  
Epoch 395/2000  
1500/1500 [=====] - 0s - loss: 0.0908 - b  
inary\_accuracy: 0.8967  
Epoch 396/2000  
1500/1500 [=====] - 0s - loss: 0.0907 - b  
inary\_accuracy: 0.8960  
Epoch 397/2000  
1500/1500 [=====] - 0s - loss: 0.0907 - b  
inary\_accuracy: 0.8967  
Epoch 398/2000  
1500/1500 [=====] - 0s - loss: 0.0907 - b  
inary\_accuracy: 0.8960  
Epoch 399/2000  
1500/1500 [=====] - 0s - loss: 0.0906 - b  
inary\_accuracy: 0.8960  
Epoch 400/2000  
1500/1500 [=====] - 0s - loss: 0.0906 - b  
inary\_accuracy: 0.8960  
Epoch 401/2000  
1500/1500 [=====] - 0s - loss: 0.0906 - b  
inary\_accuracy: 0.8967  
Epoch 402/2000  
1500/1500 [=====] - 0s - loss: 0.0905 - b  
inary\_accuracy: 0.8960  
Epoch 403/2000  
1500/1500 [=====] - 0s - loss: 0.0905 - b  
inary\_accuracy: 0.8960  
Epoch 404/2000  
1500/1500 [=====] - 0s - loss: 0.0905 - b  
inary\_accuracy: 0.8967  
Epoch 405/2000  
1500/1500 [=====] - 0s - loss: 0.0904 - b  
inary\_accuracy: 0.8967  
Epoch 406/2000  
1500/1500 [=====] - 0s - loss: 0.0904 - b  
inary\_accuracy: 0.8967  
Epoch 407/2000  
1500/1500 [=====] - 0s - loss: 0.0904 - b  
inary\_accuracy: 0.8967  
Epoch 408/2000  
1500/1500 [=====] - 0s - loss: 0.0903 - b  
inary\_accuracy: 0.8967  
Epoch 409/2000  
1500/1500 [=====] - 0s - loss: 0.0903 - b  
inary\_accuracy: 0.8967  
Epoch 410/2000  
1500/1500 [=====] - 0s - loss: 0.0903 - b  
inary\_accuracy: 0.8967  
Epoch 411/2000  
1500/1500 [=====] - 0s - loss: 0.0903 - b

inary\_accuracy: 0.8967  
Epoch 412/2000  
1500/1500 [=====] - 0s - loss: 0.0902 - b  
inary\_accuracy: 0.8967  
Epoch 413/2000  
1500/1500 [=====] - 0s - loss: 0.0902 - b  
inary\_accuracy: 0.8967  
Epoch 414/2000  
1500/1500 [=====] - 0s - loss: 0.0902 - b  
inary\_accuracy: 0.8967  
Epoch 415/2000  
1500/1500 [=====] - 0s - loss: 0.0901 - b  
inary\_accuracy: 0.8967  
Epoch 416/2000  
1500/1500 [=====] - 0s - loss: 0.0901 - b  
inary\_accuracy: 0.8973  
Epoch 417/2000  
1500/1500 [=====] - 0s - loss: 0.0901 - b  
inary\_accuracy: 0.8973  
Epoch 418/2000  
1500/1500 [=====] - 0s - loss: 0.0901 - b  
inary\_accuracy: 0.8973 - ETA: 0s - loss: 0.0897 - binary\_accu  
acy: 0.896  
Epoch 419/2000  
1500/1500 [=====] - 0s - loss: 0.0900 - b  
inary\_accuracy: 0.8973  
Epoch 420/2000  
1500/1500 [=====] - 0s - loss: 0.0900 - b  
inary\_accuracy: 0.8973  
Epoch 421/2000  
1500/1500 [=====] - 0s - loss: 0.0900 - b  
inary\_accuracy: 0.8973  
Epoch 422/2000  
1500/1500 [=====] - 0s - loss: 0.0900 - b  
inary\_accuracy: 0.8973  
Epoch 423/2000  
1500/1500 [=====] - 0s - loss: 0.0899 - b  
inary\_accuracy: 0.8973  
Epoch 424/2000  
1500/1500 [=====] - 0s - loss: 0.0899 - b  
inary\_accuracy: 0.8973  
Epoch 425/2000  
1500/1500 [=====] - 0s - loss: 0.0899 - b  
inary\_accuracy: 0.8973  
Epoch 426/2000  
1500/1500 [=====] - 0s - loss: 0.0898 - b  
inary\_accuracy: 0.8973  
Epoch 427/2000  
1500/1500 [=====] - 0s - loss: 0.0898 - b  
inary\_accuracy: 0.8973  
Epoch 428/2000  
1500/1500 [=====] - 0s - loss: 0.0898 - b  
inary\_accuracy: 0.8973  
Epoch 429/2000  
1500/1500 [=====] - 0s - loss: 0.0898 - b  
inary\_accuracy: 0.8967  
Epoch 430/2000

1500/1500 [=====] - 0s - loss: 0.0897 - b  
inary\_accuracy: 0.8967  
Epoch 431/2000  
1500/1500 [=====] - 0s - loss: 0.0897 - b  
inary\_accuracy: 0.8967  
Epoch 432/2000  
1500/1500 [=====] - 0s - loss: 0.0897 - b  
inary\_accuracy: 0.8967  
Epoch 433/2000  
1500/1500 [=====] - 0s - loss: 0.0897 - b  
inary\_accuracy: 0.8973  
Epoch 434/2000  
1500/1500 [=====] - 0s - loss: 0.0896 - b  
inary\_accuracy: 0.8967  
Epoch 435/2000  
1500/1500 [=====] - 0s - loss: 0.0896 - b  
inary\_accuracy: 0.8967  
Epoch 436/2000  
1500/1500 [=====] - 0s - loss: 0.0896 - b  
inary\_accuracy: 0.8967  
Epoch 437/2000  
1500/1500 [=====] - 0s - loss: 0.0896 - b  
inary\_accuracy: 0.8967  
Epoch 438/2000  
1500/1500 [=====] - 0s - loss: 0.0895 - b  
inary\_accuracy: 0.8967  
Epoch 439/2000  
1500/1500 [=====] - 0s - loss: 0.0895 - b  
inary\_accuracy: 0.8967  
Epoch 440/2000  
1500/1500 [=====] - 0s - loss: 0.0895 - b  
inary\_accuracy: 0.8973  
Epoch 441/2000  
1500/1500 [=====] - 0s - loss: 0.0895 - b  
inary\_accuracy: 0.8967  
Epoch 442/2000  
1500/1500 [=====] - 0s - loss: 0.0895 - b  
inary\_accuracy: 0.8967  
Epoch 443/2000  
1500/1500 [=====] - 0s - loss: 0.0894 - b  
inary\_accuracy: 0.8967  
Epoch 444/2000  
1500/1500 [=====] - 0s - loss: 0.0894 - b  
inary\_accuracy: 0.8967  
Epoch 445/2000  
1500/1500 [=====] - 0s - loss: 0.0894 - b  
inary\_accuracy: 0.8967  
Epoch 446/2000  
1500/1500 [=====] - 0s - loss: 0.0894 - b  
inary\_accuracy: 0.8967  
Epoch 447/2000  
1500/1500 [=====] - 0s - loss: 0.0893 - b  
inary\_accuracy: 0.8967  
Epoch 448/2000  
1500/1500 [=====] - 0s - loss: 0.0893 - b  
inary\_accuracy: 0.8973  
Epoch 449/2000



1500/1500 [=====] - 0s - loss: 0.0893 - b  
inary\_accuracy: 0.8973  
Epoch 450/2000  
1500/1500 [=====] - 0s - loss: 0.0893 - b  
inary\_accuracy: 0.8973  
Epoch 451/2000  
1500/1500 [=====] - 0s - loss: 0.0892 - b  
inary\_accuracy: 0.8980  
Epoch 452/2000  
1500/1500 [=====] - 0s - loss: 0.0892 - b  
inary\_accuracy: 0.8980  
Epoch 453/2000  
1500/1500 [=====] - 0s - loss: 0.0892 - b  
inary\_accuracy: 0.8987  
Epoch 454/2000  
1500/1500 [=====] - 0s - loss: 0.0892 - b  
inary\_accuracy: 0.8980  
Epoch 455/2000  
1500/1500 [=====] - 0s - loss: 0.0892 - b  
inary\_accuracy: 0.8980  
Epoch 456/2000  
1500/1500 [=====] - 0s - loss: 0.0891 - b  
inary\_accuracy: 0.8987  
Epoch 457/2000  
1500/1500 [=====] - 0s - loss: 0.0891 - b  
inary\_accuracy: 0.8987  
Epoch 458/2000  
1500/1500 [=====] - 0s - loss: 0.0891 - b  
inary\_accuracy: 0.8987  
Epoch 459/2000  
1500/1500 [=====] - 0s - loss: 0.0891 - b  
inary\_accuracy: 0.8987  
Epoch 460/2000  
1500/1500 [=====] - 0s - loss: 0.0891 - b  
inary\_accuracy: 0.8987  
Epoch 461/2000  
1500/1500 [=====] - 0s - loss: 0.0890 - b  
inary\_accuracy: 0.8987  
Epoch 462/2000  
1500/1500 [=====] - 0s - loss: 0.0890 - b  
inary\_accuracy: 0.8987  
Epoch 463/2000  
1500/1500 [=====] - 0s - loss: 0.0890 - b  
inary\_accuracy: 0.8987  
Epoch 464/2000  
1500/1500 [=====] - 0s - loss: 0.0890 - b  
inary\_accuracy: 0.8987  
Epoch 465/2000  
1500/1500 [=====] - 0s - loss: 0.0889 - b  
inary\_accuracy: 0.8987  
Epoch 466/2000  
1500/1500 [=====] - 0s - loss: 0.0889 - b  
inary\_accuracy: 0.8987  
Epoch 467/2000  
1500/1500 [=====] - 0s - loss: 0.0889 - b  
inary\_accuracy: 0.8987  
Epoch 468/2000

1500/1500 [=====] - 0s - loss: 0.0889 - b  
inary\_accuracy: 0.8987  
Epoch 469/2000  
1500/1500 [=====] - 0s - loss: 0.0889 - b  
inary\_accuracy: 0.8987  
Epoch 470/2000  
1500/1500 [=====] - 0s - loss: 0.0888 - b  
inary\_accuracy: 0.8987  
Epoch 471/2000  
1500/1500 [=====] - 0s - loss: 0.0888 - b  
inary\_accuracy: 0.8987  
Epoch 472/2000  
1500/1500 [=====] - 0s - loss: 0.0888 - b  
inary\_accuracy: 0.8987  
Epoch 473/2000  
1500/1500 [=====] - 0s - loss: 0.0888 - b  
inary\_accuracy: 0.8993  
Epoch 474/2000  
1500/1500 [=====] - 0s - loss: 0.0888 - b  
inary\_accuracy: 0.9000  
Epoch 475/2000  
1500/1500 [=====] - 0s - loss: 0.0887 - b  
inary\_accuracy: 0.9000  
Epoch 476/2000  
1500/1500 [=====] - 0s - loss: 0.0887 - b  
inary\_accuracy: 0.8993  
Epoch 477/2000  
1500/1500 [=====] - 0s - loss: 0.0887 - b  
inary\_accuracy: 0.8993  
Epoch 478/2000  
1500/1500 [=====] - 0s - loss: 0.0887 - b  
inary\_accuracy: 0.9000  
Epoch 479/2000  
1500/1500 [=====] - 0s - loss: 0.0887 - b  
inary\_accuracy: 0.9000  
Epoch 480/2000  
1500/1500 [=====] - 0s - loss: 0.0887 - b  
inary\_accuracy: 0.9000  
Epoch 481/2000  
1500/1500 [=====] - 0s - loss: 0.0886 - b  
inary\_accuracy: 0.8987  
Epoch 482/2000  
1500/1500 [=====] - 0s - loss: 0.0886 - b  
inary\_accuracy: 0.9000  
Epoch 483/2000  
1500/1500 [=====] - 0s - loss: 0.0886 - b  
inary\_accuracy: 0.9000  
Epoch 484/2000  
1500/1500 [=====] - 0s - loss: 0.0886 - b  
inary\_accuracy: 0.8993  
Epoch 485/2000  
1500/1500 [=====] - 0s - loss: 0.0886 - b  
inary\_accuracy: 0.9000  
Epoch 486/2000  
1500/1500 [=====] - 0s - loss: 0.0885 - b  
inary\_accuracy: 0.9000  
Epoch 487/2000

1500/1500 [=====] - 0s - loss: 0.0885 - binary\_accuracy: 0.9000  
Epoch 488/2000  
1500/1500 [=====] - 0s - loss: 0.0885 - binary\_accuracy: 0.9007  
Epoch 489/2000  
1500/1500 [=====] - 0s - loss: 0.0885 - binary\_accuracy: 0.9007  
Epoch 490/2000  
1500/1500 [=====] - 0s - loss: 0.0885 - binary\_accuracy: 0.9007  
Epoch 491/2000  
1500/1500 [=====] - 0s - loss: 0.0884 - binary\_accuracy: 0.9007  
Epoch 492/2000  
1500/1500 [=====] - 0s - loss: 0.0884 - binary\_accuracy: 0.9007  
Epoch 493/2000  
1500/1500 [=====] - 0s - loss: 0.0884 - binary\_accuracy: 0.9007  
Epoch 494/2000  
1500/1500 [=====] - 0s - loss: 0.0884 - binary\_accuracy: 0.9007  
Epoch 495/2000  
1500/1500 [=====] - 0s - loss: 0.0884 - binary\_accuracy: 0.9007  
Epoch 496/2000  
1500/1500 [=====] - 0s - loss: 0.0884 - binary\_accuracy: 0.9007  
Epoch 497/2000  
1500/1500 [=====] - 0s - loss: 0.0883 - binary\_accuracy: 0.9007  
Epoch 498/2000  
1500/1500 [=====] - 0s - loss: 0.0883 - binary\_accuracy: 0.9007  
Epoch 499/2000  
1500/1500 [=====] - 0s - loss: 0.0883 - binary\_accuracy: 0.9007  
Epoch 500/2000  
1500/1500 [=====] - 0s - loss: 0.0883 - binary\_accuracy: 0.9007  
Epoch 501/2000  
1500/1500 [=====] - 0s - loss: 0.0883 - binary\_accuracy: 0.9007  
Epoch 502/2000  
1500/1500 [=====] - 0s - loss: 0.0883 - binary\_accuracy: 0.9007  
Epoch 503/2000  
1500/1500 [=====] - 0s - loss: 0.0882 - binary\_accuracy: 0.9007  
Epoch 504/2000  
1500/1500 [=====] - 0s - loss: 0.0882 - binary\_accuracy: 0.9007  
Epoch 505/2000  
1500/1500 [=====] - 0s - loss: 0.0882 - binary\_accuracy: 0.9007  
Epoch 506/2000

1500/1500 [=====] - 0s - loss: 0.0882 - b  
inary\_accuracy: 0.9007  
Epoch 507/2000  
1500/1500 [=====] - 0s - loss: 0.0882 - b  
inary\_accuracy: 0.9007  
Epoch 508/2000  
1500/1500 [=====] - 0s - loss: 0.0882 - b  
inary\_accuracy: 0.9007  
Epoch 509/2000  
1500/1500 [=====] - 0s - loss: 0.0881 - b  
inary\_accuracy: 0.9013  
Epoch 510/2000  
1500/1500 [=====] - 0s - loss: 0.0881 - b  
inary\_accuracy: 0.9007  
Epoch 511/2000  
1500/1500 [=====] - 0s - loss: 0.0881 - b  
inary\_accuracy: 0.9007  
Epoch 512/2000  
1500/1500 [=====] - 0s - loss: 0.0881 - b  
inary\_accuracy: 0.9007  
Epoch 513/2000  
1500/1500 [=====] - 0s - loss: 0.0881 - b  
inary\_accuracy: 0.9007  
Epoch 514/2000  
1500/1500 [=====] - 0s - loss: 0.0881 - b  
inary\_accuracy: 0.9007  
Epoch 515/2000  
1500/1500 [=====] - 0s - loss: 0.0880 - b  
inary\_accuracy: 0.9007  
Epoch 516/2000  
1500/1500 [=====] - 0s - loss: 0.0880 - b  
inary\_accuracy: 0.9007  
Epoch 517/2000  
1500/1500 [=====] - 0s - loss: 0.0880 - b  
inary\_accuracy: 0.9007  
Epoch 518/2000  
1500/1500 [=====] - 0s - loss: 0.0880 - b  
inary\_accuracy: 0.9007  
Epoch 519/2000  
1500/1500 [=====] - 0s - loss: 0.0880 - b  
inary\_accuracy: 0.9007  
Epoch 520/2000  
1500/1500 [=====] - 0s - loss: 0.0880 - b  
inary\_accuracy: 0.9007  
Epoch 521/2000  
1500/1500 [=====] - 0s - loss: 0.0880 - b  
inary\_accuracy: 0.9007  
Epoch 522/2000  
1500/1500 [=====] - 0s - loss: 0.0879 - b  
inary\_accuracy: 0.9007  
Epoch 523/2000  
1500/1500 [=====] - 0s - loss: 0.0879 - b  
inary\_accuracy: 0.9013  
Epoch 524/2000  
1500/1500 [=====] - 0s - loss: 0.0879 - b  
inary\_accuracy: 0.9007  
Epoch 525/2000

1500/1500 [=====] - 0s - loss: 0.0879 - b  
inary\_accuracy: 0.9013  
Epoch 526/2000  
1500/1500 [=====] - 0s - loss: 0.0879 - b  
inary\_accuracy: 0.9007  
Epoch 527/2000  
1500/1500 [=====] - 0s - loss: 0.0879 - b  
inary\_accuracy: 0.9007  
Epoch 528/2000  
1500/1500 [=====] - 0s - loss: 0.0878 - b  
inary\_accuracy: 0.9013  
Epoch 529/2000  
1500/1500 [=====] - 0s - loss: 0.0878 - b  
inary\_accuracy: 0.9007  
Epoch 530/2000  
1500/1500 [=====] - 0s - loss: 0.0878 - b  
inary\_accuracy: 0.9013  
Epoch 531/2000  
1500/1500 [=====] - 0s - loss: 0.0878 - b  
inary\_accuracy: 0.9007  
Epoch 532/2000  
1500/1500 [=====] - 0s - loss: 0.0878 - b  
inary\_accuracy: 0.9007  
Epoch 533/2000  
1500/1500 [=====] - 0s - loss: 0.0878 - b  
inary\_accuracy: 0.9013  
Epoch 534/2000  
1500/1500 [=====] - 0s - loss: 0.0878 - b  
inary\_accuracy: 0.9013  
Epoch 535/2000  
1500/1500 [=====] - 0s - loss: 0.0877 - b  
inary\_accuracy: 0.9013  
Epoch 536/2000  
1500/1500 [=====] - 0s - loss: 0.0877 - b  
inary\_accuracy: 0.9007  
Epoch 537/2000  
1500/1500 [=====] - 0s - loss: 0.0877 - b  
inary\_accuracy: 0.9013  
Epoch 538/2000  
1500/1500 [=====] - 0s - loss: 0.0877 - b  
inary\_accuracy: 0.9007  
Epoch 539/2000  
1500/1500 [=====] - 0s - loss: 0.0877 - b  
inary\_accuracy: 0.9013  
Epoch 540/2000  
1500/1500 [=====] - 0s - loss: 0.0877 - b  
inary\_accuracy: 0.9007  
Epoch 541/2000  
1500/1500 [=====] - 0s - loss: 0.0877 - b  
inary\_accuracy: 0.9013  
Epoch 542/2000  
1500/1500 [=====] - 0s - loss: 0.0877 - b  
inary\_accuracy: 0.9007  
Epoch 543/2000  
1500/1500 [=====] - 0s - loss: 0.0876 - b  
inary\_accuracy: 0.9013  
Epoch 544/2000

1500/1500 [=====] - 0s - loss: 0.0876 - b  
inary\_accuracy: 0.9013  
Epoch 545/2000  
1500/1500 [=====] - 0s - loss: 0.0876 - b  
inary\_accuracy: 0.9013  
Epoch 546/2000  
1500/1500 [=====] - 0s - loss: 0.0876 - b  
inary\_accuracy: 0.9013  
Epoch 547/2000  
1500/1500 [=====] - 0s - loss: 0.0876 - b  
inary\_accuracy: 0.9013  
Epoch 548/2000  
1500/1500 [=====] - 0s - loss: 0.0876 - b  
inary\_accuracy: 0.9013  
Epoch 549/2000  
1500/1500 [=====] - 0s - loss: 0.0876 - b  
inary\_accuracy: 0.9013  
Epoch 550/2000  
1500/1500 [=====] - 0s - loss: 0.0875 - b  
inary\_accuracy: 0.9013  
Epoch 551/2000  
1500/1500 [=====] - 0s - loss: 0.0875 - b  
inary\_accuracy: 0.9013  
Epoch 552/2000  
1500/1500 [=====] - 0s - loss: 0.0875 - b  
inary\_accuracy: 0.9013  
Epoch 553/2000  
1500/1500 [=====] - 0s - loss: 0.0875 - b  
inary\_accuracy: 0.9013  
Epoch 554/2000  
1500/1500 [=====] - 0s - loss: 0.0875 - b  
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Epoch 555/2000  
1500/1500 [=====] - 0s - loss: 0.0875 - b  
inary\_accuracy: 0.9013  
Epoch 556/2000  
1500/1500 [=====] - 0s - loss: 0.0875 - b  
inary\_accuracy: 0.9013  
Epoch 557/2000  
1500/1500 [=====] - 0s - loss: 0.0875 - b  
inary\_accuracy: 0.9013  
Epoch 558/2000  
1500/1500 [=====] - 0s - loss: 0.0874 - b  
inary\_accuracy: 0.9013  
Epoch 559/2000  
1500/1500 [=====] - 0s - loss: 0.0874 - b  
inary\_accuracy: 0.9013  
Epoch 560/2000  
1500/1500 [=====] - 0s - loss: 0.0874 - b  
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Epoch 561/2000  
1500/1500 [=====] - 0s - loss: 0.0874 - b  
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Epoch 562/2000  
1500/1500 [=====] - 0s - loss: 0.0874 - b  
inary\_accuracy: 0.9013  
Epoch 563/2000

1500/1500 [=====] - 0s - loss: 0.0874 - b  
inary\_accuracy: 0.9013  
Epoch 564/2000  
1500/1500 [=====] - 0s - loss: 0.0874 - b  
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Epoch 565/2000  
1500/1500 [=====] - 0s - loss: 0.0874 - b  
inary\_accuracy: 0.9013  
Epoch 566/2000  
1500/1500 [=====] - 0s - loss: 0.0873 - b  
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Epoch 567/2000  
1500/1500 [=====] - 0s - loss: 0.0873 - b  
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Epoch 568/2000  
1500/1500 [=====] - 0s - loss: 0.0873 - b  
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Epoch 569/2000  
1500/1500 [=====] - 0s - loss: 0.0873 - b  
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Epoch 570/2000  
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Epoch 571/2000  
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Epoch 572/2000  
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Epoch 573/2000  
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Epoch 574/2000  
1500/1500 [=====] - 0s - loss: 0.0872 - b  
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Epoch 575/2000  
1500/1500 [=====] - 0s - loss: 0.0872 - b  
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Epoch 576/2000  
1500/1500 [=====] - 0s - loss: 0.0872 - b  
inary\_accuracy: 0.9013  
Epoch 577/2000  
1500/1500 [=====] - 0s - loss: 0.0872 - b  
inary\_accuracy: 0.9013  
Epoch 578/2000  
1500/1500 [=====] - 0s - loss: 0.0872 - b  
inary\_accuracy: 0.9013  
Epoch 579/2000  
1500/1500 [=====] - 0s - loss: 0.0872 - b  
inary\_accuracy: 0.9013  
Epoch 580/2000  
1500/1500 [=====] - 0s - loss: 0.0872 - b  
inary\_accuracy: 0.9013  
Epoch 581/2000  
1500/1500 [=====] - 0s - loss: 0.0872 - b  
inary\_accuracy: 0.9013  
Epoch 582/2000

1500/1500 [=====] - 0s - loss: 0.0871 - b  
inary\_accuracy: 0.9013  
Epoch 583/2000  
1500/1500 [=====] - 0s - loss: 0.0871 - b  
inary\_accuracy: 0.9013  
Epoch 584/2000  
1500/1500 [=====] - 0s - loss: 0.0871 - b  
inary\_accuracy: 0.9013  
Epoch 585/2000  
1500/1500 [=====] - 0s - loss: 0.0871 - b  
inary\_accuracy: 0.9013  
Epoch 586/2000  
1500/1500 [=====] - 0s - loss: 0.0871 - b  
inary\_accuracy: 0.9013  
Epoch 587/2000  
1500/1500 [=====] - 0s - loss: 0.0871 - b  
inary\_accuracy: 0.9013  
Epoch 588/2000  
1500/1500 [=====] - 0s - loss: 0.0871 - b  
inary\_accuracy: 0.9013  
Epoch 589/2000  
1500/1500 [=====] - 0s - loss: 0.0871 - b  
inary\_accuracy: 0.9013  
Epoch 590/2000  
1500/1500 [=====] - 0s - loss: 0.0871 - b  
inary\_accuracy: 0.9013  
Epoch 591/2000  
1500/1500 [=====] - 0s - loss: 0.0870 - b  
inary\_accuracy: 0.9013  
Epoch 592/2000  
1500/1500 [=====] - 0s - loss: 0.0870 - b  
inary\_accuracy: 0.9013  
Epoch 593/2000  
1500/1500 [=====] - 0s - loss: 0.0870 - b  
inary\_accuracy: 0.9013  
Epoch 594/2000  
1500/1500 [=====] - 0s - loss: 0.0870 - b  
inary\_accuracy: 0.9013  
Epoch 595/2000  
1500/1500 [=====] - 0s - loss: 0.0870 - b  
inary\_accuracy: 0.9013  
Epoch 596/2000  
1500/1500 [=====] - 0s - loss: 0.0870 - b  
inary\_accuracy: 0.9013  
Epoch 597/2000  
1500/1500 [=====] - 0s - loss: 0.0870 - b  
inary\_accuracy: 0.9013  
Epoch 598/2000  
1500/1500 [=====] - 0s - loss: 0.0870 - b  
inary\_accuracy: 0.9013  
Epoch 599/2000  
1500/1500 [=====] - 0s - loss: 0.0870 - b  
inary\_accuracy: 0.9013  
Epoch 600/2000  
1500/1500 [=====] - 0s - loss: 0.0869 - b  
inary\_accuracy: 0.9013  
Epoch 601/2000



1500/1500 [=====] - 0s - loss: 0.0869 - b  
inary\_accuracy: 0.9007  
Epoch 602/2000  
1500/1500 [=====] - 0s - loss: 0.0869 - b  
inary\_accuracy: 0.9013  
Epoch 603/2000  
1500/1500 [=====] - 0s - loss: 0.0869 - b  
inary\_accuracy: 0.9013  
Epoch 604/2000  
1500/1500 [=====] - 0s - loss: 0.0869 - b  
inary\_accuracy: 0.9013  
Epoch 605/2000  
1500/1500 [=====] - 0s - loss: 0.0869 - b  
inary\_accuracy: 0.9007  
Epoch 606/2000  
1500/1500 [=====] - 0s - loss: 0.0869 - b  
inary\_accuracy: 0.9013  
Epoch 607/2000  
1500/1500 [=====] - 0s - loss: 0.0869 - b  
inary\_accuracy: 0.9007  
Epoch 608/2000  
1500/1500 [=====] - 0s - loss: 0.0869 - b  
inary\_accuracy: 0.9007  
Epoch 609/2000  
1500/1500 [=====] - 0s - loss: 0.0869 - b  
inary\_accuracy: 0.9013  
Epoch 610/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.9007  
Epoch 611/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.9007  
Epoch 612/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.9013  
Epoch 613/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.9013  
Epoch 614/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.9013  
Epoch 615/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.9013  
Epoch 616/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.9020  
Epoch 617/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.9013  
Epoch 618/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.9013  
Epoch 619/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.9013  
Epoch 620/2000

1500/1500 [=====] - 0s - loss: 0.0867 - b  
inary\_accuracy: 0.9013  
Epoch 621/2000  
1500/1500 [=====] - 0s - loss: 0.0867 - b  
inary\_accuracy: 0.9020  
Epoch 622/2000  
1500/1500 [=====] - 0s - loss: 0.0867 - b  
inary\_accuracy: 0.9020  
Epoch 623/2000  
1500/1500 [=====] - 0s - loss: 0.0867 - b  
inary\_accuracy: 0.9020  
Epoch 624/2000  
1500/1500 [=====] - 0s - loss: 0.0867 - b  
inary\_accuracy: 0.9020  
Epoch 625/2000  
1500/1500 [=====] - 0s - loss: 0.0867 - b  
inary\_accuracy: 0.9020  
Epoch 626/2000  
1500/1500 [=====] - 0s - loss: 0.0867 - b  
inary\_accuracy: 0.9020  
Epoch 627/2000  
1500/1500 [=====] - 0s - loss: 0.0867 - b  
inary\_accuracy: 0.9020  
Epoch 628/2000  
1500/1500 [=====] - 0s - loss: 0.0867 - b  
inary\_accuracy: 0.9020  
Epoch 629/2000  
1500/1500 [=====] - 0s - loss: 0.0867 - b  
inary\_accuracy: 0.9020  
Epoch 630/2000  
1500/1500 [=====] - 0s - loss: 0.0866 - b  
inary\_accuracy: 0.9020  
Epoch 631/2000  
1500/1500 [=====] - 0s - loss: 0.0866 - b  
inary\_accuracy: 0.9020  
Epoch 632/2000  
1500/1500 [=====] - 0s - loss: 0.0866 - b  
inary\_accuracy: 0.9020  
Epoch 633/2000  
1500/1500 [=====] - 0s - loss: 0.0866 - b  
inary\_accuracy: 0.9020  
Epoch 634/2000  
1500/1500 [=====] - 0s - loss: 0.0866 - b  
inary\_accuracy: 0.9020  
Epoch 635/2000  
1500/1500 [=====] - 0s - loss: 0.0866 - b  
inary\_accuracy: 0.9020  
Epoch 636/2000  
1500/1500 [=====] - 0s - loss: 0.0866 - b  
inary\_accuracy: 0.9020  
Epoch 637/2000  
1500/1500 [=====] - 0s - loss: 0.0866 - b  
inary\_accuracy: 0.9020  
Epoch 638/2000  
1500/1500 [=====] - 0s - loss: 0.0866 - b  
inary\_accuracy: 0.9020  
Epoch 639/2000

1500/1500 [=====] - 0s - loss: 0.0866 - b  
inary\_accuracy: 0.9020  
Epoch 640/2000  
1500/1500 [=====] - 0s - loss: 0.0866 - b  
inary\_accuracy: 0.9020  
Epoch 641/2000  
1500/1500 [=====] - 0s - loss: 0.0865 - b  
inary\_accuracy: 0.9020  
Epoch 642/2000  
1500/1500 [=====] - 0s - loss: 0.0865 - b  
inary\_accuracy: 0.9020  
Epoch 643/2000  
1500/1500 [=====] - 0s - loss: 0.0865 - b  
inary\_accuracy: 0.9020  
Epoch 644/2000  
1500/1500 [=====] - 0s - loss: 0.0865 - b  
inary\_accuracy: 0.9020  
Epoch 645/2000  
1500/1500 [=====] - 0s - loss: 0.0865 - b  
inary\_accuracy: 0.9020  
Epoch 646/2000  
1500/1500 [=====] - 0s - loss: 0.0865 - b  
inary\_accuracy: 0.9020  
Epoch 647/2000  
1500/1500 [=====] - 0s - loss: 0.0865 - b  
inary\_accuracy: 0.9020  
Epoch 648/2000  
1500/1500 [=====] - 0s - loss: 0.0865 - b  
inary\_accuracy: 0.9020  
Epoch 649/2000  
1500/1500 [=====] - 0s - loss: 0.0865 - b  
inary\_accuracy: 0.9020  
Epoch 650/2000  
1500/1500 [=====] - 0s - loss: 0.0865 - b  
inary\_accuracy: 0.9020  
Epoch 651/2000  
1500/1500 [=====] - 0s - loss: 0.0865 - b  
inary\_accuracy: 0.9013  
Epoch 652/2000  
1500/1500 [=====] - 0s - loss: 0.0864 - b  
inary\_accuracy: 0.9020  
Epoch 653/2000  
1500/1500 [=====] - 0s - loss: 0.0864 - b  
inary\_accuracy: 0.9013  
Epoch 654/2000  
1500/1500 [=====] - 0s - loss: 0.0864 - b  
inary\_accuracy: 0.9020  
Epoch 655/2000  
1500/1500 [=====] - 0s - loss: 0.0864 - b  
inary\_accuracy: 0.9013  
Epoch 656/2000  
1500/1500 [=====] - 0s - loss: 0.0864 - b  
inary\_accuracy: 0.9013  
Epoch 657/2000  
1500/1500 [=====] - 0s - loss: 0.0864 - b  
inary\_accuracy: 0.9013  
Epoch 658/2000

1500/1500 [=====] - 0s - loss: 0.0864 - b  
inary\_accuracy: 0.9013  
Epoch 659/2000  
1500/1500 [=====] - 0s - loss: 0.0864 - b  
inary\_accuracy: 0.9013  
Epoch 660/2000  
1500/1500 [=====] - 0s - loss: 0.0864 - b  
inary\_accuracy: 0.9013  
Epoch 661/2000  
1500/1500 [=====] - 0s - loss: 0.0864 - b  
inary\_accuracy: 0.9013  
Epoch 662/2000  
1500/1500 [=====] - 0s - loss: 0.0864 - b  
inary\_accuracy: 0.9013  
Epoch 663/2000  
1500/1500 [=====] - 0s - loss: 0.0864 - b  
inary\_accuracy: 0.9013  
Epoch 664/2000  
1500/1500 [=====] - 0s - loss: 0.0863 - b  
inary\_accuracy: 0.9013  
Epoch 665/2000  
1500/1500 [=====] - 0s - loss: 0.0863 - b  
inary\_accuracy: 0.9013  
Epoch 666/2000  
1500/1500 [=====] - 0s - loss: 0.0863 - b  
inary\_accuracy: 0.9013  
Epoch 667/2000  
1500/1500 [=====] - 0s - loss: 0.0863 - b  
inary\_accuracy: 0.9013  
Epoch 668/2000  
1500/1500 [=====] - 0s - loss: 0.0863 - b  
inary\_accuracy: 0.9013  
Epoch 669/2000  
1500/1500 [=====] - 0s - loss: 0.0863 - b  
inary\_accuracy: 0.9013  
Epoch 670/2000  
1500/1500 [=====] - 0s - loss: 0.0863 - b  
inary\_accuracy: 0.9013  
Epoch 671/2000  
1500/1500 [=====] - 0s - loss: 0.0863 - b  
inary\_accuracy: 0.9013  
Epoch 672/2000  
1500/1500 [=====] - 0s - loss: 0.0863 - b  
inary\_accuracy: 0.9013  
Epoch 673/2000  
1500/1500 [=====] - 0s - loss: 0.0863 - b  
inary\_accuracy: 0.9013  
Epoch 674/2000  
1500/1500 [=====] - 0s - loss: 0.0863 - b  
inary\_accuracy: 0.9013  
Epoch 675/2000  
1500/1500 [=====] - 0s - loss: 0.0863 - b  
inary\_accuracy: 0.9013  
Epoch 676/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.9020  
Epoch 677/2000

1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.9013  
Epoch 678/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.9013  
Epoch 679/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.9020  
Epoch 680/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.9020  
Epoch 681/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.9020  
Epoch 682/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.9013  
Epoch 683/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.9020  
Epoch 684/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.9013  
Epoch 685/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.9013  
Epoch 686/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.9013  
Epoch 687/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.9020  
Epoch 688/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.9013  
Epoch 689/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - b  
inary\_accuracy: 0.9013  
Epoch 690/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - b  
inary\_accuracy: 0.9013  
Epoch 691/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - b  
inary\_accuracy: 0.9013  
Epoch 692/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - b  
inary\_accuracy: 0.9013  
Epoch 693/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - b  
inary\_accuracy: 0.9013  
Epoch 694/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - b  
inary\_accuracy: 0.9013  
Epoch 695/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - b  
inary\_accuracy: 0.9013  
Epoch 696/2000

1500/1500 [=====] - 0s - loss: 0.0861 - binary\_accuracy: 0.9013  
Epoch 697/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - binary\_accuracy: 0.9013  
Epoch 698/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - binary\_accuracy: 0.9013  
Epoch 699/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - binary\_accuracy: 0.9013  
Epoch 700/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - binary\_accuracy: 0.9013  
Epoch 701/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - binary\_accuracy: 0.9013  
Epoch 702/2000  
1500/1500 [=====] - 0s - loss: 0.0860 - binary\_accuracy: 0.9013  
Epoch 703/2000  
1500/1500 [=====] - 0s - loss: 0.0860 - binary\_accuracy: 0.9013  
Epoch 704/2000  
1500/1500 [=====] - 0s - loss: 0.0860 - binary\_accuracy: 0.9013  
Epoch 705/2000  
1500/1500 [=====] - 0s - loss: 0.0860 - binary\_accuracy: 0.9013  
Epoch 706/2000  
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Epoch 707/2000  
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Epoch 708/2000  
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Epoch 709/2000  
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Epoch 710/2000  
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Epoch 711/2000  
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Epoch 712/2000  
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Epoch 713/2000  
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Epoch 714/2000  
1500/1500 [=====] - 0s - loss: 0.0860 - binary\_accuracy: 0.9013  
Epoch 715/2000

1500/1500 [=====] - 0s - loss: 0.0860 - b  
inary\_accuracy: 0.9013  
Epoch 716/2000  
1500/1500 [=====] - 0s - loss: 0.0859 - b  
inary\_accuracy: 0.9013  
Epoch 717/2000  
1500/1500 [=====] - 0s - loss: 0.0859 - b  
inary\_accuracy: 0.9013  
Epoch 718/2000  
1500/1500 [=====] - 0s - loss: 0.0859 - b  
inary\_accuracy: 0.9013  
Epoch 719/2000  
1500/1500 [=====] - 0s - loss: 0.0859 - b  
inary\_accuracy: 0.9013  
Epoch 720/2000  
1500/1500 [=====] - 0s - loss: 0.0859 - b  
inary\_accuracy: 0.9013  
Epoch 721/2000  
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inary\_accuracy: 0.9013  
Epoch 722/2000  
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inary\_accuracy: 0.9013  
Epoch 723/2000  
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inary\_accuracy: 0.9013  
Epoch 724/2000  
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inary\_accuracy: 0.9013  
Epoch 725/2000  
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inary\_accuracy: 0.9013  
Epoch 726/2000  
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inary\_accuracy: 0.9013  
Epoch 727/2000  
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inary\_accuracy: 0.9013  
Epoch 728/2000  
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inary\_accuracy: 0.9013  
Epoch 729/2000  
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inary\_accuracy: 0.9013  
Epoch 730/2000  
1500/1500 [=====] - 0s - loss: 0.0858 - b  
inary\_accuracy: 0.9013  
Epoch 731/2000  
1500/1500 [=====] - 0s - loss: 0.0858 - b  
inary\_accuracy: 0.9013  
Epoch 732/2000  
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inary\_accuracy: 0.9013  
Epoch 733/2000  
1500/1500 [=====] - 0s - loss: 0.0858 - b  
inary\_accuracy: 0.9013  
Epoch 734/2000

1500/1500 [=====] - 0s - loss: 0.0858 - binary\_accuracy: 0.9013  
Epoch 735/2000  
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Epoch 736/2000  
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Epoch 737/2000  
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Epoch 738/2000  
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Epoch 746/2000  
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Epoch 747/2000  
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Epoch 748/2000  
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Epoch 749/2000  
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Epoch 750/2000  
1500/1500 [=====] - 0s - loss: 0.0857 - binary\_accuracy: 0.9013  
Epoch 751/2000  
1500/1500 [=====] - 0s - loss: 0.0857 - binary\_accuracy: 0.9020  
Epoch 752/2000  
1500/1500 [=====] - 0s - loss: 0.0857 - binary\_accuracy: 0.9013  
Epoch 753/2000



1500/1500 [=====] - 0s - loss: 0.0857 - b  
inary\_accuracy: 0.9020  
Epoch 754/2000  
1500/1500 [=====] - 0s - loss: 0.0857 - b  
inary\_accuracy: 0.9013  
Epoch 755/2000  
1500/1500 [=====] - 0s - loss: 0.0857 - b  
inary\_accuracy: 0.9013  
Epoch 756/2000  
1500/1500 [=====] - 0s - loss: 0.0857 - b  
inary\_accuracy: 0.9013  
Epoch 757/2000  
1500/1500 [=====] - 0s - loss: 0.0857 - b  
inary\_accuracy: 0.9020 - ETA: 0s - loss: 0.0856 - binary\_accu  
acy: 0.902  
Epoch 758/2000  
1500/1500 [=====] - 0s - loss: 0.0857 - b  
inary\_accuracy: 0.9020  
Epoch 759/2000  
1500/1500 [=====] - 0s - loss: 0.0857 - b  
inary\_accuracy: 0.9020  
Epoch 760/2000  
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inary\_accuracy: 0.9020  
Epoch 761/2000  
1500/1500 [=====] - 0s - loss: 0.0856 - b  
inary\_accuracy: 0.9020  
Epoch 762/2000  
1500/1500 [=====] - 0s - loss: 0.0856 - b  
inary\_accuracy: 0.9020  
Epoch 763/2000  
1500/1500 [=====] - 0s - loss: 0.0856 - b  
inary\_accuracy: 0.9020  
Epoch 764/2000  
1500/1500 [=====] - 0s - loss: 0.0856 - b  
inary\_accuracy: 0.9020  
Epoch 765/2000  
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inary\_accuracy: 0.9020  
Epoch 766/2000  
1500/1500 [=====] - 0s - loss: 0.0856 - b  
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Epoch 767/2000  
1500/1500 [=====] - 0s - loss: 0.0856 - b  
inary\_accuracy: 0.9020  
Epoch 768/2000  
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Epoch 769/2000  
1500/1500 [=====] - 0s - loss: 0.0856 - b  
inary\_accuracy: 0.9020  
Epoch 770/2000  
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inary\_accuracy: 0.9020  
Epoch 771/2000  
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inary\_accuracy: 0.9020

Epoch 772/2000  
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Epoch 773/2000  
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Epoch 774/2000  
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Epoch 777/2000  
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Epoch 778/2000  
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Epoch 779/2000  
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Epoch 780/2000  
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Epoch 781/2000  
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Epoch 794/2000  
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Epoch 803/2000  
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Epoch 814/2000  
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Epoch 850/2000  
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Epoch 851/2000  
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Epoch 853/2000  
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Epoch 854/2000  
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Epoch 858/2000  
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Epoch 867/2000  
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Epoch 868/2000  
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Epoch 869/2000  
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Epoch 870/2000  
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Epoch 871/2000  
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Epoch 872/2000  
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Epoch 873/2000  
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Epoch 874/2000  
1500/1500 [=====] - 0s - loss: 0.0850 - binary\_accuracy: 0.9027  
Epoch 875/2000  
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Epoch 876/2000  
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Epoch 877/2000  
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Epoch 878/2000  
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Epoch 879/2000  
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Epoch 880/2000  
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Epoch 881/2000  
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Epoch 882/2000  
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Epoch 883/2000  
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Epoch 884/2000  
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Epoch 885/2000  
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Epoch 886/2000  
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Epoch 888/2000  
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Epoch 889/2000  
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Epoch 893/2000  
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Epoch 894/2000  
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Epoch 895/2000  
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inary\_accuracy: 0.9033  
Epoch 1093/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1094/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b

inary\_accuracy: 0.9033  
Epoch 1095/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1096/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1097/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1098/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1099/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1100/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1101/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1102/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1103/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1104/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1105/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1106/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1107/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1108/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1109/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1110/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1111/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1112/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1113/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b

inary\_accuracy: 0.9033  
Epoch 1114/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1115/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1116/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1117/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1118/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1119/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1120/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.9033  
Epoch 1121/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1122/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1123/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1124/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1125/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1126/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1127/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9040  
Epoch 1128/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1129/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9040  
Epoch 1130/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1131/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1132/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b

inary\_accuracy: 0.9033  
Epoch 1133/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1134/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9040  
Epoch 1135/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1136/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1137/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1138/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1139/2000  
1500/1500 [=====] - ETA: 0s - loss: 0.081  
7 - binary\_accuracy: 0.905 - 0s - loss: 0.0841 - binary\_accuracy:  
0.9033  
Epoch 1140/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1141/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1142/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1143/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9040  
Epoch 1144/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1145/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9040  
Epoch 1146/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1147/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1148/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1149/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9040  
Epoch 1150/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.9033  
Epoch 1151/2000

1500/1500 [=====] - 0s - loss: 0.0841 - binary\_accuracy: 0.9033  
Epoch 1152/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - binary\_accuracy: 0.9033  
Epoch 1153/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - binary\_accuracy: 0.9040  
Epoch 1154/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - binary\_accuracy: 0.9040  
Epoch 1155/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - binary\_accuracy: 0.9040  
Epoch 1156/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9040  
Epoch 1157/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9040  
Epoch 1158/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9040  
Epoch 1159/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9033  
Epoch 1160/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9040  
Epoch 1161/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9033  
Epoch 1162/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9040  
Epoch 1163/2000  
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Epoch 1164/2000  
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Epoch 1165/2000  
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Epoch 1166/2000  
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Epoch 1167/2000  
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Epoch 1168/2000  
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Epoch 1169/2000  
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Epoch 1170/2000

1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9040  
Epoch 1171/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9040  
Epoch 1172/2000  
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Epoch 1173/2000  
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Epoch 1174/2000  
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Epoch 1175/2000  
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Epoch 1176/2000  
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Epoch 1177/2000  
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Epoch 1178/2000  
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Epoch 1179/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9040  
Epoch 1180/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9040  
Epoch 1181/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9040  
Epoch 1182/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9040  
Epoch 1183/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9040  
Epoch 1184/2000  
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Epoch 1185/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9040  
Epoch 1186/2000  
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Epoch 1187/2000  
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Epoch 1188/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - binary\_accuracy: 0.9040  
Epoch 1189/2000

1500/1500 [=====] - 0s - loss: 0.0840 - b  
inary\_accuracy: 0.9040  
Epoch 1190/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - b  
inary\_accuracy: 0.9040  
Epoch 1191/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - b  
inary\_accuracy: 0.9040  
Epoch 1192/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - b  
inary\_accuracy: 0.9040  
Epoch 1193/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - b  
inary\_accuracy: 0.9040  
Epoch 1194/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - b  
inary\_accuracy: 0.9040  
Epoch 1195/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1196/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1197/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1198/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1199/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1200/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1201/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1202/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1203/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1204/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1205/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1206/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1207/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1208/2000



1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9040  
Epoch 1209/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9040  
Epoch 1210/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9040  
Epoch 1211/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9040  
Epoch 1212/2000  
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Epoch 1213/2000  
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Epoch 1214/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9040  
Epoch 1215/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9040  
Epoch 1216/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9040  
Epoch 1217/2000  
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Epoch 1218/2000  
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Epoch 1219/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9040  
Epoch 1220/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9040  
Epoch 1221/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9040  
Epoch 1222/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9040  
Epoch 1223/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9040  
Epoch 1224/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9040  
Epoch 1225/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9040  
Epoch 1226/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - binary\_accuracy: 0.9047  
Epoch 1227/2000

1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1228/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1229/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1230/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1231/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9047  
Epoch 1232/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1233/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9040  
Epoch 1234/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1235/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1236/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1237/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9047  
Epoch 1238/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1239/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1240/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1241/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9047  
Epoch 1242/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1243/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1244/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1245/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1246/2000

1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1247/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1248/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1249/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1250/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9047  
Epoch 1251/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1252/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9047  
Epoch 1253/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1254/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1255/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1256/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1257/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1258/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1259/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1260/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9047  
Epoch 1261/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1262/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1263/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1264/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - binary\_accuracy: 0.9040  
Epoch 1265/2000

1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1266/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9047  
Epoch 1267/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1268/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1269/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9047  
Epoch 1270/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9047  
Epoch 1271/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9047  
Epoch 1272/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1273/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9040  
Epoch 1274/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9047  
Epoch 1275/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.9047  
Epoch 1276/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - b  
inary\_accuracy: 0.9033  
Epoch 1277/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - b  
inary\_accuracy: 0.9047  
Epoch 1278/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - b  
inary\_accuracy: 0.9047  
Epoch 1279/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - b  
inary\_accuracy: 0.9047  
Epoch 1280/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - b  
inary\_accuracy: 0.9047  
Epoch 1281/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - b  
inary\_accuracy: 0.9047  
Epoch 1282/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - b  
inary\_accuracy: 0.9047  
Epoch 1283/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - b  
inary\_accuracy: 0.9040  
Epoch 1284/2000

1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1285/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1286/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1287/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9040  
Epoch 1288/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9040  
Epoch 1289/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9040  
Epoch 1290/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1291/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1292/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1293/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1294/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1295/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1296/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9040  
Epoch 1297/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9040  
Epoch 1298/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9040  
Epoch 1299/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1300/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9040  
Epoch 1301/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1302/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1303/2000

1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1304/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1305/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1306/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1307/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1308/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1309/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9040  
Epoch 1310/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9040  
Epoch 1311/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1312/2000  
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Epoch 1313/2000  
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Epoch 1314/2000  
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Epoch 1315/2000  
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Epoch 1316/2000  
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Epoch 1317/2000  
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Epoch 1318/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - binary\_accuracy: 0.9047  
Epoch 1319/2000  
1500/1500 [=====] - 0s - loss: 0.0836 - binary\_accuracy: 0.9047  
Epoch 1320/2000  
1500/1500 [=====] - 0s - loss: 0.0836 - binary\_accuracy: 0.9040  
Epoch 1321/2000  
1500/1500 [=====] - 0s - loss: 0.0836 - binary\_accuracy: 0.9040  
Epoch 1322/2000

1500/1500 [=====] - 0s - loss: 0.0836 - binary\_accuracy: 0.9047  
Epoch 1323/2000  
1500/1500 [=====] - 0s - loss: 0.0836 - binary\_accuracy: 0.9040  
Epoch 1324/2000  
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Epoch 1325/2000  
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Epoch 1326/2000  
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Epoch 1327/2000  
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Epoch 1328/2000  
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Epoch 1329/2000  
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Epoch 1333/2000  
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Epoch 1334/2000  
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Epoch 1335/2000  
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Epoch 1336/2000  
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Epoch 1337/2000  
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Epoch 1338/2000  
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Epoch 1339/2000  
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Epoch 1340/2000  
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Epoch 1341/2000

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Epoch 1342/2000  
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Epoch 1343/2000  
1500/1500 [=====] - 0s - loss: 0.0836 - binary\_accuracy: 0.9040  
Epoch 1344/2000  
1500/1500 [=====] - 0s - loss: 0.0836 - binary\_accuracy: 0.9047  
Epoch 1345/2000  
1500/1500 [=====] - 0s - loss: 0.0836 - binary\_accuracy: 0.9040  
Epoch 1346/2000  
1500/1500 [=====] - 0s - loss: 0.0836 - binary\_accuracy: 0.9047  
Epoch 1347/2000  
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Epoch 1348/2000  
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Epoch 1349/2000  
1500/1500 [=====] - 0s - loss: 0.0836 - binary\_accuracy: 0.9047  
Epoch 1350/2000  
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Epoch 1351/2000  
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Epoch 1352/2000  
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Epoch 1353/2000  
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Epoch 1354/2000  
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Epoch 1355/2000  
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Epoch 1356/2000  
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Epoch 1357/2000  
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Epoch 1358/2000  
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Epoch 1359/2000  
1500/1500 [=====] - 0s - loss: 0.0836 - binary\_accuracy: 0.9040  
Epoch 1360/2000



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inary\_accuracy: 0.9040  
Epoch 1361/2000  
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Epoch 1362/2000  
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Epoch 1363/2000  
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Epoch 1364/2000  
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Epoch 1365/2000  
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Epoch 1366/2000  
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Epoch 1367/2000  
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Epoch 1368/2000  
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Epoch 1369/2000  
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Epoch 1370/2000  
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Epoch 1372/2000  
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Epoch 1373/2000  
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Epoch 1374/2000  
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Epoch 1375/2000  
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Epoch 1376/2000  
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Epoch 1377/2000  
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Epoch 1378/2000  
1500/1500 [=====] - 0s - loss: 0.0835 - b  
inary\_accuracy: 0.9047  
Epoch 1379/2000

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Epoch 1380/2000  
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Epoch 1381/2000  
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Epoch 1382/2000  
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Epoch 1383/2000  
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Epoch 1384/2000  
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Epoch 1387/2000  
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Epoch 1389/2000  
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Epoch 1390/2000  
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Epoch 1395/2000  
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Epoch 1396/2000  
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Epoch 1397/2000  
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Epoch 1398/2000

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Epoch 1399/2000  
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Epoch 1400/2000  
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Epoch 1401/2000  
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Epoch 1402/2000  
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Epoch 1403/2000  
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Epoch 1404/2000  
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Epoch 1405/2000  
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Epoch 1407/2000  
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Epoch 1408/2000  
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Epoch 1409/2000  
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Epoch 1410/2000  
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Epoch 1411/2000  
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Epoch 1412/2000  
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Epoch 1413/2000  
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Epoch 1414/2000  
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Epoch 1415/2000  
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Epoch 1416/2000  
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Epoch 1417/2000

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Epoch 1418/2000  
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inary\_accuracy: 0.9040  
Epoch 1419/2000  
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inary\_accuracy: 0.9040  
Epoch 1420/2000  
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inary\_accuracy: 0.9040  
Epoch 1421/2000  
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inary\_accuracy: 0.9040  
Epoch 1422/2000  
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inary\_accuracy: 0.9040  
Epoch 1423/2000  
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inary\_accuracy: 0.9040  
Epoch 1424/2000  
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inary\_accuracy: 0.9040  
Epoch 1425/2000  
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inary\_accuracy: 0.9040  
Epoch 1426/2000  
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inary\_accuracy: 0.9040 - ETA: 0s - loss: 0.0785 - binary\_accu  
acy: 0.909  
Epoch 1427/2000  
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inary\_accuracy: 0.9040  
Epoch 1428/2000  
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Epoch 1429/2000  
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Epoch 1430/2000  
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Epoch 1431/2000  
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inary\_accuracy: 0.9040  
Epoch 1432/2000  
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inary\_accuracy: 0.9040  
Epoch 1433/2000  
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inary\_accuracy: 0.9047  
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inary\_accuracy: 0.9040  
Epoch 1435/2000  
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inary\_accuracy: 0.9040

Epoch 1436/2000  
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Epoch 1437/2000  
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Epoch 1438/2000  
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Epoch 1439/2000  
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Epoch 1440/2000  
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Epoch 1441/2000  
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Epoch 1442/2000  
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Epoch 1445/2000  
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Epoch 1446/2000  
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Epoch 1447/2000  
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Epoch 1450/2000  
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Epoch 1451/2000  
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Epoch 1454/2000  
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Epoch 1455/2000  
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Epoch 1456/2000  
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Epoch 1457/2000  
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Epoch 1462/2000  
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Epoch 1466/2000  
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Epoch 1467/2000  
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Epoch 1468/2000  
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Epoch 1469/2000  
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Epoch 1470/2000  
1500/1500 [=====] - 0s - loss: 0.0833 - binary\_accuracy: 0.9040  
Epoch 1471/2000  
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Epoch 1472/2000  
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Epoch 1473/2000  
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Epoch 1474/2000  
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Epoch 1475/2000  
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Epoch 1476/2000  
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Epoch 1477/2000  
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Epoch 1478/2000  
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Epoch 1480/2000  
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Epoch 1481/2000  
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Epoch 1482/2000  
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Epoch 1483/2000  
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Epoch 1484/2000  
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Epoch 1485/2000  
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Epoch 1487/2000  
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Epoch 1488/2000  
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Epoch 1489/2000  
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Epoch 1490/2000  
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Epoch 1491/2000  
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Epoch 1492/2000  
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Epoch 1493/2000  
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Epoch 1495/2000  
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Epoch 1496/2000  
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Epoch 1497/2000  
1500/1500 [=====] - 0s - loss: 0.0833 - binary\_accuracy: 0.9040  
Epoch 1498/2000  
1500/1500 [=====] - 0s - loss: 0.0833 - binary\_accuracy: 0.9040  
Epoch 1499/2000  
1500/1500 [=====] - 0s - loss: 0.0833 - binary\_accuracy: 0.9040  
Epoch 1500/2000  
1500/1500 [=====] - 0s - loss: 0.0833 - binary\_accuracy: 0.9040 - ETA: 0s - loss: 0.0879 - binary\_accuracy: 0.899  
Epoch 1501/2000  
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Epoch 1502/2000  
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Epoch 1503/2000  
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Epoch 1504/2000  
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Epoch 1699/2000  
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Epoch 1701/2000  
1500/1500 [=====] - 0s - loss: 0.0829 - b

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Epoch 1702/2000  
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Epoch 1703/2000  
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Epoch 1704/2000  
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Epoch 1705/2000  
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Epoch 1707/2000  
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Epoch 1708/2000  
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Epoch 1711/2000  
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Epoch 1712/2000  
1500/1500 [=====] - 0s - loss: 0.0829 - b  
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Epoch 1713/2000  
1500/1500 [=====] - 0s - loss: 0.0829 - b  
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Epoch 1714/2000  
1500/1500 [=====] - 0s - loss: 0.0829 - b  
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Epoch 1715/2000  
1500/1500 [=====] - 0s - loss: 0.0829 - b  
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Epoch 1716/2000  
1500/1500 [=====] - 0s - loss: 0.0829 - b  
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Epoch 1717/2000  
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Epoch 1719/2000  
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Epoch 1720/2000  
1500/1500 [=====] - 0s - loss: 0.0829 - b

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Epoch 1722/2000  
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Epoch 1729/2000  
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Epoch 1758/2000  
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Epoch 1773/2000  
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Epoch 1777/2000  
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Epoch 1778/2000  
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Epoch 1785/2000  
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Epoch 1786/2000  
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Epoch 1787/2000  
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Epoch 1788/2000  
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Epoch 1789/2000  
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Epoch 1790/2000  
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Epoch 1791/2000  
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acy: 0.902  
Epoch 1792/2000  
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Epoch 1793/2000  
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Epoch 1794/2000  
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Epoch 1795/2000  
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inary\_accuracy: 0.9040  
Epoch 1796/2000

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Epoch 1797/2000  
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Epoch 1798/2000  
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Epoch 1799/2000  
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Epoch 1801/2000  
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Epoch 1802/2000  
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Epoch 1803/2000  
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Epoch 1804/2000  
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Epoch 1805/2000  
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Epoch 1806/2000  
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Epoch 1807/2000  
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Epoch 1808/2000  
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Epoch 1809/2000  
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Epoch 1810/2000  
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Epoch 1811/2000  
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Epoch 1812/2000  
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Epoch 1813/2000  
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Epoch 1814/2000  
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Epoch 1815/2000



1500/1500 [=====] - 0s - loss: 0.0828 - b  
inary\_accuracy: 0.9040  
Epoch 1816/2000  
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Epoch 1817/2000  
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Epoch 1818/2000  
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Epoch 1820/2000  
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Epoch 1822/2000  
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acy: 0.899  
Epoch 1823/2000  
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Epoch 1827/2000  
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Epoch 1833/2000  
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inary\_accuracy: 0.9040

Epoch 1834/2000  
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Epoch 1835/2000  
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Epoch 1836/2000  
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Epoch 1837/2000  
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Epoch 1842/2000  
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Epoch 1843/2000  
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Epoch 1844/2000  
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Epoch 1845/2000  
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Epoch 1846/2000  
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Epoch 1847/2000  
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Epoch 1848/2000  
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Epoch 1852/2000  
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Epoch 1853/2000  
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Epoch 1854/2000  
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Epoch 1855/2000  
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Epoch 1856/2000  
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Epoch 1864/2000  
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Epoch 1865/2000  
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Epoch 1866/2000  
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Epoch 1867/2000  
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Epoch 1869/2000  
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Epoch 1871/2000  
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Epoch 1872/2000  
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Epoch 1875/2000  
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Epoch 1876/2000  
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Epoch 1877/2000  
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Epoch 1878/2000  
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Epoch 1886/2000  
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Epoch 1887/2000  
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Epoch 1889/2000  
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Epoch 1890/2000  
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Epoch 1891/2000  
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inary\_accuracy: 0.9047  
Epoch 1899/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1900/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1901/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1902/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1903/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1904/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1905/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1906/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1907/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1908/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1909/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b

inary\_accuracy: 0.9047  
Epoch 1910/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1911/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1912/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1913/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1914/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1915/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1916/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1917/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1918/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1919/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1920/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1921/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1922/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1923/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1924/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1925/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1926/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1927/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1928/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b

inary\_accuracy: 0.9047  
Epoch 1929/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1930/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1931/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1932/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1933/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1934/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1935/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1936/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1937/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1938/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1939/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1940/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1941/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1942/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1943/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1944/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1945/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1946/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1947/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b

inary\_accuracy: 0.9047  
Epoch 1948/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9040  
Epoch 1949/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1950/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1951/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1952/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1953/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1954/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1955/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1956/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1957/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1958/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9047  
Epoch 1959/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1960/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1961/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1962/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1963/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1964/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1965/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1966/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b



inary\_accuracy: 0.9047  
Epoch 1967/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1968/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1969/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1970/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1971/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1972/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1973/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1974/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1975/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1976/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1977/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1978/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1979/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1980/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1981/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1982/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1983/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1984/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1985/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b

inary\_accuracy: 0.9047  
Epoch 1986/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1987/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1988/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1989/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1990/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1991/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1992/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1993/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1994/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1995/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1996/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1997/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1998/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 1999/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047  
Epoch 2000/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9047

In [173]:

```
print("\n ##### Tempo de Treinamento da Rede Feed-Forward #####\n")
print ("\n\t ----- Computation time = " + str(t2 - t1) + "s -----")
print("\n #####\n")
```

##### Tempo de Treinamento da Rede Feed-Forward #####

----- Computation time = 254.36487299999862s -----

#####  
##

In [174]:

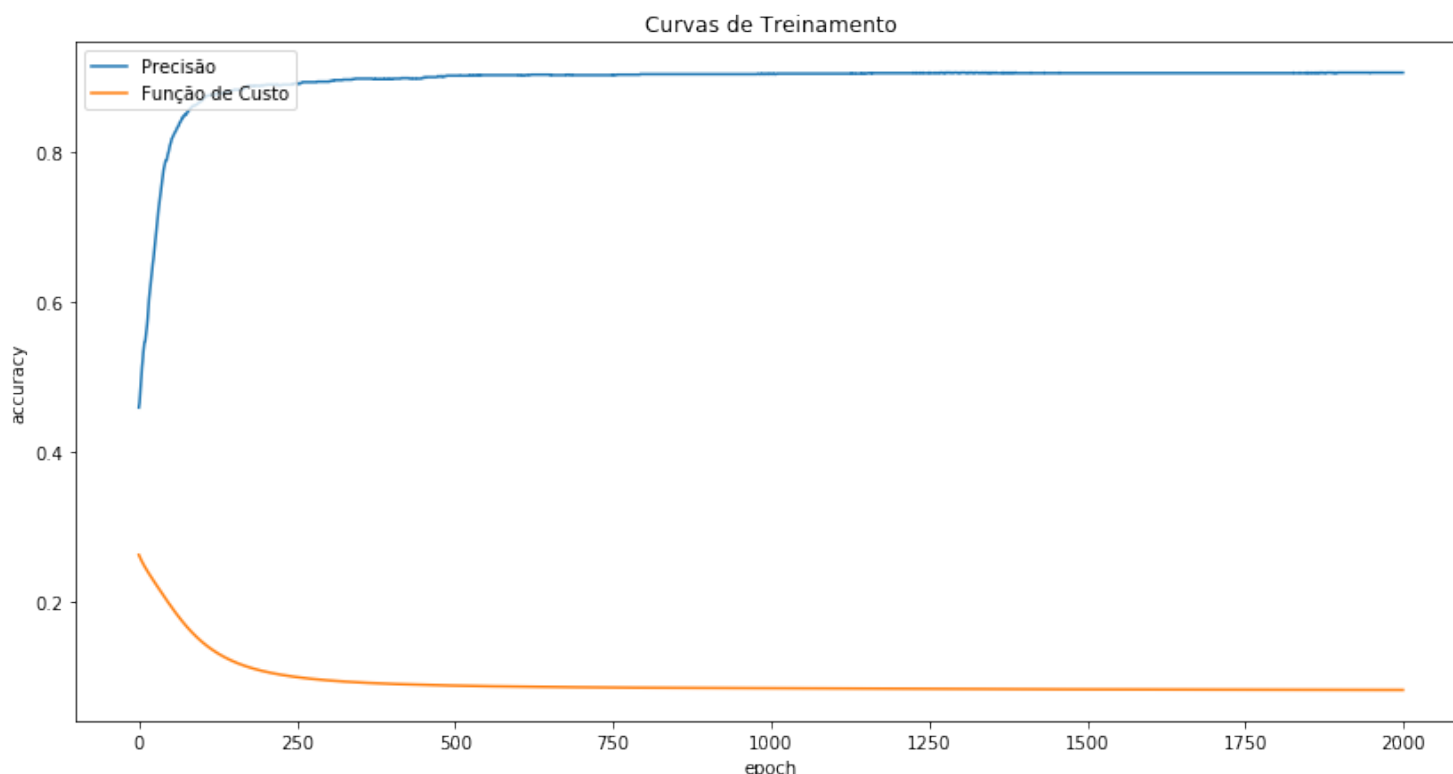
```
# Obtendo as métricas para exibir o Gráfico
metrics = history.history
metrics.keys()
```

Out[174]:

dict\_keys(['loss', 'binary\_accuracy'])

In [175]:

```
plt.figure(figsize=(14,7))
plt.plot(metrics['binary_accuracy'])
plt.plot(metrics['loss'])
plt.title('Curvas de Treinamento')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.legend(['Precisão', 'Função de Custo'], loc='upper left')
plt.show();
```



## Construção da Rede Neural *feed – forward* with Neurons = 11 and Activation = relu

In [176]:

```
model = Sequential()  
L1 = Dense(11, input_dim=11, activation='relu')  
model.add(L1)  
L2 = Dense(1, activation='relu')  
model.add(L2)
```

## Configuração da Rede Neural *feed – forward* with Epochs = 2000

In [177]:

```
t1 = time.process_time()  
model.compile(loss='mean_squared_error', optimizer='sgd', metrics=['binary_acc  
uracy'])  
history = model.fit(PTrain, Train, epochs=2000, verbose=1)  
t2 = time.process_time()
```

```
Epoch 1/2000  
1500/1500 [=====] - 0s - loss: 0.4645 - b  
inary_accuracy: 0.5673  
Epoch 2/2000  
1500/1500 [=====] - 0s - loss: 0.2615 - b  
inary_accuracy: 0.6713  
Epoch 3/2000  
1500/1500 [=====] - 0s - loss: 0.2127 - b  
inary_accuracy: 0.7300  
Epoch 4/2000  
1500/1500 [=====] - 0s - loss: 0.1813 - b  
inary_accuracy: 0.7660  
Epoch 5/2000  
1500/1500 [=====] - 0s - loss: 0.1586 - b  
inary_accuracy: 0.7867  
Epoch 6/2000  
1500/1500 [=====] - 0s - loss: 0.1458 - b  
inary_accuracy: 0.8060  
Epoch 7/2000  
1500/1500 [=====] - 0s - loss: 0.1383 - b  
inary_accuracy: 0.8200  
Epoch 8/2000  
1500/1500 [=====] - 0s - loss: 0.1334 - b  
inary_accuracy: 0.8253  
Epoch 9/2000  
1500/1500 [=====] - 0s - loss: 0.1300 - b  
inary_accuracy: 0.8307  
Epoch 10/2000  
1500/1500 [=====] - 0s - loss: 0.1271 - b  
inary_accuracy: 0.8367  
Epoch 11/2000  
1500/1500 [=====] - 0s - loss: 0.1248 - b  
inary_accuracy: 0.8393
```

Epoch 12/2000  
1500/1500 [=====] - 0s - loss: 0.1230 - binary\_accuracy: 0.8440

Epoch 13/2000  
1500/1500 [=====] - 0s - loss: 0.1215 - binary\_accuracy: 0.8487

Epoch 14/2000  
1500/1500 [=====] - 0s - loss: 0.1199 - binary\_accuracy: 0.8493

Epoch 15/2000  
1500/1500 [=====] - 0s - loss: 0.1185 - binary\_accuracy: 0.8500

Epoch 16/2000  
1500/1500 [=====] - 0s - loss: 0.1174 - binary\_accuracy: 0.8513

Epoch 17/2000  
1500/1500 [=====] - 0s - loss: 0.1163 - binary\_accuracy: 0.8553

Epoch 18/2000  
1500/1500 [=====] - 0s - loss: 0.1155 - binary\_accuracy: 0.8527

Epoch 19/2000  
1500/1500 [=====] - 0s - loss: 0.1144 - binary\_accuracy: 0.8573

Epoch 20/2000  
1500/1500 [=====] - 0s - loss: 0.1136 - binary\_accuracy: 0.8553

Epoch 21/2000  
1500/1500 [=====] - 0s - loss: 0.1129 - binary\_accuracy: 0.8593

Epoch 22/2000  
1500/1500 [=====] - 0s - loss: 0.1121 - binary\_accuracy: 0.8607

Epoch 23/2000  
1500/1500 [=====] - 0s - loss: 0.1116 - binary\_accuracy: 0.8607

Epoch 24/2000  
1500/1500 [=====] - 0s - loss: 0.1110 - binary\_accuracy: 0.8607

Epoch 25/2000  
1500/1500 [=====] - 0s - loss: 0.1103 - binary\_accuracy: 0.8627

Epoch 26/2000  
1500/1500 [=====] - 0s - loss: 0.1099 - binary\_accuracy: 0.8600

Epoch 27/2000  
1500/1500 [=====] - 0s - loss: 0.1093 - binary\_accuracy: 0.8633

Epoch 28/2000  
1500/1500 [=====] - 0s - loss: 0.1089 - binary\_accuracy: 0.8633

Epoch 29/2000  
1500/1500 [=====] - 0s - loss: 0.1085 - binary\_accuracy: 0.8640

Epoch 30/2000  
1500/1500 [=====] - 0s - loss: 0.1080 - binary\_accuracy: 0.8647

Epoch 31/2000  
1500/1500 [=====] - 0s - loss: 0.1078 - binary\_accuracy: 0.8633

Epoch 32/2000  
1500/1500 [=====] - 0s - loss: 0.1075 - binary\_accuracy: 0.8653

Epoch 33/2000  
1500/1500 [=====] - 0s - loss: 0.1071 - binary\_accuracy: 0.8660

Epoch 34/2000  
1500/1500 [=====] - 0s - loss: 0.1069 - binary\_accuracy: 0.8627

Epoch 35/2000  
1500/1500 [=====] - 0s - loss: 0.1066 - binary\_accuracy: 0.8680

Epoch 36/2000  
1500/1500 [=====] - 0s - loss: 0.1062 - binary\_accuracy: 0.8660

Epoch 37/2000  
1500/1500 [=====] - 0s - loss: 0.1061 - binary\_accuracy: 0.8667

Epoch 38/2000  
1500/1500 [=====] - 0s - loss: 0.1057 - binary\_accuracy: 0.8673

Epoch 39/2000  
1500/1500 [=====] - 0s - loss: 0.1055 - binary\_accuracy: 0.8667

Epoch 40/2000  
1500/1500 [=====] - 0s - loss: 0.1054 - binary\_accuracy: 0.8667

Epoch 41/2000  
1500/1500 [=====] - 0s - loss: 0.1051 - binary\_accuracy: 0.8667

Epoch 42/2000  
1500/1500 [=====] - 0s - loss: 0.1048 - binary\_accuracy: 0.8680

Epoch 43/2000  
1500/1500 [=====] - 0s - loss: 0.1046 - binary\_accuracy: 0.8660

Epoch 44/2000  
1500/1500 [=====] - 0s - loss: 0.1045 - binary\_accuracy: 0.8653

Epoch 45/2000  
1500/1500 [=====] - 0s - loss: 0.1043 - binary\_accuracy: 0.8673

Epoch 46/2000  
1500/1500 [=====] - 0s - loss: 0.1042 - binary\_accuracy: 0.8667

Epoch 47/2000  
1500/1500 [=====] - 0s - loss: 0.1041 - binary\_accuracy: 0.8673

Epoch 48/2000  
1500/1500 [=====] - 0s - loss: 0.1039 - binary\_accuracy: 0.8660

Epoch 49/2000  
1500/1500 [=====] - 0s - loss: 0.1036 - binary\_accuracy: 0.8660

Epoch 50/2000  
1500/1500 [=====] - 0s - loss: 0.1035 - binary\_accuracy: 0.8667

Epoch 51/2000  
1500/1500 [=====] - 0s - loss: 0.1034 - binary\_accuracy: 0.8667

Epoch 52/2000  
1500/1500 [=====] - 0s - loss: 0.1031 - binary\_accuracy: 0.8673

Epoch 53/2000  
1500/1500 [=====] - 0s - loss: 0.1030 - binary\_accuracy: 0.8680

Epoch 54/2000  
1500/1500 [=====] - 0s - loss: 0.1029 - binary\_accuracy: 0.8680

Epoch 55/2000  
1500/1500 [=====] - 0s - loss: 0.1027 - binary\_accuracy: 0.8667

Epoch 56/2000  
1500/1500 [=====] - 0s - loss: 0.1026 - binary\_accuracy: 0.8673

Epoch 57/2000  
1500/1500 [=====] - 0s - loss: 0.1024 - binary\_accuracy: 0.8707

Epoch 58/2000  
1500/1500 [=====] - 0s - loss: 0.1024 - binary\_accuracy: 0.8673

Epoch 59/2000  
1500/1500 [=====] - 0s - loss: 0.1022 - binary\_accuracy: 0.8667

Epoch 60/2000  
1500/1500 [=====] - 0s - loss: 0.1020 - binary\_accuracy: 0.8687

Epoch 61/2000  
1500/1500 [=====] - 0s - loss: 0.1019 - binary\_accuracy: 0.8660

Epoch 62/2000  
1500/1500 [=====] - 0s - loss: 0.1018 - binary\_accuracy: 0.8667

Epoch 63/2000  
1500/1500 [=====] - 0s - loss: 0.1017 - binary\_accuracy: 0.8653

Epoch 64/2000  
1500/1500 [=====] - 0s - loss: 0.1015 - binary\_accuracy: 0.8687

Epoch 65/2000  
1500/1500 [=====] - 0s - loss: 0.1015 - binary\_accuracy: 0.8693

Epoch 66/2000  
1500/1500 [=====] - 0s - loss: 0.1013 - binary\_accuracy: 0.8667

Epoch 67/2000  
1500/1500 [=====] - 0s - loss: 0.1012 - binary\_accuracy: 0.8687

Epoch 68/2000  
1500/1500 [=====] - 0s - loss: 0.1012 - binary\_accuracy: 0.8700

Epoch 69/2000  
1500/1500 [=====] - 0s - loss: 0.1009 - binary\_accuracy: 0.8720

Epoch 70/2000  
1500/1500 [=====] - 0s - loss: 0.1010 - binary\_accuracy: 0.8687

Epoch 71/2000  
1500/1500 [=====] - 0s - loss: 0.1007 - binary\_accuracy: 0.8713

Epoch 72/2000  
1500/1500 [=====] - 0s - loss: 0.1008 - binary\_accuracy: 0.8687

Epoch 73/2000  
1500/1500 [=====] - 0s - loss: 0.1006 - binary\_accuracy: 0.8713

Epoch 74/2000  
1500/1500 [=====] - 0s - loss: 0.1005 - binary\_accuracy: 0.8700

Epoch 75/2000  
1500/1500 [=====] - 0s - loss: 0.1004 - binary\_accuracy: 0.8700

Epoch 76/2000  
1500/1500 [=====] - 0s - loss: 0.1004 - binary\_accuracy: 0.8727

Epoch 77/2000  
1500/1500 [=====] - 0s - loss: 0.1003 - binary\_accuracy: 0.8707

Epoch 78/2000  
1500/1500 [=====] - 0s - loss: 0.1002 - binary\_accuracy: 0.8720

Epoch 79/2000  
1500/1500 [=====] - 0s - loss: 0.1001 - binary\_accuracy: 0.8707

Epoch 80/2000  
1500/1500 [=====] - 0s - loss: 0.1001 - binary\_accuracy: 0.8713

Epoch 81/2000  
1500/1500 [=====] - 0s - loss: 0.0998 - binary\_accuracy: 0.8713

Epoch 82/2000  
1500/1500 [=====] - 0s - loss: 0.0999 - binary\_accuracy: 0.8707

Epoch 83/2000  
1500/1500 [=====] - 0s - loss: 0.0997 - binary\_accuracy: 0.8720

Epoch 84/2000  
1500/1500 [=====] - 0s - loss: 0.0997 - binary\_accuracy: 0.8720

Epoch 85/2000  
1500/1500 [=====] - 0s - loss: 0.0996 - binary\_accuracy: 0.8727

Epoch 86/2000  
1500/1500 [=====] - 0s - loss: 0.0995 - binary\_accuracy: 0.8693

Epoch 87/2000  
1500/1500 [=====] - 0s - loss: 0.0994 - binary\_accuracy: 0.8720



Epoch 88/2000  
1500/1500 [=====] - 0s - loss: 0.0993 - binary\_accuracy: 0.8700

Epoch 89/2000  
1500/1500 [=====] - 0s - loss: 0.0992 - binary\_accuracy: 0.8747

Epoch 90/2000  
1500/1500 [=====] - 0s - loss: 0.0992 - binary\_accuracy: 0.8727

Epoch 91/2000  
1500/1500 [=====] - 0s - loss: 0.0990 - binary\_accuracy: 0.8733

Epoch 92/2000  
1500/1500 [=====] - 0s - loss: 0.0990 - binary\_accuracy: 0.8713

Epoch 93/2000  
1500/1500 [=====] - 0s - loss: 0.0989 - binary\_accuracy: 0.8733

Epoch 94/2000  
1500/1500 [=====] - 0s - loss: 0.0988 - binary\_accuracy: 0.8720

Epoch 95/2000  
1500/1500 [=====] - 0s - loss: 0.0987 - binary\_accuracy: 0.8753

Epoch 96/2000  
1500/1500 [=====] - 0s - loss: 0.0987 - binary\_accuracy: 0.8733

Epoch 97/2000  
1500/1500 [=====] - 0s - loss: 0.0986 - binary\_accuracy: 0.8720

Epoch 98/2000  
1500/1500 [=====] - 0s - loss: 0.0985 - binary\_accuracy: 0.8753

Epoch 99/2000  
1500/1500 [=====] - 0s - loss: 0.0984 - binary\_accuracy: 0.8727

Epoch 100/2000  
1500/1500 [=====] - 0s - loss: 0.0984 - binary\_accuracy: 0.8740

Epoch 101/2000  
1500/1500 [=====] - 0s - loss: 0.0984 - binary\_accuracy: 0.8740

Epoch 102/2000  
1500/1500 [=====] - 0s - loss: 0.0982 - binary\_accuracy: 0.8740

Epoch 103/2000  
1500/1500 [=====] - 0s - loss: 0.0982 - binary\_accuracy: 0.8733

Epoch 104/2000  
1500/1500 [=====] - 0s - loss: 0.0981 - binary\_accuracy: 0.8747

Epoch 105/2000  
1500/1500 [=====] - 0s - loss: 0.0980 - binary\_accuracy: 0.8740

Epoch 106/2000  
1500/1500 [=====] - 0s - loss: 0.0980 - binary\_accuracy: 0.8733

Epoch 107/2000  
1500/1500 [=====] - 0s - loss: 0.0979 - binary\_accuracy: 0.8747

Epoch 108/2000  
1500/1500 [=====] - 0s - loss: 0.0978 - binary\_accuracy: 0.8747

Epoch 109/2000  
1500/1500 [=====] - 0s - loss: 0.0977 - binary\_accuracy: 0.8733

Epoch 110/2000  
1500/1500 [=====] - 0s - loss: 0.0977 - binary\_accuracy: 0.8753

Epoch 111/2000  
1500/1500 [=====] - 0s - loss: 0.0977 - binary\_accuracy: 0.8767

Epoch 112/2000  
1500/1500 [=====] - 0s - loss: 0.0976 - binary\_accuracy: 0.8747

Epoch 113/2000  
1500/1500 [=====] - 0s - loss: 0.0976 - binary\_accuracy: 0.8747

Epoch 114/2000  
1500/1500 [=====] - 0s - loss: 0.0975 - binary\_accuracy: 0.8753

Epoch 115/2000  
1500/1500 [=====] - 0s - loss: 0.0974 - binary\_accuracy: 0.8753

Epoch 116/2000  
1500/1500 [=====] - 0s - loss: 0.0974 - binary\_accuracy: 0.8773

Epoch 117/2000  
1500/1500 [=====] - 0s - loss: 0.0973 - binary\_accuracy: 0.8767

Epoch 118/2000  
1500/1500 [=====] - 0s - loss: 0.0972 - binary\_accuracy: 0.8753

Epoch 119/2000  
1500/1500 [=====] - 0s - loss: 0.0970 - binary\_accuracy: 0.8747

Epoch 120/2000  
1500/1500 [=====] - 0s - loss: 0.0970 - binary\_accuracy: 0.8753

Epoch 121/2000  
1500/1500 [=====] - 0s - loss: 0.0969 - binary\_accuracy: 0.8753

Epoch 122/2000  
1500/1500 [=====] - 0s - loss: 0.0969 - binary\_accuracy: 0.8773

Epoch 123/2000  
1500/1500 [=====] - 0s - loss: 0.0967 - binary\_accuracy: 0.8760

Epoch 124/2000  
1500/1500 [=====] - 0s - loss: 0.0966 - binary\_accuracy: 0.8767

Epoch 125/2000  
1500/1500 [=====] - 0s - loss: 0.0966 - binary\_accuracy: 0.8760

Epoch 126/2000  
1500/1500 [=====] - 0s - loss: 0.0964 - b  
inary\_accuracy: 0.8760  
Epoch 127/2000  
1500/1500 [=====] - 0s - loss: 0.0964 - b  
inary\_accuracy: 0.8753  
Epoch 128/2000  
1500/1500 [=====] - 0s - loss: 0.0964 - b  
inary\_accuracy: 0.8780  
Epoch 129/2000  
1500/1500 [=====] - ETA: 0s - loss: 0.099  
3 - binary\_accuracy: 0.872 - 0s - loss: 0.0961 - binary\_accuracy:  
0.8773  
Epoch 130/2000  
1500/1500 [=====] - 0s - loss: 0.0962 - b  
inary\_accuracy: 0.8767  
Epoch 131/2000  
1500/1500 [=====] - 0s - loss: 0.0961 - b  
inary\_accuracy: 0.8753  
Epoch 132/2000  
1500/1500 [=====] - 0s - loss: 0.0960 - b  
inary\_accuracy: 0.8760  
Epoch 133/2000  
1500/1500 [=====] - 0s - loss: 0.0959 - b  
inary\_accuracy: 0.8773  
Epoch 134/2000  
1500/1500 [=====] - 0s - loss: 0.0957 - b  
inary\_accuracy: 0.8787  
Epoch 135/2000  
1500/1500 [=====] - 0s - loss: 0.0957 - b  
inary\_accuracy: 0.8773  
Epoch 136/2000  
1500/1500 [=====] - 0s - loss: 0.0957 - b  
inary\_accuracy: 0.8780  
Epoch 137/2000  
1500/1500 [=====] - 0s - loss: 0.0956 - b  
inary\_accuracy: 0.8793  
Epoch 138/2000  
1500/1500 [=====] - 0s - loss: 0.0954 - b  
inary\_accuracy: 0.8780  
Epoch 139/2000  
1500/1500 [=====] - 0s - loss: 0.0954 - b  
inary\_accuracy: 0.8787  
Epoch 140/2000  
1500/1500 [=====] - 0s - loss: 0.0954 - b  
inary\_accuracy: 0.8800  
Epoch 141/2000  
1500/1500 [=====] - 0s - loss: 0.0953 - b  
inary\_accuracy: 0.8787  
Epoch 142/2000  
1500/1500 [=====] - 0s - loss: 0.0953 - b  
inary\_accuracy: 0.8787  
Epoch 143/2000  
1500/1500 [=====] - 0s - loss: 0.0951 - b  
inary\_accuracy: 0.8787  
Epoch 144/2000  
1500/1500 [=====] - 0s - loss: 0.0951 - b

inary\_accuracy: 0.8793  
Epoch 145/2000  
1500/1500 [=====] - 0s - loss: 0.0949 - b  
inary\_accuracy: 0.8780  
Epoch 146/2000  
1500/1500 [=====] - 0s - loss: 0.0951 - b  
inary\_accuracy: 0.8780  
Epoch 147/2000  
1500/1500 [=====] - 0s - loss: 0.0949 - b  
inary\_accuracy: 0.8787  
Epoch 148/2000  
1500/1500 [=====] - 0s - loss: 0.0949 - b  
inary\_accuracy: 0.8807  
Epoch 149/2000  
1500/1500 [=====] - 0s - loss: 0.0948 - b  
inary\_accuracy: 0.8787  
Epoch 150/2000  
1500/1500 [=====] - 0s - loss: 0.0947 - b  
inary\_accuracy: 0.8793  
Epoch 151/2000  
1500/1500 [=====] - 0s - loss: 0.0946 - b  
inary\_accuracy: 0.8793  
Epoch 152/2000  
1500/1500 [=====] - 0s - loss: 0.0946 - b  
inary\_accuracy: 0.8793  
Epoch 153/2000  
1500/1500 [=====] - 0s - loss: 0.0944 - b  
inary\_accuracy: 0.8787  
Epoch 154/2000  
1500/1500 [=====] - 0s - loss: 0.0945 - b  
inary\_accuracy: 0.8820  
Epoch 155/2000  
1500/1500 [=====] - 0s - loss: 0.0944 - b  
inary\_accuracy: 0.8813  
Epoch 156/2000  
1500/1500 [=====] - 0s - loss: 0.0944 - b  
inary\_accuracy: 0.8807  
Epoch 157/2000  
1500/1500 [=====] - 0s - loss: 0.0943 - b  
inary\_accuracy: 0.8787  
Epoch 158/2000  
1500/1500 [=====] - 0s - loss: 0.0941 - b  
inary\_accuracy: 0.8800  
Epoch 159/2000  
1500/1500 [=====] - 0s - loss: 0.0942 - b  
inary\_accuracy: 0.8833  
Epoch 160/2000  
1500/1500 [=====] - 0s - loss: 0.0942 - b  
inary\_accuracy: 0.8800  
Epoch 161/2000  
1500/1500 [=====] - 0s - loss: 0.0942 - b  
inary\_accuracy: 0.8827  
Epoch 162/2000  
1500/1500 [=====] - 0s - loss: 0.0939 - b  
inary\_accuracy: 0.8820  
Epoch 163/2000  
1500/1500 [=====] - 0s - loss: 0.0940 - b

inary\_accuracy: 0.8800  
Epoch 164/2000  
1500/1500 [=====] - 0s - loss: 0.0939 - b  
inary\_accuracy: 0.8820  
Epoch 165/2000  
1500/1500 [=====] - 0s - loss: 0.0938 - b  
inary\_accuracy: 0.8833  
Epoch 166/2000  
1500/1500 [=====] - 0s - loss: 0.0938 - b  
inary\_accuracy: 0.8800  
Epoch 167/2000  
1500/1500 [=====] - 0s - loss: 0.0937 - b  
inary\_accuracy: 0.8833  
Epoch 168/2000  
1500/1500 [=====] - 0s - loss: 0.0937 - b  
inary\_accuracy: 0.8840  
Epoch 169/2000  
1500/1500 [=====] - 0s - loss: 0.0937 - b  
inary\_accuracy: 0.8820  
Epoch 170/2000  
1500/1500 [=====] - 0s - loss: 0.0936 - b  
inary\_accuracy: 0.8813  
Epoch 171/2000  
1500/1500 [=====] - 0s - loss: 0.0936 - b  
inary\_accuracy: 0.8827  
Epoch 172/2000  
1500/1500 [=====] - 0s - loss: 0.0936 - b  
inary\_accuracy: 0.8813  
Epoch 173/2000  
1500/1500 [=====] - 0s - loss: 0.0935 - b  
inary\_accuracy: 0.8813  
Epoch 174/2000  
1500/1500 [=====] - 0s - loss: 0.0934 - b  
inary\_accuracy: 0.8820  
Epoch 175/2000  
1500/1500 [=====] - 0s - loss: 0.0934 - b  
inary\_accuracy: 0.8820  
Epoch 176/2000  
1500/1500 [=====] - 0s - loss: 0.0933 - b  
inary\_accuracy: 0.8833  
Epoch 177/2000  
1500/1500 [=====] - 0s - loss: 0.0933 - b  
inary\_accuracy: 0.8827  
Epoch 178/2000  
1500/1500 [=====] - 0s - loss: 0.0932 - b  
inary\_accuracy: 0.8827  
Epoch 179/2000  
1500/1500 [=====] - 0s - loss: 0.0932 - b  
inary\_accuracy: 0.8840  
Epoch 180/2000  
1500/1500 [=====] - 0s - loss: 0.0931 - b  
inary\_accuracy: 0.8833  
Epoch 181/2000  
1500/1500 [=====] - 0s - loss: 0.0931 - b  
inary\_accuracy: 0.8860  
Epoch 182/2000  
1500/1500 [=====] - 0s - loss: 0.0930 - b

inary\_accuracy: 0.8847  
Epoch 183/2000  
1500/1500 [=====] - 0s - loss: 0.0931 - b  
inary\_accuracy: 0.8827  
Epoch 184/2000  
1500/1500 [=====] - 0s - loss: 0.0931 - b  
inary\_accuracy: 0.8860  
Epoch 185/2000  
1500/1500 [=====] - 0s - loss: 0.0929 - b  
inary\_accuracy: 0.8840  
Epoch 186/2000  
1500/1500 [=====] - 0s - loss: 0.0929 - b  
inary\_accuracy: 0.8853  
Epoch 187/2000  
1500/1500 [=====] - 0s - loss: 0.0929 - b  
inary\_accuracy: 0.8840  
Epoch 188/2000  
1500/1500 [=====] - 0s - loss: 0.0928 - b  
inary\_accuracy: 0.8840  
Epoch 189/2000  
1500/1500 [=====] - 0s - loss: 0.0928 - b  
inary\_accuracy: 0.8820  
Epoch 190/2000  
1500/1500 [=====] - 0s - loss: 0.0927 - b  
inary\_accuracy: 0.8847  
Epoch 191/2000  
1500/1500 [=====] - 0s - loss: 0.0927 - b  
inary\_accuracy: 0.8847  
Epoch 192/2000  
1500/1500 [=====] - 0s - loss: 0.0928 - b  
inary\_accuracy: 0.8867  
Epoch 193/2000  
1500/1500 [=====] - 0s - loss: 0.0927 - b  
inary\_accuracy: 0.8860  
Epoch 194/2000  
1500/1500 [=====] - 0s - loss: 0.0927 - b  
inary\_accuracy: 0.8860  
Epoch 195/2000  
1500/1500 [=====] - 0s - loss: 0.0927 - b  
inary\_accuracy: 0.8847  
Epoch 196/2000  
1500/1500 [=====] - 0s - loss: 0.0926 - b  
inary\_accuracy: 0.8840  
Epoch 197/2000  
1500/1500 [=====] - 0s - loss: 0.0925 - b  
inary\_accuracy: 0.8873  
Epoch 198/2000  
1500/1500 [=====] - 0s - loss: 0.0924 - b  
inary\_accuracy: 0.8860  
Epoch 199/2000  
1500/1500 [=====] - 0s - loss: 0.0926 - b  
inary\_accuracy: 0.8840  
Epoch 200/2000  
1500/1500 [=====] - 0s - loss: 0.0925 - b  
inary\_accuracy: 0.8867  
Epoch 201/2000  
1500/1500 [=====] - 0s - loss: 0.0925 - b

inary\_accuracy: 0.8880  
Epoch 202/2000  
1500/1500 [=====] - 0s - loss: 0.0923 - b  
inary\_accuracy: 0.8900  
Epoch 203/2000  
1500/1500 [=====] - 0s - loss: 0.0925 - b  
inary\_accuracy: 0.8840  
Epoch 204/2000  
1500/1500 [=====] - 0s - loss: 0.0925 - b  
inary\_accuracy: 0.8853  
Epoch 205/2000  
1500/1500 [=====] - 0s - loss: 0.0924 - b  
inary\_accuracy: 0.8880  
Epoch 206/2000  
1500/1500 [=====] - 0s - loss: 0.0923 - b  
inary\_accuracy: 0.8887  
Epoch 207/2000  
1500/1500 [=====] - 0s - loss: 0.0923 - b  
inary\_accuracy: 0.8847  
Epoch 208/2000  
1500/1500 [=====] - 0s - loss: 0.0924 - b  
inary\_accuracy: 0.8867  
Epoch 209/2000  
1500/1500 [=====] - 0s - loss: 0.0922 - b  
inary\_accuracy: 0.8867  
Epoch 210/2000  
1500/1500 [=====] - 0s - loss: 0.0921 - b  
inary\_accuracy: 0.8880  
Epoch 211/2000  
1500/1500 [=====] - 0s - loss: 0.0922 - b  
inary\_accuracy: 0.8887  
Epoch 212/2000  
1500/1500 [=====] - 0s - loss: 0.0921 - b  
inary\_accuracy: 0.8887  
Epoch 213/2000  
1500/1500 [=====] - 0s - loss: 0.0920 - b  
inary\_accuracy: 0.8880  
Epoch 214/2000  
1500/1500 [=====] - 0s - loss: 0.0921 - b  
inary\_accuracy: 0.8873  
Epoch 215/2000  
1500/1500 [=====] - 0s - loss: 0.0920 - b  
inary\_accuracy: 0.8893  
Epoch 216/2000  
1500/1500 [=====] - 0s - loss: 0.0920 - b  
inary\_accuracy: 0.8873  
Epoch 217/2000  
1500/1500 [=====] - 0s - loss: 0.0919 - b  
inary\_accuracy: 0.8893  
Epoch 218/2000  
1500/1500 [=====] - 0s - loss: 0.0919 - b  
inary\_accuracy: 0.8887  
Epoch 219/2000  
1500/1500 [=====] - 0s - loss: 0.0919 - b  
inary\_accuracy: 0.8887  
Epoch 220/2000  
1500/1500 [=====] - 0s - loss: 0.0918 - b

inary\_accuracy: 0.8907  
Epoch 221/2000  
1500/1500 [=====] - 0s - loss: 0.0918 - b  
inary\_accuracy: 0.8880  
Epoch 222/2000  
1500/1500 [=====] - 0s - loss: 0.0917 - b  
inary\_accuracy: 0.8853  
Epoch 223/2000  
1500/1500 [=====] - 0s - loss: 0.0918 - b  
inary\_accuracy: 0.8900  
Epoch 224/2000  
1500/1500 [=====] - 0s - loss: 0.0918 - b  
inary\_accuracy: 0.8900  
Epoch 225/2000  
1500/1500 [=====] - 0s - loss: 0.0917 - b  
inary\_accuracy: 0.8880  
Epoch 226/2000  
1500/1500 [=====] - 0s - loss: 0.0917 - b  
inary\_accuracy: 0.8900  
Epoch 227/2000  
1500/1500 [=====] - 0s - loss: 0.0916 - b  
inary\_accuracy: 0.8900  
Epoch 228/2000  
1500/1500 [=====] - 0s - loss: 0.0915 - b  
inary\_accuracy: 0.8920  
Epoch 229/2000  
1500/1500 [=====] - 0s - loss: 0.0916 - b  
inary\_accuracy: 0.8900  
Epoch 230/2000  
1500/1500 [=====] - 0s - loss: 0.0916 - b  
inary\_accuracy: 0.8900  
Epoch 231/2000  
1500/1500 [=====] - 0s - loss: 0.0914 - b  
inary\_accuracy: 0.8907  
Epoch 232/2000  
1500/1500 [=====] - 0s - loss: 0.0915 - b  
inary\_accuracy: 0.8900  
Epoch 233/2000  
1500/1500 [=====] - 0s - loss: 0.0915 - b  
inary\_accuracy: 0.8920  
Epoch 234/2000  
1500/1500 [=====] - 0s - loss: 0.0914 - b  
inary\_accuracy: 0.8893  
Epoch 235/2000  
1500/1500 [=====] - 0s - loss: 0.0913 - b  
inary\_accuracy: 0.8907  
Epoch 236/2000  
1500/1500 [=====] - 0s - loss: 0.0914 - b  
inary\_accuracy: 0.8887  
Epoch 237/2000  
1500/1500 [=====] - 0s - loss: 0.0913 - b  
inary\_accuracy: 0.8900  
Epoch 238/2000  
1500/1500 [=====] - 0s - loss: 0.0912 - b  
inary\_accuracy: 0.8887  
Epoch 239/2000  
1500/1500 [=====] - 0s - loss: 0.0913 - b



inary\_accuracy: 0.8900  
Epoch 240/2000  
1500/1500 [=====] - 0s - loss: 0.0912 - b  
inary\_accuracy: 0.8893  
Epoch 241/2000  
1500/1500 [=====] - 0s - loss: 0.0911 - b  
inary\_accuracy: 0.8907  
Epoch 242/2000  
1500/1500 [=====] - 0s - loss: 0.0911 - b  
inary\_accuracy: 0.8900  
Epoch 243/2000  
1500/1500 [=====] - 0s - loss: 0.0910 - b  
inary\_accuracy: 0.8893  
Epoch 244/2000  
1500/1500 [=====] - 0s - loss: 0.0909 - b  
inary\_accuracy: 0.8907  
Epoch 245/2000  
1500/1500 [=====] - 0s - loss: 0.0909 - b  
inary\_accuracy: 0.8900  
Epoch 246/2000  
1500/1500 [=====] - 0s - loss: 0.0908 - b  
inary\_accuracy: 0.8900  
Epoch 247/2000  
1500/1500 [=====] - 0s - loss: 0.0907 - b  
inary\_accuracy: 0.8900  
Epoch 248/2000  
1500/1500 [=====] - 0s - loss: 0.0907 - b  
inary\_accuracy: 0.8913  
Epoch 249/2000  
1500/1500 [=====] - 0s - loss: 0.0906 - b  
inary\_accuracy: 0.8893  
Epoch 250/2000  
1500/1500 [=====] - 0s - loss: 0.0905 - b  
inary\_accuracy: 0.8913  
Epoch 251/2000  
1500/1500 [=====] - 0s - loss: 0.0904 - b  
inary\_accuracy: 0.8907  
Epoch 252/2000  
1500/1500 [=====] - 0s - loss: 0.0905 - b  
inary\_accuracy: 0.8920  
Epoch 253/2000  
1500/1500 [=====] - 0s - loss: 0.0904 - b  
inary\_accuracy: 0.8927  
Epoch 254/2000  
1500/1500 [=====] - 0s - loss: 0.0903 - b  
inary\_accuracy: 0.8920  
Epoch 255/2000  
1500/1500 [=====] - 0s - loss: 0.0902 - b  
inary\_accuracy: 0.8907  
Epoch 256/2000  
1500/1500 [=====] - 0s - loss: 0.0901 - b  
inary\_accuracy: 0.8927  
Epoch 257/2000  
1500/1500 [=====] - 0s - loss: 0.0901 - b  
inary\_accuracy: 0.8913  
Epoch 258/2000  
1500/1500 [=====] - 0s - loss: 0.0899 - b

inary\_accuracy: 0.8920  
Epoch 259/2000  
1500/1500 [=====] - 0s - loss: 0.0899 - b  
inary\_accuracy: 0.8913  
Epoch 260/2000  
1500/1500 [=====] - 0s - loss: 0.0899 - b  
inary\_accuracy: 0.8920  
Epoch 261/2000  
1500/1500 [=====] - 0s - loss: 0.0898 - b  
inary\_accuracy: 0.8907  
Epoch 262/2000  
1500/1500 [=====] - 0s - loss: 0.0898 - b  
inary\_accuracy: 0.8900  
Epoch 263/2000  
1500/1500 [=====] - 0s - loss: 0.0897 - b  
inary\_accuracy: 0.8907  
Epoch 264/2000  
1500/1500 [=====] - 0s - loss: 0.0896 - b  
inary\_accuracy: 0.8920  
Epoch 265/2000  
1500/1500 [=====] - 0s - loss: 0.0896 - b  
inary\_accuracy: 0.8920  
Epoch 266/2000  
1500/1500 [=====] - 0s - loss: 0.0895 - b  
inary\_accuracy: 0.8900  
Epoch 267/2000  
1500/1500 [=====] - 0s - loss: 0.0894 - b  
inary\_accuracy: 0.8933  
Epoch 268/2000  
1500/1500 [=====] - 0s - loss: 0.0894 - b  
inary\_accuracy: 0.8907  
Epoch 269/2000  
1500/1500 [=====] - 0s - loss: 0.0893 - b  
inary\_accuracy: 0.8913  
Epoch 270/2000  
1500/1500 [=====] - 0s - loss: 0.0894 - b  
inary\_accuracy: 0.8900  
Epoch 271/2000  
1500/1500 [=====] - 0s - loss: 0.0893 - b  
inary\_accuracy: 0.8927  
Epoch 272/2000  
1500/1500 [=====] - 0s - loss: 0.0892 - b  
inary\_accuracy: 0.8907  
Epoch 273/2000  
1500/1500 [=====] - 0s - loss: 0.0892 - b  
inary\_accuracy: 0.8913  
Epoch 274/2000  
1500/1500 [=====] - 0s - loss: 0.0891 - b  
inary\_accuracy: 0.8927  
Epoch 275/2000  
1500/1500 [=====] - 0s - loss: 0.0890 - b  
inary\_accuracy: 0.8913  
Epoch 276/2000  
1500/1500 [=====] - 0s - loss: 0.0889 - b  
inary\_accuracy: 0.8920  
Epoch 277/2000  
1500/1500 [=====] - 0s - loss: 0.0889 - b

inary\_accuracy: 0.8933  
Epoch 278/2000  
1500/1500 [=====] - 0s - loss: 0.0889 - b  
inary\_accuracy: 0.8920  
Epoch 279/2000  
1500/1500 [=====] - 0s - loss: 0.0888 - b  
inary\_accuracy: 0.8913  
Epoch 280/2000  
1500/1500 [=====] - 0s - loss: 0.0888 - b  
inary\_accuracy: 0.8933  
Epoch 281/2000  
1500/1500 [=====] - 0s - loss: 0.0886 - b  
inary\_accuracy: 0.8920  
Epoch 282/2000  
1500/1500 [=====] - 0s - loss: 0.0887 - b  
inary\_accuracy: 0.8913  
Epoch 283/2000  
1500/1500 [=====] - 0s - loss: 0.0886 - b  
inary\_accuracy: 0.8927  
Epoch 284/2000  
1500/1500 [=====] - 0s - loss: 0.0885 - b  
inary\_accuracy: 0.8913  
Epoch 285/2000  
1500/1500 [=====] - 0s - loss: 0.0885 - b  
inary\_accuracy: 0.8913  
Epoch 286/2000  
1500/1500 [=====] - 0s - loss: 0.0884 - b  
inary\_accuracy: 0.8913  
Epoch 287/2000  
1500/1500 [=====] - 0s - loss: 0.0883 - b  
inary\_accuracy: 0.8920  
Epoch 288/2000  
1500/1500 [=====] - 0s - loss: 0.0884 - b  
inary\_accuracy: 0.8920  
Epoch 289/2000  
1500/1500 [=====] - 0s - loss: 0.0884 - b  
inary\_accuracy: 0.8920  
Epoch 290/2000  
1500/1500 [=====] - 0s - loss: 0.0882 - b  
inary\_accuracy: 0.8913  
Epoch 291/2000  
1500/1500 [=====] - 0s - loss: 0.0882 - b  
inary\_accuracy: 0.8913  
Epoch 292/2000  
1500/1500 [=====] - 0s - loss: 0.0882 - b  
inary\_accuracy: 0.8927  
Epoch 293/2000  
1500/1500 [=====] - 0s - loss: 0.0881 - b  
inary\_accuracy: 0.8920  
Epoch 294/2000  
1500/1500 [=====] - 0s - loss: 0.0881 - b  
inary\_accuracy: 0.8913  
Epoch 295/2000  
1500/1500 [=====] - 0s - loss: 0.0880 - b  
inary\_accuracy: 0.8920  
Epoch 296/2000  
1500/1500 [=====] - 0s - loss: 0.0879 - b

inary\_accuracy: 0.8913  
Epoch 297/2000  
1500/1500 [=====] - 0s - loss: 0.0881 - b  
inary\_accuracy: 0.8907  
Epoch 298/2000  
1500/1500 [=====] - 0s - loss: 0.0879 - b  
inary\_accuracy: 0.8927  
Epoch 299/2000  
1500/1500 [=====] - 0s - loss: 0.0879 - b  
inary\_accuracy: 0.8907  
Epoch 300/2000  
1500/1500 [=====] - 0s - loss: 0.0878 - b  
inary\_accuracy: 0.8940  
Epoch 301/2000  
1500/1500 [=====] - 0s - loss: 0.0877 - b  
inary\_accuracy: 0.8920  
Epoch 302/2000  
1500/1500 [=====] - 0s - loss: 0.0877 - b  
inary\_accuracy: 0.8933  
Epoch 303/2000  
1500/1500 [=====] - 0s - loss: 0.0876 - b  
inary\_accuracy: 0.8933  
Epoch 304/2000  
1500/1500 [=====] - 0s - loss: 0.0877 - b  
inary\_accuracy: 0.8933  
Epoch 305/2000  
1500/1500 [=====] - 0s - loss: 0.0874 - b  
inary\_accuracy: 0.8953  
Epoch 306/2000  
1500/1500 [=====] - 0s - loss: 0.0876 - b  
inary\_accuracy: 0.8933  
Epoch 307/2000  
1500/1500 [=====] - 0s - loss: 0.0875 - b  
inary\_accuracy: 0.8920  
Epoch 308/2000  
1500/1500 [=====] - 0s - loss: 0.0874 - b  
inary\_accuracy: 0.8933  
Epoch 309/2000  
1500/1500 [=====] - 0s - loss: 0.0875 - b  
inary\_accuracy: 0.8933  
Epoch 310/2000  
1500/1500 [=====] - 0s - loss: 0.0875 - b  
inary\_accuracy: 0.8960  
Epoch 311/2000  
1500/1500 [=====] - 0s - loss: 0.0873 - b  
inary\_accuracy: 0.8933  
Epoch 312/2000  
1500/1500 [=====] - 0s - loss: 0.0874 - b  
inary\_accuracy: 0.8940  
Epoch 313/2000  
1500/1500 [=====] - 0s - loss: 0.0872 - b  
inary\_accuracy: 0.8927  
Epoch 314/2000  
1500/1500 [=====] - 0s - loss: 0.0873 - b  
inary\_accuracy: 0.8927  
Epoch 315/2000  
1500/1500 [=====] - 0s - loss: 0.0872 - b

inary\_accuracy: 0.8940  
Epoch 316/2000  
1500/1500 [=====] - 0s - loss: 0.0872 - b  
inary\_accuracy: 0.8940  
Epoch 317/2000  
1500/1500 [=====] - 0s - loss: 0.0871 - b  
inary\_accuracy: 0.8947  
Epoch 318/2000  
1500/1500 [=====] - 0s - loss: 0.0871 - b  
inary\_accuracy: 0.8947  
Epoch 319/2000  
1500/1500 [=====] - 0s - loss: 0.0871 - b  
inary\_accuracy: 0.8940  
Epoch 320/2000  
1500/1500 [=====] - 0s - loss: 0.0871 - b  
inary\_accuracy: 0.8940  
Epoch 321/2000  
1500/1500 [=====] - 0s - loss: 0.0870 - b  
inary\_accuracy: 0.8947  
Epoch 322/2000  
1500/1500 [=====] - 0s - loss: 0.0870 - b  
inary\_accuracy: 0.8933  
Epoch 323/2000  
1500/1500 [=====] - 0s - loss: 0.0870 - b  
inary\_accuracy: 0.8947  
Epoch 324/2000  
1500/1500 [=====] - 0s - loss: 0.0869 - b  
inary\_accuracy: 0.8953  
Epoch 325/2000  
1500/1500 [=====] - 0s - loss: 0.0869 - b  
inary\_accuracy: 0.8960  
Epoch 326/2000  
1500/1500 [=====] - 0s - loss: 0.0869 - b  
inary\_accuracy: 0.8960  
Epoch 327/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.8940  
Epoch 328/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.8927  
Epoch 329/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.8947  
Epoch 330/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.8960  
Epoch 331/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.8940  
Epoch 332/2000  
1500/1500 [=====] - 0s - loss: 0.0867 - b  
inary\_accuracy: 0.8933  
Epoch 333/2000  
1500/1500 [=====] - 0s - loss: 0.0868 - b  
inary\_accuracy: 0.8973  
Epoch 334/2000  
1500/1500 [=====] - 0s - loss: 0.0867 - b

inary\_accuracy: 0.8947  
Epoch 335/2000  
1500/1500 [=====] - 0s - loss: 0.0866 - b  
inary\_accuracy: 0.8947  
Epoch 336/2000  
1500/1500 [=====] - 0s - loss: 0.0866 - b  
inary\_accuracy: 0.8973  
Epoch 337/2000  
1500/1500 [=====] - 0s - loss: 0.0866 - b  
inary\_accuracy: 0.8933  
Epoch 338/2000  
1500/1500 [=====] - 0s - loss: 0.0865 - b  
inary\_accuracy: 0.8967  
Epoch 339/2000  
1500/1500 [=====] - 0s - loss: 0.0865 - b  
inary\_accuracy: 0.8967  
Epoch 340/2000  
1500/1500 [=====] - 0s - loss: 0.0864 - b  
inary\_accuracy: 0.8987  
Epoch 341/2000  
1500/1500 [=====] - 0s - loss: 0.0865 - b  
inary\_accuracy: 0.8967  
Epoch 342/2000  
1500/1500 [=====] - 0s - loss: 0.0864 - b  
inary\_accuracy: 0.8933  
Epoch 343/2000  
1500/1500 [=====] - 0s - loss: 0.0863 - b  
inary\_accuracy: 0.8980  
Epoch 344/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.8960  
Epoch 345/2000  
1500/1500 [=====] - 0s - loss: 0.0863 - b  
inary\_accuracy: 0.8967  
Epoch 346/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.8947  
Epoch 347/2000  
1500/1500 [=====] - 0s - loss: 0.0862 - b  
inary\_accuracy: 0.8987  
Epoch 348/2000  
1500/1500 [=====] - ETA: 0s - loss: 0.080  
6 - binary\_accuracy: 0.905 - 0s - loss: 0.0862 - binary\_accuracy:  
0.8953  
Epoch 349/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - b  
inary\_accuracy: 0.8980  
Epoch 350/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - b  
inary\_accuracy: 0.8960  
Epoch 351/2000  
1500/1500 [=====] - 0s - loss: 0.0861 - b  
inary\_accuracy: 0.8980  
Epoch 352/2000  
1500/1500 [=====] - 0s - loss: 0.0860 - b  
inary\_accuracy: 0.8987  
Epoch 353/2000

1500/1500 [=====] - 0s - loss: 0.0860 - b  
inary\_accuracy: 0.8947  
Epoch 354/2000  
1500/1500 [=====] - 0s - loss: 0.0860 - b  
inary\_accuracy: 0.8987  
Epoch 355/2000  
1500/1500 [=====] - 0s - loss: 0.0860 - b  
inary\_accuracy: 0.8993  
Epoch 356/2000  
1500/1500 [=====] - 0s - loss: 0.0860 - b  
inary\_accuracy: 0.8980  
Epoch 357/2000  
1500/1500 [=====] - 0s - loss: 0.0860 - b  
inary\_accuracy: 0.8987  
Epoch 358/2000  
1500/1500 [=====] - 0s - loss: 0.0859 - b  
inary\_accuracy: 0.8953  
Epoch 359/2000  
1500/1500 [=====] - 0s - loss: 0.0859 - b  
inary\_accuracy: 0.8967  
Epoch 360/2000  
1500/1500 [=====] - 0s - loss: 0.0859 - b  
inary\_accuracy: 0.8947  
Epoch 361/2000  
1500/1500 [=====] - 0s - loss: 0.0858 - b  
inary\_accuracy: 0.8993  
Epoch 362/2000  
1500/1500 [=====] - 0s - loss: 0.0858 - b  
inary\_accuracy: 0.8980  
Epoch 363/2000  
1500/1500 [=====] - 0s - loss: 0.0858 - b  
inary\_accuracy: 0.8973  
Epoch 364/2000  
1500/1500 [=====] - 0s - loss: 0.0858 - b  
inary\_accuracy: 0.8993  
Epoch 365/2000  
1500/1500 [=====] - 0s - loss: 0.0857 - b  
inary\_accuracy: 0.8980  
Epoch 366/2000  
1500/1500 [=====] - 0s - loss: 0.0857 - b  
inary\_accuracy: 0.8967  
Epoch 367/2000  
1500/1500 [=====] - 0s - loss: 0.0856 - b  
inary\_accuracy: 0.8993  
Epoch 368/2000  
1500/1500 [=====] - 0s - loss: 0.0856 - b  
inary\_accuracy: 0.8953  
Epoch 369/2000  
1500/1500 [=====] - 0s - loss: 0.0856 - b  
inary\_accuracy: 0.8973  
Epoch 370/2000  
1500/1500 [=====] - 0s - loss: 0.0857 - b  
inary\_accuracy: 0.8967  
Epoch 371/2000  
1500/1500 [=====] - 0s - loss: 0.0856 - b  
inary\_accuracy: 0.8993  
Epoch 372/2000

1500/1500 [=====] - 0s - loss: 0.0855 - b  
inary\_accuracy: 0.8993  
Epoch 373/2000  
1500/1500 [=====] - 0s - loss: 0.0856 - b  
inary\_accuracy: 0.8967  
Epoch 374/2000  
1500/1500 [=====] - 0s - loss: 0.0855 - b  
inary\_accuracy: 0.8973  
Epoch 375/2000  
1500/1500 [=====] - 0s - loss: 0.0855 - b  
inary\_accuracy: 0.8960  
Epoch 376/2000  
1500/1500 [=====] - 0s - loss: 0.0855 - b  
inary\_accuracy: 0.8973  
Epoch 377/2000  
1500/1500 [=====] - 0s - loss: 0.0854 - b  
inary\_accuracy: 0.8973  
Epoch 378/2000  
1500/1500 [=====] - 0s - loss: 0.0854 - b  
inary\_accuracy: 0.8980  
Epoch 379/2000  
1500/1500 [=====] - 0s - loss: 0.0853 - b  
inary\_accuracy: 0.8980  
Epoch 380/2000  
1500/1500 [=====] - 0s - loss: 0.0853 - b  
inary\_accuracy: 0.8967  
Epoch 381/2000  
1500/1500 [=====] - 0s - loss: 0.0853 - b  
inary\_accuracy: 0.8993  
Epoch 382/2000  
1500/1500 [=====] - 0s - loss: 0.0853 - b  
inary\_accuracy: 0.8980  
Epoch 383/2000  
1500/1500 [=====] - 0s - loss: 0.0853 - b  
inary\_accuracy: 0.8993  
Epoch 384/2000  
1500/1500 [=====] - 0s - loss: 0.0852 - b  
inary\_accuracy: 0.8973  
Epoch 385/2000  
1500/1500 [=====] - 0s - loss: 0.0852 - b  
inary\_accuracy: 0.8980  
Epoch 386/2000  
1500/1500 [=====] - 0s - loss: 0.0852 - b  
inary\_accuracy: 0.8940  
Epoch 387/2000  
1500/1500 [=====] - 0s - loss: 0.0852 - b  
inary\_accuracy: 0.9000  
Epoch 388/2000  
1500/1500 [=====] - 0s - loss: 0.0852 - b  
inary\_accuracy: 0.8987  
Epoch 389/2000  
1500/1500 [=====] - 0s - loss: 0.0852 - b  
inary\_accuracy: 0.8987  
Epoch 390/2000  
1500/1500 [=====] - 0s - loss: 0.0852 - b  
inary\_accuracy: 0.8980  
Epoch 391/2000



1500/1500 [=====] - 0s - loss: 0.0851 - b  
inary\_accuracy: 0.8960  
Epoch 392/2000  
1500/1500 [=====] - 0s - loss: 0.0851 - b  
inary\_accuracy: 0.8980  
Epoch 393/2000  
1500/1500 [=====] - 0s - loss: 0.0851 - b  
inary\_accuracy: 0.8967  
Epoch 394/2000  
1500/1500 [=====] - 0s - loss: 0.0851 - b  
inary\_accuracy: 0.8973  
Epoch 395/2000  
1500/1500 [=====] - 0s - loss: 0.0851 - b  
inary\_accuracy: 0.8987  
Epoch 396/2000  
1500/1500 [=====] - 0s - loss: 0.0851 - b  
inary\_accuracy: 0.9007  
Epoch 397/2000  
1500/1500 [=====] - 0s - loss: 0.0850 - b  
inary\_accuracy: 0.9000  
Epoch 398/2000  
1500/1500 [=====] - 0s - loss: 0.0850 - b  
inary\_accuracy: 0.8967  
Epoch 399/2000  
1500/1500 [=====] - 0s - loss: 0.0850 - b  
inary\_accuracy: 0.8987  
Epoch 400/2000  
1500/1500 [=====] - 0s - loss: 0.0849 - b  
inary\_accuracy: 0.9007  
Epoch 401/2000  
1500/1500 [=====] - 0s - loss: 0.0849 - b  
inary\_accuracy: 0.8967  
Epoch 402/2000  
1500/1500 [=====] - 0s - loss: 0.0849 - b  
inary\_accuracy: 0.8973  
Epoch 403/2000  
1500/1500 [=====] - 0s - loss: 0.0849 - b  
inary\_accuracy: 0.9000  
Epoch 404/2000  
1500/1500 [=====] - 0s - loss: 0.0849 - b  
inary\_accuracy: 0.9000  
Epoch 405/2000  
1500/1500 [=====] - 0s - loss: 0.0847 - b  
inary\_accuracy: 0.8980  
Epoch 406/2000  
1500/1500 [=====] - 0s - loss: 0.0848 - b  
inary\_accuracy: 0.8980  
Epoch 407/2000  
1500/1500 [=====] - 0s - loss: 0.0847 - b  
inary\_accuracy: 0.8987  
Epoch 408/2000  
1500/1500 [=====] - 0s - loss: 0.0847 - b  
inary\_accuracy: 0.8973  
Epoch 409/2000  
1500/1500 [=====] - 0s - loss: 0.0847 - b  
inary\_accuracy: 0.8973  
Epoch 410/2000

1500/1500 [=====] - 0s - loss: 0.0847 - b  
inary\_accuracy: 0.8973  
Epoch 411/2000  
1500/1500 [=====] - 0s - loss: 0.0846 - b  
inary\_accuracy: 0.8980  
Epoch 412/2000  
1500/1500 [=====] - 0s - loss: 0.0846 - b  
inary\_accuracy: 0.8967  
Epoch 413/2000  
1500/1500 [=====] - 0s - loss: 0.0845 - b  
inary\_accuracy: 0.8967  
Epoch 414/2000  
1500/1500 [=====] - 0s - loss: 0.0845 - b  
inary\_accuracy: 0.9013  
Epoch 415/2000  
1500/1500 [=====] - 0s - loss: 0.0844 - b  
inary\_accuracy: 0.8987  
Epoch 416/2000  
1500/1500 [=====] - 0s - loss: 0.0844 - b  
inary\_accuracy: 0.8993  
Epoch 417/2000  
1500/1500 [=====] - 0s - loss: 0.0844 - b  
inary\_accuracy: 0.8987  
Epoch 418/2000  
1500/1500 [=====] - 0s - loss: 0.0844 - b  
inary\_accuracy: 0.8987  
Epoch 419/2000  
1500/1500 [=====] - 0s - loss: 0.0844 - b  
inary\_accuracy: 0.8980  
Epoch 420/2000  
1500/1500 [=====] - 0s - loss: 0.0843 - b  
inary\_accuracy: 0.8987  
Epoch 421/2000  
1500/1500 [=====] - 0s - loss: 0.0844 - b  
inary\_accuracy: 0.8993  
Epoch 422/2000  
1500/1500 [=====] - 0s - loss: 0.0843 - b  
inary\_accuracy: 0.9000  
Epoch 423/2000  
1500/1500 [=====] - 0s - loss: 0.0843 - b  
inary\_accuracy: 0.8987  
Epoch 424/2000  
1500/1500 [=====] - 0s - loss: 0.0843 - b  
inary\_accuracy: 0.8973  
Epoch 425/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.8987  
Epoch 426/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.8993  
Epoch 427/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.8993  
Epoch 428/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.8993  
Epoch 429/2000

1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.8980  
Epoch 430/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.8987  
Epoch 431/2000  
1500/1500 [=====] - 0s - loss: 0.0842 - b  
inary\_accuracy: 0.8993  
Epoch 432/2000  
1500/1500 [=====] - 0s - loss: 0.0841 - b  
inary\_accuracy: 0.8987  
Epoch 433/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - b  
inary\_accuracy: 0.9007  
Epoch 434/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - b  
inary\_accuracy: 0.8987  
Epoch 435/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - b  
inary\_accuracy: 0.8967  
Epoch 436/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9000  
Epoch 437/2000  
1500/1500 [=====] - 0s - loss: 0.0840 - b  
inary\_accuracy: 0.8987  
Epoch 438/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9013  
Epoch 439/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9007  
Epoch 440/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.8993  
Epoch 441/2000  
1500/1500 [=====] - 0s - loss: 0.0839 - b  
inary\_accuracy: 0.9007  
Epoch 442/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.8980  
Epoch 443/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - b  
inary\_accuracy: 0.9007  
Epoch 444/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - b  
inary\_accuracy: 0.9007  
Epoch 445/2000  
1500/1500 [=====] - 0s - loss: 0.0838 - b  
inary\_accuracy: 0.8980  
Epoch 446/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - b  
inary\_accuracy: 0.9013  
Epoch 447/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - b  
inary\_accuracy: 0.8987  
Epoch 448/2000

1500/1500 [=====] - 0s - loss: 0.0836 - b  
inary\_accuracy: 0.8993  
Epoch 449/2000  
1500/1500 [=====] - 0s - loss: 0.0836 - b  
inary\_accuracy: 0.9000  
Epoch 450/2000  
1500/1500 [=====] - 0s - loss: 0.0837 - b  
inary\_accuracy: 0.8987  
Epoch 451/2000  
1500/1500 [=====] - 0s - loss: 0.0836 - b  
inary\_accuracy: 0.8987  
Epoch 452/2000  
1500/1500 [=====] - 0s - loss: 0.0835 - b  
inary\_accuracy: 0.8993  
Epoch 453/2000  
1500/1500 [=====] - 0s - loss: 0.0835 - b  
inary\_accuracy: 0.9000  
Epoch 454/2000  
1500/1500 [=====] - 0s - loss: 0.0835 - b  
inary\_accuracy: 0.8980  
Epoch 455/2000  
1500/1500 [=====] - 0s - loss: 0.0835 - b  
inary\_accuracy: 0.9013  
Epoch 456/2000  
1500/1500 [=====] - 0s - loss: 0.0834 - b  
inary\_accuracy: 0.9013  
Epoch 457/2000  
1500/1500 [=====] - 0s - loss: 0.0835 - b  
inary\_accuracy: 0.9000  
Epoch 458/2000  
1500/1500 [=====] - 0s - loss: 0.0835 - b  
inary\_accuracy: 0.9013  
Epoch 459/2000  
1500/1500 [=====] - 0s - loss: 0.0834 - b  
inary\_accuracy: 0.9000  
Epoch 460/2000  
1500/1500 [=====] - 0s - loss: 0.0834 - b  
inary\_accuracy: 0.8993  
Epoch 461/2000  
1500/1500 [=====] - 0s - loss: 0.0835 - b  
inary\_accuracy: 0.9007  
Epoch 462/2000  
1500/1500 [=====] - 0s - loss: 0.0834 - b  
inary\_accuracy: 0.9000  
Epoch 463/2000  
1500/1500 [=====] - 0s - loss: 0.0834 - b  
inary\_accuracy: 0.9020  
Epoch 464/2000  
1500/1500 [=====] - 0s - loss: 0.0833 - b  
inary\_accuracy: 0.9007  
Epoch 465/2000  
1500/1500 [=====] - 0s - loss: 0.0833 - b  
inary\_accuracy: 0.9000  
Epoch 466/2000  
1500/1500 [=====] - 0s - loss: 0.0834 - b  
inary\_accuracy: 0.8987  
Epoch 467/2000

1500/1500 [=====] - 0s - loss: 0.0833 - b  
inary\_accuracy: 0.8987  
Epoch 468/2000  
1500/1500 [=====] - 0s - loss: 0.0833 - b  
inary\_accuracy: 0.9007  
Epoch 469/2000  
1500/1500 [=====] - 0s - loss: 0.0834 - b  
inary\_accuracy: 0.9000  
Epoch 470/2000  
1500/1500 [=====] - 0s - loss: 0.0832 - b  
inary\_accuracy: 0.8987  
Epoch 471/2000  
1500/1500 [=====] - 0s - loss: 0.0833 - b  
inary\_accuracy: 0.9000  
Epoch 472/2000  
1500/1500 [=====] - 0s - loss: 0.0833 - b  
inary\_accuracy: 0.8980  
Epoch 473/2000  
1500/1500 [=====] - 0s - loss: 0.0833 - b  
inary\_accuracy: 0.8987  
Epoch 474/2000  
1500/1500 [=====] - 0s - loss: 0.0831 - b  
inary\_accuracy: 0.9007  
Epoch 475/2000  
1500/1500 [=====] - 0s - loss: 0.0832 - b  
inary\_accuracy: 0.8980  
Epoch 476/2000  
1500/1500 [=====] - 0s - loss: 0.0832 - b  
inary\_accuracy: 0.8993  
Epoch 477/2000  
1500/1500 [=====] - 0s - loss: 0.0832 - b  
inary\_accuracy: 0.8993  
Epoch 478/2000  
1500/1500 [=====] - 0s - loss: 0.0831 - b  
inary\_accuracy: 0.8980  
Epoch 479/2000  
1500/1500 [=====] - 0s - loss: 0.0832 - b  
inary\_accuracy: 0.8987  
Epoch 480/2000  
1500/1500 [=====] - 0s - loss: 0.0831 - b  
inary\_accuracy: 0.8993  
Epoch 481/2000  
1500/1500 [=====] - 0s - loss: 0.0831 - b  
inary\_accuracy: 0.9000  
Epoch 482/2000  
1500/1500 [=====] - 0s - loss: 0.0831 - b  
inary\_accuracy: 0.9013  
Epoch 483/2000  
1500/1500 [=====] - 0s - loss: 0.0831 - b  
inary\_accuracy: 0.9000  
Epoch 484/2000  
1500/1500 [=====] - 0s - loss: 0.0831 - b  
inary\_accuracy: 0.8987  
Epoch 485/2000  
1500/1500 [=====] - 0s - loss: 0.0830 - b  
inary\_accuracy: 0.9000  
Epoch 486/2000

1500/1500 [=====] - 0s - loss: 0.0831 - b  
inary\_accuracy: 0.8993  
Epoch 487/2000  
1500/1500 [=====] - 0s - loss: 0.0830 - b  
inary\_accuracy: 0.9013  
Epoch 488/2000  
1500/1500 [=====] - 0s - loss: 0.0831 - b  
inary\_accuracy: 0.9007  
Epoch 489/2000  
1500/1500 [=====] - 0s - loss: 0.0830 - b  
inary\_accuracy: 0.9000  
Epoch 490/2000  
1500/1500 [=====] - 0s - loss: 0.0830 - b  
inary\_accuracy: 0.9013  
Epoch 491/2000  
1500/1500 [=====] - 0s - loss: 0.0830 - b  
inary\_accuracy: 0.8987  
Epoch 492/2000  
1500/1500 [=====] - 0s - loss: 0.0830 - b  
inary\_accuracy: 0.8993  
Epoch 493/2000  
1500/1500 [=====] - 0s - loss: 0.0830 - b  
inary\_accuracy: 0.9000  
Epoch 494/2000  
1500/1500 [=====] - 0s - loss: 0.0829 - b  
inary\_accuracy: 0.9020  
Epoch 495/2000  
1500/1500 [=====] - 0s - loss: 0.0829 - b  
inary\_accuracy: 0.9013  
Epoch 496/2000  
1500/1500 [=====] - 0s - loss: 0.0829 - b  
inary\_accuracy: 0.9007  
Epoch 497/2000  
1500/1500 [=====] - 0s - loss: 0.0828 - b  
inary\_accuracy: 0.8980  
Epoch 498/2000  
1500/1500 [=====] - 0s - loss: 0.0829 - b  
inary\_accuracy: 0.9013  
Epoch 499/2000  
1500/1500 [=====] - 0s - loss: 0.0829 - b  
inary\_accuracy: 0.9007  
Epoch 500/2000  
1500/1500 [=====] - 0s - loss: 0.0828 - b  
inary\_accuracy: 0.9007  
Epoch 501/2000  
1500/1500 [=====] - 0s - loss: 0.0828 - b  
inary\_accuracy: 0.8993  
Epoch 502/2000  
1500/1500 [=====] - 0s - loss: 0.0829 - b  
inary\_accuracy: 0.9020  
Epoch 503/2000  
1500/1500 [=====] - 0s - loss: 0.0828 - b  
inary\_accuracy: 0.9013  
Epoch 504/2000  
1500/1500 [=====] - 0s - loss: 0.0829 - b  
inary\_accuracy: 0.9013  
Epoch 505/2000

1500/1500 [=====] - 0s - loss: 0.0827 - b  
inary\_accuracy: 0.9020  
Epoch 506/2000  
1500/1500 [=====] - 0s - loss: 0.0827 - b  
inary\_accuracy: 0.9013  
Epoch 507/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9013  
Epoch 508/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9027  
Epoch 509/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9027  
Epoch 510/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9020  
Epoch 511/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9020  
Epoch 512/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9013  
Epoch 513/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9020  
Epoch 514/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9013  
Epoch 515/2000  
1500/1500 [=====] - 0s - loss: 0.0826 - b  
inary\_accuracy: 0.9027  
Epoch 516/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9020  
Epoch 517/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9033  
Epoch 518/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9033  
Epoch 519/2000  
1500/1500 [=====] - 0s - loss: 0.0825 - b  
inary\_accuracy: 0.9020  
Epoch 520/2000  
1500/1500 [=====] - 0s - loss: 0.0824 - b  
inary\_accuracy: 0.9060  
Epoch 521/2000  
1500/1500 [=====] - 0s - loss: 0.0822 - b  
inary\_accuracy: 0.9040  
Epoch 522/2000  
1500/1500 [=====] - 0s - loss: 0.0824 - b  
inary\_accuracy: 0.9040  
Epoch 523/2000  
1500/1500 [=====] - 0s - loss: 0.0824 - b  
inary\_accuracy: 0.9040  
Epoch 524/2000

1500/1500 [=====] - 0s - loss: 0.0824 - b  
inary\_accuracy: 0.9033  
Epoch 525/2000  
1500/1500 [=====] - 0s - loss: 0.0824 - b  
inary\_accuracy: 0.9033  
Epoch 526/2000  
1500/1500 [=====] - 0s - loss: 0.0823 - b  
inary\_accuracy: 0.9040  
Epoch 527/2000  
1500/1500 [=====] - 0s - loss: 0.0823 - b  
inary\_accuracy: 0.9027  
Epoch 528/2000  
1500/1500 [=====] - 0s - loss: 0.0824 - b  
inary\_accuracy: 0.9040  
Epoch 529/2000  
1500/1500 [=====] - ETA: 0s - loss: 0.077  
9 - binary\_accuracy: 0.908 - 0s - loss: 0.0823 - binary\_accuracy:  
0.9033  
Epoch 530/2000  
1500/1500 [=====] - 0s - loss: 0.0822 - b  
inary\_accuracy: 0.9040  
Epoch 531/2000  
1500/1500 [=====] - 0s - loss: 0.0823 - b  
inary\_accuracy: 0.9040  
Epoch 532/2000  
1500/1500 [=====] - 0s - loss: 0.0822 - b  
inary\_accuracy: 0.9020  
Epoch 533/2000  
1500/1500 [=====] - 0s - loss: 0.0822 - b  
inary\_accuracy: 0.9040  
Epoch 534/2000  
1500/1500 [=====] - 0s - loss: 0.0823 - b  
inary\_accuracy: 0.9047  
Epoch 535/2000  
1500/1500 [=====] - 0s - loss: 0.0822 - b  
inary\_accuracy: 0.9053  
Epoch 536/2000  
1500/1500 [=====] - 0s - loss: 0.0822 - b  
inary\_accuracy: 0.9047  
Epoch 537/2000  
1500/1500 [=====] - 0s - loss: 0.0822 - b  
inary\_accuracy: 0.9053  
Epoch 538/2000  
1500/1500 [=====] - 0s - loss: 0.0822 - b  
inary\_accuracy: 0.9040  
Epoch 539/2000  
1500/1500 [=====] - 0s - loss: 0.0821 - b  
inary\_accuracy: 0.9047  
Epoch 540/2000  
1500/1500 [=====] - 0s - loss: 0.0821 - b  
inary\_accuracy: 0.9047  
Epoch 541/2000  
1500/1500 [=====] - 0s - loss: 0.0822 - b  
inary\_accuracy: 0.9060  
Epoch 542/2000  
1500/1500 [=====] - 0s - loss: 0.0821 - b  
inary\_accuracy: 0.9053



Epoch 543/2000  
1500/1500 [=====] - 0s - loss: 0.0822 - binary\_accuracy: 0.9053  
Epoch 544/2000  
1500/1500 [=====] - 0s - loss: 0.0821 - binary\_accuracy: 0.9033  
Epoch 545/2000  
1500/1500 [=====] - 0s - loss: 0.0821 - binary\_accuracy: 0.9047  
Epoch 546/2000  
1500/1500 [=====] - 0s - loss: 0.0821 - binary\_accuracy: 0.9047  
Epoch 547/2000  
1500/1500 [=====] - 0s - loss: 0.0821 - binary\_accuracy: 0.9033  
Epoch 548/2000  
1500/1500 [=====] - 0s - loss: 0.0820 - binary\_accuracy: 0.9053  
Epoch 549/2000  
1500/1500 [=====] - 0s - loss: 0.0820 - binary\_accuracy: 0.9040  
Epoch 550/2000  
1500/1500 [=====] - 0s - loss: 0.0820 - binary\_accuracy: 0.9033  
Epoch 551/2000  
1500/1500 [=====] - 0s - loss: 0.0818 - binary\_accuracy: 0.9047  
Epoch 552/2000  
1500/1500 [=====] - 0s - loss: 0.0820 - binary\_accuracy: 0.9033  
Epoch 553/2000  
1500/1500 [=====] - 0s - loss: 0.0819 - binary\_accuracy: 0.9053  
Epoch 554/2000  
1500/1500 [=====] - 0s - loss: 0.0820 - binary\_accuracy: 0.9047  
Epoch 555/2000  
1500/1500 [=====] - 0s - loss: 0.0819 - binary\_accuracy: 0.9047  
Epoch 556/2000  
1500/1500 [=====] - 0s - loss: 0.0819 - binary\_accuracy: 0.9047  
Epoch 557/2000  
1500/1500 [=====] - 0s - loss: 0.0819 - binary\_accuracy: 0.9067  
Epoch 558/2000  
1500/1500 [=====] - 0s - loss: 0.0819 - binary\_accuracy: 0.9040  
Epoch 559/2000  
1500/1500 [=====] - 0s - loss: 0.0819 - binary\_accuracy: 0.9053  
Epoch 560/2000  
1500/1500 [=====] - 0s - loss: 0.0818 - binary\_accuracy: 0.9040  
Epoch 561/2000  
1500/1500 [=====] - 0s - loss: 0.0819 - binary\_accuracy: 0.9020

Epoch 562/2000  
1500/1500 [=====] - 0s - loss: 0.0819 - binary\_accuracy: 0.9047  
Epoch 563/2000  
1500/1500 [=====] - 0s - loss: 0.0819 - binary\_accuracy: 0.9047  
Epoch 564/2000  
1500/1500 [=====] - 0s - loss: 0.0818 - binary\_accuracy: 0.9053  
Epoch 565/2000  
1500/1500 [=====] - 0s - loss: 0.0818 - binary\_accuracy: 0.9033  
Epoch 566/2000  
1500/1500 [=====] - 0s - loss: 0.0819 - binary\_accuracy: 0.9033  
Epoch 567/2000  
1500/1500 [=====] - 0s - loss: 0.0818 - binary\_accuracy: 0.9047  
Epoch 568/2000  
1500/1500 [=====] - 0s - loss: 0.0818 - binary\_accuracy: 0.9053  
Epoch 569/2000  
1500/1500 [=====] - 0s - loss: 0.0818 - binary\_accuracy: 0.9047  
Epoch 570/2000  
1500/1500 [=====] - 0s - loss: 0.0817 - binary\_accuracy: 0.9053  
Epoch 571/2000  
1500/1500 [=====] - 0s - loss: 0.0818 - binary\_accuracy: 0.9053  
Epoch 572/2000  
1500/1500 [=====] - 0s - loss: 0.0816 - binary\_accuracy: 0.9047  
Epoch 573/2000  
1500/1500 [=====] - 0s - loss: 0.0817 - binary\_accuracy: 0.9033  
Epoch 574/2000  
1500/1500 [=====] - 0s - loss: 0.0817 - binary\_accuracy: 0.9067  
Epoch 575/2000  
1500/1500 [=====] - 0s - loss: 0.0817 - binary\_accuracy: 0.9033  
Epoch 576/2000  
1500/1500 [=====] - 0s - loss: 0.0816 - binary\_accuracy: 0.9040  
Epoch 577/2000  
1500/1500 [=====] - 0s - loss: 0.0816 - binary\_accuracy: 0.9053  
Epoch 578/2000  
1500/1500 [=====] - 0s - loss: 0.0816 - binary\_accuracy: 0.9047  
Epoch 579/2000  
1500/1500 [=====] - 0s - loss: 0.0816 - binary\_accuracy: 0.9033  
Epoch 580/2000  
1500/1500 [=====] - 0s - loss: 0.0816 - binary\_accuracy: 0.9047

Epoch 581/2000  
1500/1500 [=====] - 0s - loss: 0.0816 - binary\_accuracy: 0.9047  
Epoch 582/2000  
1500/1500 [=====] - 0s - loss: 0.0816 - binary\_accuracy: 0.9033  
Epoch 583/2000  
1500/1500 [=====] - 0s - loss: 0.0816 - binary\_accuracy: 0.9040  
Epoch 584/2000  
1500/1500 [=====] - 0s - loss: 0.0815 - binary\_accuracy: 0.9047  
Epoch 585/2000  
1500/1500 [=====] - 0s - loss: 0.0816 - binary\_accuracy: 0.9053  
Epoch 586/2000  
1500/1500 [=====] - 0s - loss: 0.0815 - binary\_accuracy: 0.9040  
Epoch 587/2000  
1500/1500 [=====] - 0s - loss: 0.0815 - binary\_accuracy: 0.9040  
Epoch 588/2000  
1500/1500 [=====] - 0s - loss: 0.0815 - binary\_accuracy: 0.9047  
Epoch 589/2000  
1500/1500 [=====] - 0s - loss: 0.0815 - binary\_accuracy: 0.9047  
Epoch 590/2000  
1500/1500 [=====] - 0s - loss: 0.0814 - binary\_accuracy: 0.9033  
Epoch 591/2000  
1500/1500 [=====] - 0s - loss: 0.0814 - binary\_accuracy: 0.9040  
Epoch 592/2000  
1500/1500 [=====] - 0s - loss: 0.0814 - binary\_accuracy: 0.9033  
Epoch 593/2000  
1500/1500 [=====] - 0s - loss: 0.0814 - binary\_accuracy: 0.9047  
Epoch 594/2000  
1500/1500 [=====] - 0s - loss: 0.0814 - binary\_accuracy: 0.9053  
Epoch 595/2000  
1500/1500 [=====] - 0s - loss: 0.0814 - binary\_accuracy: 0.9027  
Epoch 596/2000  
1500/1500 [=====] - 0s - loss: 0.0814 - binary\_accuracy: 0.9047  
Epoch 597/2000  
1500/1500 [=====] - 0s - loss: 0.0813 - binary\_accuracy: 0.9040  
Epoch 598/2000  
1500/1500 [=====] - 0s - loss: 0.0814 - binary\_accuracy: 0.9040  
Epoch 599/2000  
1500/1500 [=====] - 0s - loss: 0.0813 - binary\_accuracy: 0.9033

Epoch 600/2000  
1500/1500 [=====] - 0s - loss: 0.0813 - binary\_accuracy: 0.9053  
Epoch 601/2000  
1500/1500 [=====] - 0s - loss: 0.0814 - binary\_accuracy: 0.9020  
Epoch 602/2000  
1500/1500 [=====] - 0s - loss: 0.0813 - binary\_accuracy: 0.9040  
Epoch 603/2000  
1500/1500 [=====] - 0s - loss: 0.0813 - binary\_accuracy: 0.9047  
Epoch 604/2000  
1500/1500 [=====] - 0s - loss: 0.0814 - binary\_accuracy: 0.9047  
Epoch 605/2000  
1500/1500 [=====] - 0s - loss: 0.0813 - binary\_accuracy: 0.9040  
Epoch 606/2000  
1500/1500 [=====] - 0s - loss: 0.0813 - binary\_accuracy: 0.9033  
Epoch 607/2000  
1500/1500 [=====] - 0s - loss: 0.0813 - binary\_accuracy: 0.9060  
Epoch 608/2000  
1500/1500 [=====] - 0s - loss: 0.0813 - binary\_accuracy: 0.9040  
Epoch 609/2000  
1500/1500 [=====] - 0s - loss: 0.0813 - binary\_accuracy: 0.9047  
Epoch 610/2000  
1500/1500 [=====] - 0s - loss: 0.0812 - binary\_accuracy: 0.9053  
Epoch 611/2000  
1500/1500 [=====] - 0s - loss: 0.0812 - binary\_accuracy: 0.9047  
Epoch 612/2000  
1500/1500 [=====] - 0s - loss: 0.0812 - binary\_accuracy: 0.9047  
Epoch 613/2000  
1500/1500 [=====] - 0s - loss: 0.0813 - binary\_accuracy: 0.9047  
Epoch 614/2000  
1500/1500 [=====] - 0s - loss: 0.0811 - binary\_accuracy: 0.9053  
Epoch 615/2000  
1500/1500 [=====] - 0s - loss: 0.0811 - binary\_accuracy: 0.9040  
Epoch 616/2000  
1500/1500 [=====] - 0s - loss: 0.0811 - binary\_accuracy: 0.9053  
Epoch 617/2000  
1500/1500 [=====] - 0s - loss: 0.0811 - binary\_accuracy: 0.9040  
Epoch 618/2000  
1500/1500 [=====] - 0s - loss: 0.0811 - binary\_accuracy: 0.9053

Epoch 619/2000  
1500/1500 [=====] - 0s - loss: 0.0810 - binary\_accuracy: 0.9053  
Epoch 620/2000  
1500/1500 [=====] - 0s - loss: 0.0810 - binary\_accuracy: 0.9053  
Epoch 621/2000  
1500/1500 [=====] - 0s - loss: 0.0810 - binary\_accuracy: 0.9060  
Epoch 622/2000  
1500/1500 [=====] - 0s - loss: 0.0810 - binary\_accuracy: 0.9060  
Epoch 623/2000  
1500/1500 [=====] - 0s - loss: 0.0809 - binary\_accuracy: 0.9053  
Epoch 624/2000  
1500/1500 [=====] - 0s - loss: 0.0809 - binary\_accuracy: 0.9040  
Epoch 625/2000  
1500/1500 [=====] - 0s - loss: 0.0809 - binary\_accuracy: 0.9047  
Epoch 626/2000  
1500/1500 [=====] - 0s - loss: 0.0808 - binary\_accuracy: 0.9047  
Epoch 627/2000  
1500/1500 [=====] - 0s - loss: 0.0809 - binary\_accuracy: 0.9067  
Epoch 628/2000  
1500/1500 [=====] - 0s - loss: 0.0807 - binary\_accuracy: 0.9047  
Epoch 629/2000  
1500/1500 [=====] - 0s - loss: 0.0807 - binary\_accuracy: 0.9067  
Epoch 630/2000  
1500/1500 [=====] - 0s - loss: 0.0807 - binary\_accuracy: 0.9067  
Epoch 631/2000  
1500/1500 [=====] - 0s - loss: 0.0807 - binary\_accuracy: 0.9067  
Epoch 632/2000  
1500/1500 [=====] - 0s - loss: 0.0806 - binary\_accuracy: 0.9060  
Epoch 633/2000  
1500/1500 [=====] - 0s - loss: 0.0806 - binary\_accuracy: 0.9053  
Epoch 634/2000  
1500/1500 [=====] - 0s - loss: 0.0806 - binary\_accuracy: 0.9067  
Epoch 635/2000  
1500/1500 [=====] - 0s - loss: 0.0806 - binary\_accuracy: 0.9053  
Epoch 636/2000  
1500/1500 [=====] - 0s - loss: 0.0804 - binary\_accuracy: 0.9060  
Epoch 637/2000  
1500/1500 [=====] - 0s - loss: 0.0804 - binary\_accuracy: 0.9047

Epoch 638/2000  
1500/1500 [=====] - 0s - loss: 0.0805 - binary\_accuracy: 0.9040

Epoch 639/2000  
1500/1500 [=====] - 0s - loss: 0.0804 - binary\_accuracy: 0.9047

Epoch 640/2000  
1500/1500 [=====] - 0s - loss: 0.0803 - binary\_accuracy: 0.9060

Epoch 641/2000  
1500/1500 [=====] - 0s - loss: 0.0804 - binary\_accuracy: 0.9053

Epoch 642/2000  
1500/1500 [=====] - 0s - loss: 0.0803 - binary\_accuracy: 0.9080

Epoch 643/2000  
1500/1500 [=====] - 0s - loss: 0.0803 - binary\_accuracy: 0.9073

Epoch 644/2000  
1500/1500 [=====] - 0s - loss: 0.0802 - binary\_accuracy: 0.9040

Epoch 645/2000  
1500/1500 [=====] - 0s - loss: 0.0802 - binary\_accuracy: 0.9073

Epoch 646/2000  
1500/1500 [=====] - 0s - loss: 0.0802 - binary\_accuracy: 0.9053

Epoch 647/2000  
1500/1500 [=====] - 0s - loss: 0.0802 - binary\_accuracy: 0.9060

Epoch 648/2000  
1500/1500 [=====] - 0s - loss: 0.0803 - binary\_accuracy: 0.9047

Epoch 649/2000  
1500/1500 [=====] - 0s - loss: 0.0801 - binary\_accuracy: 0.9047

Epoch 650/2000  
1500/1500 [=====] - 0s - loss: 0.0801 - binary\_accuracy: 0.9053

Epoch 651/2000  
1500/1500 [=====] - 0s - loss: 0.0801 - binary\_accuracy: 0.9047

Epoch 652/2000  
1500/1500 [=====] - 0s - loss: 0.0800 - binary\_accuracy: 0.9067

Epoch 653/2000  
1500/1500 [=====] - 0s - loss: 0.0800 - binary\_accuracy: 0.9040

Epoch 654/2000  
1500/1500 [=====] - 0s - loss: 0.0800 - binary\_accuracy: 0.9067

Epoch 655/2000  
1500/1500 [=====] - 0s - loss: 0.0800 - binary\_accuracy: 0.9073

Epoch 656/2000  
1500/1500 [=====] - 0s - loss: 0.0799 - binary\_accuracy: 0.9067

Epoch 657/2000  
1500/1500 [=====] - 0s - loss: 0.0799 - binary\_accuracy: 0.9080

Epoch 658/2000  
1500/1500 [=====] - 0s - loss: 0.0799 - binary\_accuracy: 0.9073

Epoch 659/2000  
1500/1500 [=====] - 0s - loss: 0.0798 - binary\_accuracy: 0.9067

Epoch 660/2000  
1500/1500 [=====] - 0s - loss: 0.0798 - binary\_accuracy: 0.9073

Epoch 661/2000  
1500/1500 [=====] - 0s - loss: 0.0797 - binary\_accuracy: 0.9060

Epoch 662/2000  
1500/1500 [=====] - 0s - loss: 0.0798 - binary\_accuracy: 0.9060

Epoch 663/2000  
1500/1500 [=====] - 0s - loss: 0.0798 - binary\_accuracy: 0.9060

Epoch 664/2000  
1500/1500 [=====] - 0s - loss: 0.0798 - binary\_accuracy: 0.9080

Epoch 665/2000  
1500/1500 [=====] - 0s - loss: 0.0797 - binary\_accuracy: 0.9073

Epoch 666/2000  
1500/1500 [=====] - 0s - loss: 0.0797 - binary\_accuracy: 0.9093

Epoch 667/2000  
1500/1500 [=====] - 0s - loss: 0.0796 - binary\_accuracy: 0.9073

Epoch 668/2000  
1500/1500 [=====] - 0s - loss: 0.0796 - binary\_accuracy: 0.9073

Epoch 669/2000  
1500/1500 [=====] - 0s - loss: 0.0796 - binary\_accuracy: 0.9080

Epoch 670/2000  
1500/1500 [=====] - 0s - loss: 0.0797 - binary\_accuracy: 0.9067

Epoch 671/2000  
1500/1500 [=====] - 0s - loss: 0.0796 - binary\_accuracy: 0.9093

Epoch 672/2000  
1500/1500 [=====] - 0s - loss: 0.0796 - binary\_accuracy: 0.9067

Epoch 673/2000  
1500/1500 [=====] - 0s - loss: 0.0795 - binary\_accuracy: 0.9080

Epoch 674/2000  
1500/1500 [=====] - 0s - loss: 0.0796 - binary\_accuracy: 0.9080

Epoch 675/2000  
1500/1500 [=====] - 0s - loss: 0.0795 - binary\_accuracy: 0.9080

Epoch 676/2000  
1500/1500 [=====] - 0s - loss: 0.0796 - binary\_accuracy: 0.9080  
Epoch 677/2000  
1500/1500 [=====] - 0s - loss: 0.0795 - binary\_accuracy: 0.9087  
Epoch 678/2000  
1500/1500 [=====] - 0s - loss: 0.0795 - binary\_accuracy: 0.9067  
Epoch 679/2000  
1500/1500 [=====] - 0s - loss: 0.0795 - binary\_accuracy: 0.9073  
Epoch 680/2000  
1500/1500 [=====] - 0s - loss: 0.0795 - binary\_accuracy: 0.9073  
Epoch 681/2000  
1500/1500 [=====] - 0s - loss: 0.0794 - binary\_accuracy: 0.9087  
Epoch 682/2000  
1500/1500 [=====] - 0s - loss: 0.0795 - binary\_accuracy: 0.9053  
Epoch 683/2000  
1500/1500 [=====] - 0s - loss: 0.0794 - binary\_accuracy: 0.9060  
Epoch 684/2000  
1500/1500 [=====] - 0s - loss: 0.0794 - binary\_accuracy: 0.9093  
Epoch 685/2000  
1500/1500 [=====] - 0s - loss: 0.0794 - binary\_accuracy: 0.9067  
Epoch 686/2000  
1500/1500 [=====] - 0s - loss: 0.0794 - binary\_accuracy: 0.9073  
Epoch 687/2000  
1500/1500 [=====] - 0s - loss: 0.0794 - binary\_accuracy: 0.9073  
Epoch 688/2000  
1500/1500 [=====] - 0s - loss: 0.0793 - binary\_accuracy: 0.9080  
Epoch 689/2000  
1500/1500 [=====] - 0s - loss: 0.0793 - binary\_accuracy: 0.9060  
Epoch 690/2000  
1500/1500 [=====] - 0s - loss: 0.0793 - binary\_accuracy: 0.9073  
Epoch 691/2000  
1500/1500 [=====] - 0s - loss: 0.0793 - binary\_accuracy: 0.9080  
Epoch 692/2000  
1500/1500 [=====] - 0s - loss: 0.0794 - binary\_accuracy: 0.9073  
Epoch 693/2000  
1500/1500 [=====] - 0s - loss: 0.0793 - binary\_accuracy: 0.9087  
Epoch 694/2000  
1500/1500 [=====] - 0s - loss: 0.0793 - binary\_accuracy: 0.9073



Epoch 695/2000  
1500/1500 [=====] - 0s - loss: 0.0793 - binary\_accuracy: 0.9067  
Epoch 696/2000  
1500/1500 [=====] - 0s - loss: 0.0792 - binary\_accuracy: 0.9060  
Epoch 697/2000  
1500/1500 [=====] - 0s - loss: 0.0793 - binary\_accuracy: 0.9060  
Epoch 698/2000  
1500/1500 [=====] - 0s - loss: 0.0793 - binary\_accuracy: 0.9073  
Epoch 699/2000  
1500/1500 [=====] - 0s - loss: 0.0792 - binary\_accuracy: 0.9067  
Epoch 700/2000  
1500/1500 [=====] - 0s - loss: 0.0792 - binary\_accuracy: 0.9047  
Epoch 701/2000  
1500/1500 [=====] - 0s - loss: 0.0791 - binary\_accuracy: 0.9073  
Epoch 702/2000  
1500/1500 [=====] - 0s - loss: 0.0793 - binary\_accuracy: 0.9080  
Epoch 703/2000  
1500/1500 [=====] - 0s - loss: 0.0792 - binary\_accuracy: 0.9093  
Epoch 704/2000  
1500/1500 [=====] - 0s - loss: 0.0792 - binary\_accuracy: 0.9100  
Epoch 705/2000  
1500/1500 [=====] - 0s - loss: 0.0791 - binary\_accuracy: 0.9073  
Epoch 706/2000  
1500/1500 [=====] - 0s - loss: 0.0790 - binary\_accuracy: 0.9080  
Epoch 707/2000  
1500/1500 [=====] - 0s - loss: 0.0792 - binary\_accuracy: 0.9080  
Epoch 708/2000  
1500/1500 [=====] - 0s - loss: 0.0791 - binary\_accuracy: 0.9073  
Epoch 709/2000  
1500/1500 [=====] - 0s - loss: 0.0791 - binary\_accuracy: 0.9067  
Epoch 710/2000  
1500/1500 [=====] - 0s - loss: 0.0790 - binary\_accuracy: 0.9073  
Epoch 711/2000  
1500/1500 [=====] - 0s - loss: 0.0791 - binary\_accuracy: 0.9053  
Epoch 712/2000  
1500/1500 [=====] - 0s - loss: 0.0789 - binary\_accuracy: 0.9087  
Epoch 713/2000  
1500/1500 [=====] - 0s - loss: 0.0790 - binary\_accuracy: 0.9067

Epoch 714/2000  
1500/1500 [=====] - 0s - loss: 0.0789 - binary\_accuracy: 0.9067  
Epoch 715/2000  
1500/1500 [=====] - 0s - loss: 0.0790 - binary\_accuracy: 0.9087  
Epoch 716/2000  
1500/1500 [=====] - 0s - loss: 0.0789 - binary\_accuracy: 0.9067  
Epoch 717/2000  
1500/1500 [=====] - 0s - loss: 0.0789 - binary\_accuracy: 0.9073  
Epoch 718/2000  
1500/1500 [=====] - 0s - loss: 0.0789 - binary\_accuracy: 0.9060  
Epoch 719/2000  
1500/1500 [=====] - 0s - loss: 0.0789 - binary\_accuracy: 0.9073  
Epoch 720/2000  
1500/1500 [=====] - 0s - loss: 0.0788 - binary\_accuracy: 0.9067  
Epoch 721/2000  
1500/1500 [=====] - 0s - loss: 0.0786 - binary\_accuracy: 0.9067  
Epoch 722/2000  
1500/1500 [=====] - 0s - loss: 0.0788 - binary\_accuracy: 0.9060  
Epoch 723/2000  
1500/1500 [=====] - 0s - loss: 0.0787 - binary\_accuracy: 0.9073  
Epoch 724/2000  
1500/1500 [=====] - 0s - loss: 0.0788 - binary\_accuracy: 0.9073  
Epoch 725/2000  
1500/1500 [=====] - 0s - loss: 0.0787 - binary\_accuracy: 0.9073  
Epoch 726/2000  
1500/1500 [=====] - 0s - loss: 0.0787 - binary\_accuracy: 0.9080  
Epoch 727/2000  
1500/1500 [=====] - 0s - loss: 0.0786 - binary\_accuracy: 0.9067  
Epoch 728/2000  
1500/1500 [=====] - 0s - loss: 0.0787 - binary\_accuracy: 0.9087  
Epoch 729/2000  
1500/1500 [=====] - 0s - loss: 0.0786 - binary\_accuracy: 0.9073  
Epoch 730/2000  
1500/1500 [=====] - 0s - loss: 0.0786 - binary\_accuracy: 0.9073  
Epoch 731/2000  
1500/1500 [=====] - 0s - loss: 0.0786 - binary\_accuracy: 0.9073  
Epoch 732/2000  
1500/1500 [=====] - 0s - loss: 0.0786 - binary\_accuracy: 0.9067

Epoch 733/2000  
1500/1500 [=====] - 0s - loss: 0.0786 - binary\_accuracy: 0.9073

Epoch 734/2000  
1500/1500 [=====] - 0s - loss: 0.0785 - binary\_accuracy: 0.9073

Epoch 735/2000  
1500/1500 [=====] - 0s - loss: 0.0785 - binary\_accuracy: 0.9073

Epoch 736/2000  
1500/1500 [=====] - 0s - loss: 0.0785 - binary\_accuracy: 0.9080

Epoch 737/2000  
1500/1500 [=====] - 0s - loss: 0.0785 - binary\_accuracy: 0.9073

Epoch 738/2000  
1500/1500 [=====] - 0s - loss: 0.0785 - binary\_accuracy: 0.9073

Epoch 739/2000  
1500/1500 [=====] - 0s - loss: 0.0784 - binary\_accuracy: 0.9093

Epoch 740/2000  
1500/1500 [=====] - 0s - loss: 0.0785 - binary\_accuracy: 0.9087

Epoch 741/2000  
1500/1500 [=====] - 0s - loss: 0.0784 - binary\_accuracy: 0.9080

Epoch 742/2000  
1500/1500 [=====] - 0s - loss: 0.0784 - binary\_accuracy: 0.9100

Epoch 743/2000  
1500/1500 [=====] - 0s - loss: 0.0783 - binary\_accuracy: 0.9100

Epoch 744/2000  
1500/1500 [=====] - 0s - loss: 0.0783 - binary\_accuracy: 0.9093

Epoch 745/2000  
1500/1500 [=====] - 0s - loss: 0.0783 - binary\_accuracy: 0.9100

Epoch 746/2000  
1500/1500 [=====] - 0s - loss: 0.0784 - binary\_accuracy: 0.9093

Epoch 747/2000  
1500/1500 [=====] - 0s - loss: 0.0783 - binary\_accuracy: 0.9093

Epoch 748/2000  
1500/1500 [=====] - 0s - loss: 0.0782 - binary\_accuracy: 0.9087

Epoch 749/2000  
1500/1500 [=====] - 0s - loss: 0.0782 - binary\_accuracy: 0.9087

Epoch 750/2000  
1500/1500 [=====] - 0s - loss: 0.0783 - binary\_accuracy: 0.9093

Epoch 751/2000  
1500/1500 [=====] - 0s - loss: 0.0783 - binary\_accuracy: 0.9087

Epoch 752/2000  
1500/1500 [=====] - 0s - loss: 0.0783 - binary\_accuracy: 0.9087

Epoch 753/2000  
1500/1500 [=====] - 0s - loss: 0.0782 - binary\_accuracy: 0.9087

Epoch 754/2000  
1500/1500 [=====] - 0s - loss: 0.0782 - binary\_accuracy: 0.9087

Epoch 755/2000  
1500/1500 [=====] - 0s - loss: 0.0782 - binary\_accuracy: 0.9093

Epoch 756/2000  
1500/1500 [=====] - 0s - loss: 0.0781 - binary\_accuracy: 0.9100

Epoch 757/2000  
1500/1500 [=====] - 0s - loss: 0.0782 - binary\_accuracy: 0.9093

Epoch 758/2000  
1500/1500 [=====] - 0s - loss: 0.0782 - binary\_accuracy: 0.9080

Epoch 759/2000  
1500/1500 [=====] - 0s - loss: 0.0781 - binary\_accuracy: 0.9093

Epoch 760/2000  
1500/1500 [=====] - 0s - loss: 0.0780 - binary\_accuracy: 0.9080

Epoch 761/2000  
1500/1500 [=====] - 0s - loss: 0.0781 - binary\_accuracy: 0.9087

Epoch 762/2000  
1500/1500 [=====] - 0s - loss: 0.0781 - binary\_accuracy: 0.9080

Epoch 763/2000  
1500/1500 [=====] - 0s - loss: 0.0781 - binary\_accuracy: 0.9087

Epoch 764/2000  
1500/1500 [=====] - 0s - loss: 0.0781 - binary\_accuracy: 0.9093

Epoch 765/2000  
1500/1500 [=====] - 0s - loss: 0.0780 - binary\_accuracy: 0.9100

Epoch 766/2000  
1500/1500 [=====] - 0s - loss: 0.0780 - binary\_accuracy: 0.9107

Epoch 767/2000  
1500/1500 [=====] - 0s - loss: 0.0780 - binary\_accuracy: 0.9093

Epoch 768/2000  
1500/1500 [=====] - 0s - loss: 0.0780 - binary\_accuracy: 0.9100

Epoch 769/2000  
1500/1500 [=====] - 0s - loss: 0.0780 - binary\_accuracy: 0.9093

Epoch 770/2000  
1500/1500 [=====] - 0s - loss: 0.0779 - binary\_accuracy: 0.9093

Epoch 771/2000  
1500/1500 [=====] - 0s - loss: 0.0779 - binary\_accuracy: 0.9093  
Epoch 772/2000  
1500/1500 [=====] - 0s - loss: 0.0779 - binary\_accuracy: 0.9093  
Epoch 773/2000  
1500/1500 [=====] - 0s - loss: 0.0778 - binary\_accuracy: 0.9100  
Epoch 774/2000  
1500/1500 [=====] - 0s - loss: 0.0778 - binary\_accuracy: 0.9100  
Epoch 775/2000  
1500/1500 [=====] - 0s - loss: 0.0778 - binary\_accuracy: 0.9093  
Epoch 776/2000  
1500/1500 [=====] - 0s - loss: 0.0778 - binary\_accuracy: 0.9093  
Epoch 777/2000  
1500/1500 [=====] - 0s - loss: 0.0778 - binary\_accuracy: 0.9093  
Epoch 778/2000  
1500/1500 [=====] - 0s - loss: 0.0778 - binary\_accuracy: 0.9093  
Epoch 779/2000  
1500/1500 [=====] - 0s - loss: 0.0778 - binary\_accuracy: 0.9100  
Epoch 780/2000  
1500/1500 [=====] - 0s - loss: 0.0778 - binary\_accuracy: 0.9100  
Epoch 781/2000  
1500/1500 [=====] - 0s - loss: 0.0778 - binary\_accuracy: 0.9093  
Epoch 782/2000  
1500/1500 [=====] - 0s - loss: 0.0777 - binary\_accuracy: 0.9100  
Epoch 783/2000  
1500/1500 [=====] - 0s - loss: 0.0777 - binary\_accuracy: 0.9087  
Epoch 784/2000  
1500/1500 [=====] - 0s - loss: 0.0777 - binary\_accuracy: 0.9093  
Epoch 785/2000  
1500/1500 [=====] - 0s - loss: 0.0777 - binary\_accuracy: 0.9087  
Epoch 786/2000  
1500/1500 [=====] - 0s - loss: 0.0777 - binary\_accuracy: 0.9107  
Epoch 787/2000  
1500/1500 [=====] - 0s - loss: 0.0777 - binary\_accuracy: 0.9087  
Epoch 788/2000  
1500/1500 [=====] - 0s - loss: 0.0776 - binary\_accuracy: 0.9093  
Epoch 789/2000  
1500/1500 [=====] - 0s - loss: 0.0777 - binary\_accuracy: 0.9100

Epoch 790/2000  
1500/1500 [=====] - 0s - loss: 0.0776 - binary\_accuracy: 0.9100  
Epoch 791/2000  
1500/1500 [=====] - 0s - loss: 0.0776 - binary\_accuracy: 0.9107  
Epoch 792/2000  
1500/1500 [=====] - 0s - loss: 0.0776 - binary\_accuracy: 0.9113  
Epoch 793/2000  
1500/1500 [=====] - 0s - loss: 0.0776 - binary\_accuracy: 0.9080  
Epoch 794/2000  
1500/1500 [=====] - 0s - loss: 0.0776 - binary\_accuracy: 0.9093  
Epoch 795/2000  
1500/1500 [=====] - 0s - loss: 0.0776 - binary\_accuracy: 0.9093  
Epoch 796/2000  
1500/1500 [=====] - 0s - loss: 0.0776 - binary\_accuracy: 0.9093  
Epoch 797/2000  
1500/1500 [=====] - 0s - loss: 0.0775 - binary\_accuracy: 0.9093  
Epoch 798/2000  
1500/1500 [=====] - 0s - loss: 0.0776 - binary\_accuracy: 0.9100  
Epoch 799/2000  
1500/1500 [=====] - 0s - loss: 0.0776 - binary\_accuracy: 0.9087  
Epoch 800/2000  
1500/1500 [=====] - 0s - loss: 0.0776 - binary\_accuracy: 0.9100  
Epoch 801/2000  
1500/1500 [=====] - 0s - loss: 0.0775 - binary\_accuracy: 0.9093  
Epoch 802/2000  
1500/1500 [=====] - 0s - loss: 0.0776 - binary\_accuracy: 0.9093  
Epoch 803/2000  
1500/1500 [=====] - 0s - loss: 0.0775 - binary\_accuracy: 0.9093  
Epoch 804/2000  
1500/1500 [=====] - 0s - loss: 0.0775 - binary\_accuracy: 0.9100  
Epoch 805/2000  
1500/1500 [=====] - 0s - loss: 0.0774 - binary\_accuracy: 0.9093  
Epoch 806/2000  
1500/1500 [=====] - 0s - loss: 0.0774 - binary\_accuracy: 0.9093  
Epoch 807/2000  
1500/1500 [=====] - 0s - loss: 0.0774 - binary\_accuracy: 0.9107  
Epoch 808/2000  
1500/1500 [=====] - 0s - loss: 0.0774 - binary\_accuracy: 0.9107

Epoch 809/2000  
1500/1500 [=====] - 0s - loss: 0.0775 - binary\_accuracy: 0.9100  
Epoch 810/2000  
1500/1500 [=====] - 0s - loss: 0.0773 - binary\_accuracy: 0.9093  
Epoch 811/2000  
1500/1500 [=====] - 0s - loss: 0.0774 - binary\_accuracy: 0.9113  
Epoch 812/2000  
1500/1500 [=====] - 0s - loss: 0.0774 - binary\_accuracy: 0.9100  
Epoch 813/2000  
1500/1500 [=====] - 0s - loss: 0.0773 - binary\_accuracy: 0.9073  
Epoch 814/2000  
1500/1500 [=====] - 0s - loss: 0.0773 - binary\_accuracy: 0.9107  
Epoch 815/2000  
1500/1500 [=====] - 0s - loss: 0.0774 - binary\_accuracy: 0.9100  
Epoch 816/2000  
1500/1500 [=====] - 0s - loss: 0.0774 - binary\_accuracy: 0.9100  
Epoch 817/2000  
1500/1500 [=====] - 0s - loss: 0.0773 - binary\_accuracy: 0.9113  
Epoch 818/2000  
1500/1500 [=====] - 0s - loss: 0.0773 - binary\_accuracy: 0.9107  
Epoch 819/2000  
1500/1500 [=====] - 0s - loss: 0.0773 - binary\_accuracy: 0.9087 - ETA: 0s - loss: 0.0746 - binary\_accuracy: 0.913  
Epoch 820/2000  
1500/1500 [=====] - 0s - loss: 0.0773 - binary\_accuracy: 0.9100  
Epoch 821/2000  
1500/1500 [=====] - 0s - loss: 0.0773 - binary\_accuracy: 0.9100  
Epoch 822/2000  
1500/1500 [=====] - 0s - loss: 0.0772 - binary\_accuracy: 0.9113  
Epoch 823/2000  
1500/1500 [=====] - 0s - loss: 0.0772 - binary\_accuracy: 0.9100  
Epoch 824/2000  
1500/1500 [=====] - 0s - loss: 0.0773 - binary\_accuracy: 0.9100  
Epoch 825/2000  
1500/1500 [=====] - 0s - loss: 0.0773 - binary\_accuracy: 0.9080  
Epoch 826/2000  
1500/1500 [=====] - 0s - loss: 0.0773 - binary\_accuracy: 0.9107  
Epoch 827/2000  
1500/1500 [=====] - 0s - loss: 0.0772 - binary\_accuracy: 0.9100

inary\_accuracy: 0.9100  
Epoch 828/2000  
1500/1500 [=====] - 0s - loss: 0.0773 - b  
inary\_accuracy: 0.9087  
Epoch 829/2000  
1500/1500 [=====] - 0s - loss: 0.0772 - b  
inary\_accuracy: 0.9093  
Epoch 830/2000  
1500/1500 [=====] - 0s - loss: 0.0772 - b  
inary\_accuracy: 0.9100  
Epoch 831/2000  
1500/1500 [=====] - 0s - loss: 0.0772 - b  
inary\_accuracy: 0.9127  
Epoch 832/2000  
1500/1500 [=====] - 0s - loss: 0.0771 - b  
inary\_accuracy: 0.9087  
Epoch 833/2000  
1500/1500 [=====] - 0s - loss: 0.0772 - b  
inary\_accuracy: 0.9080  
Epoch 834/2000  
1500/1500 [=====] - 0s - loss: 0.0771 - b  
inary\_accuracy: 0.9093  
Epoch 835/2000  
1500/1500 [=====] - 0s - loss: 0.0771 - b  
inary\_accuracy: 0.9087  
Epoch 836/2000  
1500/1500 [=====] - 0s - loss: 0.0771 - b  
inary\_accuracy: 0.9087  
Epoch 837/2000  
1500/1500 [=====] - 0s - loss: 0.0772 - b  
inary\_accuracy: 0.9080  
Epoch 838/2000  
1500/1500 [=====] - 0s - loss: 0.0770 - b  
inary\_accuracy: 0.9100  
Epoch 839/2000  
1500/1500 [=====] - 0s - loss: 0.0770 - b  
inary\_accuracy: 0.9100  
Epoch 840/2000  
1500/1500 [=====] - 0s - loss: 0.0771 - b  
inary\_accuracy: 0.9093  
Epoch 841/2000  
1500/1500 [=====] - 0s - loss: 0.0771 - b  
inary\_accuracy: 0.9087  
Epoch 842/2000  
1500/1500 [=====] - 0s - loss: 0.0771 - b  
inary\_accuracy: 0.9107  
Epoch 843/2000  
1500/1500 [=====] - 0s - loss: 0.0771 - b  
inary\_accuracy: 0.9100  
Epoch 844/2000  
1500/1500 [=====] - 0s - loss: 0.0770 - b  
inary\_accuracy: 0.9087  
Epoch 845/2000  
1500/1500 [=====] - 0s - loss: 0.0771 - b  
inary\_accuracy: 0.9107  
Epoch 846/2000  
1500/1500 [=====] - 0s - loss: 0.0769 - b



inary\_accuracy: 0.9080  
Epoch 847/2000  
1500/1500 [=====] - 0s - loss: 0.0770 - b  
inary\_accuracy: 0.9107  
Epoch 848/2000  
1500/1500 [=====] - 0s - loss: 0.0770 - b  
inary\_accuracy: 0.9120  
Epoch 849/2000  
1500/1500 [=====] - 0s - loss: 0.0769 - b  
inary\_accuracy: 0.9080  
Epoch 850/2000  
1500/1500 [=====] - 0s - loss: 0.0769 - b  
inary\_accuracy: 0.9100  
Epoch 851/2000  
1500/1500 [=====] - 0s - loss: 0.0769 - b  
inary\_accuracy: 0.9107  
Epoch 852/2000  
1500/1500 [=====] - 0s - loss: 0.0769 - b  
inary\_accuracy: 0.9113  
Epoch 853/2000  
1500/1500 [=====] - 0s - loss: 0.0769 - b  
inary\_accuracy: 0.9100  
Epoch 854/2000  
1500/1500 [=====] - 0s - loss: 0.0769 - b  
inary\_accuracy: 0.9113  
Epoch 855/2000  
1500/1500 [=====] - 0s - loss: 0.0769 - b  
inary\_accuracy: 0.9073  
Epoch 856/2000  
1500/1500 [=====] - 0s - loss: 0.0768 - b  
inary\_accuracy: 0.9093  
Epoch 857/2000  
1500/1500 [=====] - 0s - loss: 0.0769 - b  
inary\_accuracy: 0.9093  
Epoch 858/2000  
1500/1500 [=====] - 0s - loss: 0.0768 - b  
inary\_accuracy: 0.9087  
Epoch 859/2000  
1500/1500 [=====] - 0s - loss: 0.0767 - b  
inary\_accuracy: 0.9080  
Epoch 860/2000  
1500/1500 [=====] - 0s - loss: 0.0768 - b  
inary\_accuracy: 0.9100  
Epoch 861/2000  
1500/1500 [=====] - 0s - loss: 0.0768 - b  
inary\_accuracy: 0.9087  
Epoch 862/2000  
1500/1500 [=====] - 0s - loss: 0.0768 - b  
inary\_accuracy: 0.9080  
Epoch 863/2000  
1500/1500 [=====] - 0s - loss: 0.0767 - b  
inary\_accuracy: 0.9080  
Epoch 864/2000  
1500/1500 [=====] - 0s - loss: 0.0766 - b  
inary\_accuracy: 0.9073  
Epoch 865/2000  
1500/1500 [=====] - 0s - loss: 0.0767 - b

inary\_accuracy: 0.9093  
Epoch 866/2000  
1500/1500 [=====] - 0s - loss: 0.0768 - b  
inary\_accuracy: 0.9100  
Epoch 867/2000  
1500/1500 [=====] - 0s - loss: 0.0767 - b  
inary\_accuracy: 0.9080  
Epoch 868/2000  
1500/1500 [=====] - 0s - loss: 0.0766 - b  
inary\_accuracy: 0.9087  
Epoch 869/2000  
1500/1500 [=====] - 0s - loss: 0.0766 - b  
inary\_accuracy: 0.9107  
Epoch 870/2000  
1500/1500 [=====] - 0s - loss: 0.0766 - b  
inary\_accuracy: 0.9107  
Epoch 871/2000  
1500/1500 [=====] - 0s - loss: 0.0766 - b  
inary\_accuracy: 0.9087  
Epoch 872/2000  
1500/1500 [=====] - 0s - loss: 0.0767 - b  
inary\_accuracy: 0.9093  
Epoch 873/2000  
1500/1500 [=====] - 0s - loss: 0.0766 - b  
inary\_accuracy: 0.9100  
Epoch 874/2000  
1500/1500 [=====] - 0s - loss: 0.0767 - b  
inary\_accuracy: 0.9093  
Epoch 875/2000  
1500/1500 [=====] - 0s - loss: 0.0766 - b  
inary\_accuracy: 0.9107  
Epoch 876/2000  
1500/1500 [=====] - 0s - loss: 0.0765 - b  
inary\_accuracy: 0.9113  
Epoch 877/2000  
1500/1500 [=====] - 0s - loss: 0.0765 - b  
inary\_accuracy: 0.9080  
Epoch 878/2000  
1500/1500 [=====] - 0s - loss: 0.0765 - b  
inary\_accuracy: 0.9087  
Epoch 879/2000  
1500/1500 [=====] - 0s - loss: 0.0765 - b  
inary\_accuracy: 0.9080  
Epoch 880/2000  
1500/1500 [=====] - 0s - loss: 0.0765 - b  
inary\_accuracy: 0.9107  
Epoch 881/2000  
1500/1500 [=====] - 0s - loss: 0.0765 - b  
inary\_accuracy: 0.9073  
Epoch 882/2000  
1500/1500 [=====] - 0s - loss: 0.0765 - b  
inary\_accuracy: 0.9093  
Epoch 883/2000  
1500/1500 [=====] - 0s - loss: 0.0765 - b  
inary\_accuracy: 0.9080  
Epoch 884/2000  
1500/1500 [=====] - 0s - loss: 0.0765 - b

inary\_accuracy: 0.9087  
Epoch 885/2000  
1500/1500 [=====] - 0s - loss: 0.0764 - b  
inary\_accuracy: 0.9087  
Epoch 886/2000  
1500/1500 [=====] - 0s - loss: 0.0764 - b  
inary\_accuracy: 0.9100  
Epoch 887/2000  
1500/1500 [=====] - 0s - loss: 0.0764 - b  
inary\_accuracy: 0.9087  
Epoch 888/2000  
1500/1500 [=====] - 0s - loss: 0.0764 - b  
inary\_accuracy: 0.9093  
Epoch 889/2000  
1500/1500 [=====] - 0s - loss: 0.0764 - b  
inary\_accuracy: 0.9093  
Epoch 890/2000  
1500/1500 [=====] - 0s - loss: 0.0763 - b  
inary\_accuracy: 0.9100  
Epoch 891/2000  
1500/1500 [=====] - 0s - loss: 0.0764 - b  
inary\_accuracy: 0.9093  
Epoch 892/2000  
1500/1500 [=====] - 0s - loss: 0.0763 - b  
inary\_accuracy: 0.9080  
Epoch 893/2000  
1500/1500 [=====] - 0s - loss: 0.0764 - b  
inary\_accuracy: 0.9087  
Epoch 894/2000  
1500/1500 [=====] - 0s - loss: 0.0763 - b  
inary\_accuracy: 0.9093  
Epoch 895/2000  
1500/1500 [=====] - 0s - loss: 0.0763 - b  
inary\_accuracy: 0.9093  
Epoch 896/2000  
1500/1500 [=====] - 0s - loss: 0.0763 - b  
inary\_accuracy: 0.9093  
Epoch 897/2000  
1500/1500 [=====] - 0s - loss: 0.0763 - b  
inary\_accuracy: 0.9107  
Epoch 898/2000  
1500/1500 [=====] - 0s - loss: 0.0763 - b  
inary\_accuracy: 0.9100  
Epoch 899/2000  
1500/1500 [=====] - 0s - loss: 0.0763 - b  
inary\_accuracy: 0.9087  
Epoch 900/2000  
1500/1500 [=====] - 0s - loss: 0.0762 - b  
inary\_accuracy: 0.9087  
Epoch 901/2000  
1500/1500 [=====] - 0s - loss: 0.0763 - b  
inary\_accuracy: 0.9093  
Epoch 902/2000  
1500/1500 [=====] - 0s - loss: 0.0762 - b  
inary\_accuracy: 0.9100  
Epoch 903/2000  
1500/1500 [=====] - 0s - loss: 0.0762 - b

inary\_accuracy: 0.9093  
Epoch 904/2000  
1500/1500 [=====] - 0s - loss: 0.0763 - b  
inary\_accuracy: 0.9087  
Epoch 905/2000  
1500/1500 [=====] - 0s - loss: 0.0762 - b  
inary\_accuracy: 0.9073  
Epoch 906/2000  
1500/1500 [=====] - 0s - loss: 0.0761 - b  
inary\_accuracy: 0.9087  
Epoch 907/2000  
1500/1500 [=====] - 0s - loss: 0.0762 - b  
inary\_accuracy: 0.9093  
Epoch 908/2000  
1500/1500 [=====] - 0s - loss: 0.0761 - b  
inary\_accuracy: 0.9087  
Epoch 909/2000  
1500/1500 [=====] - 0s - loss: 0.0761 - b  
inary\_accuracy: 0.9093  
Epoch 910/2000  
1500/1500 [=====] - 0s - loss: 0.0761 - b  
inary\_accuracy: 0.9087  
Epoch 911/2000  
1500/1500 [=====] - 0s - loss: 0.0761 - b  
inary\_accuracy: 0.9087  
Epoch 912/2000  
1500/1500 [=====] - 0s - loss: 0.0760 - b  
inary\_accuracy: 0.9100  
Epoch 913/2000  
1500/1500 [=====] - 0s - loss: 0.0761 - b  
inary\_accuracy: 0.9080  
Epoch 914/2000  
1500/1500 [=====] - 0s - loss: 0.0761 - b  
inary\_accuracy: 0.9087  
Epoch 915/2000  
1500/1500 [=====] - 0s - loss: 0.0760 - b  
inary\_accuracy: 0.9080  
Epoch 916/2000  
1500/1500 [=====] - 0s - loss: 0.0760 - b  
inary\_accuracy: 0.9100  
Epoch 917/2000  
1500/1500 [=====] - 0s - loss: 0.0760 - b  
inary\_accuracy: 0.9093  
Epoch 918/2000  
1500/1500 [=====] - 0s - loss: 0.0760 - b  
inary\_accuracy: 0.9100  
Epoch 919/2000  
1500/1500 [=====] - 0s - loss: 0.0760 - b  
inary\_accuracy: 0.9087  
Epoch 920/2000  
1500/1500 [=====] - 0s - loss: 0.0759 - b  
inary\_accuracy: 0.9100  
Epoch 921/2000  
1500/1500 [=====] - 0s - loss: 0.0759 - b  
inary\_accuracy: 0.9100  
Epoch 922/2000  
1500/1500 [=====] - 0s - loss: 0.0759 - b

inary\_accuracy: 0.9080  
Epoch 923/2000  
1500/1500 [=====] - 0s - loss: 0.0759 - b  
inary\_accuracy: 0.9113  
Epoch 924/2000  
1500/1500 [=====] - 0s - loss: 0.0760 - b  
inary\_accuracy: 0.9100  
Epoch 925/2000  
1500/1500 [=====] - 0s - loss: 0.0759 - b  
inary\_accuracy: 0.9100  
Epoch 926/2000  
1500/1500 [=====] - 0s - loss: 0.0758 - b  
inary\_accuracy: 0.9093  
Epoch 927/2000  
1500/1500 [=====] - 0s - loss: 0.0759 - b  
inary\_accuracy: 0.9080  
Epoch 928/2000  
1500/1500 [=====] - 0s - loss: 0.0758 - b  
inary\_accuracy: 0.9087  
Epoch 929/2000  
1500/1500 [=====] - 0s - loss: 0.0758 - b  
inary\_accuracy: 0.9093  
Epoch 930/2000  
1500/1500 [=====] - 0s - loss: 0.0758 - b  
inary\_accuracy: 0.9093  
Epoch 931/2000  
1500/1500 [=====] - 0s - loss: 0.0758 - b  
inary\_accuracy: 0.9093  
Epoch 932/2000  
1500/1500 [=====] - 0s - loss: 0.0757 - b  
inary\_accuracy: 0.9093  
Epoch 933/2000  
1500/1500 [=====] - 0s - loss: 0.0757 - b  
inary\_accuracy: 0.9113  
Epoch 934/2000  
1500/1500 [=====] - 0s - loss: 0.0758 - b  
inary\_accuracy: 0.9113  
Epoch 935/2000  
1500/1500 [=====] - 0s - loss: 0.0757 - b  
inary\_accuracy: 0.9100  
Epoch 936/2000  
1500/1500 [=====] - 0s - loss: 0.0757 - b  
inary\_accuracy: 0.9093  
Epoch 937/2000  
1500/1500 [=====] - 0s - loss: 0.0758 - b  
inary\_accuracy: 0.9100  
Epoch 938/2000  
1500/1500 [=====] - 0s - loss: 0.0758 - b  
inary\_accuracy: 0.9093  
Epoch 939/2000  
1500/1500 [=====] - 0s - loss: 0.0757 - b  
inary\_accuracy: 0.9107  
Epoch 940/2000  
1500/1500 [=====] - 0s - loss: 0.0757 - b  
inary\_accuracy: 0.9100  
Epoch 941/2000  
1500/1500 [=====] - 0s - loss: 0.0756 - b

inary\_accuracy: 0.9100  
Epoch 942/2000  
1500/1500 [=====] - 0s - loss: 0.0756 - b  
inary\_accuracy: 0.9113  
Epoch 943/2000  
1500/1500 [=====] - 0s - loss: 0.0756 - b  
inary\_accuracy: 0.9100  
Epoch 944/2000  
1500/1500 [=====] - 0s - loss: 0.0756 - b  
inary\_accuracy: 0.9113  
Epoch 945/2000  
1500/1500 [=====] - 0s - loss: 0.0756 - b  
inary\_accuracy: 0.9107  
Epoch 946/2000  
1500/1500 [=====] - 0s - loss: 0.0755 - b  
inary\_accuracy: 0.9107  
Epoch 947/2000  
1500/1500 [=====] - 0s - loss: 0.0755 - b  
inary\_accuracy: 0.9107  
Epoch 948/2000  
1500/1500 [=====] - 0s - loss: 0.0756 - b  
inary\_accuracy: 0.9100  
Epoch 949/2000  
1500/1500 [=====] - 0s - loss: 0.0756 - b  
inary\_accuracy: 0.9113  
Epoch 950/2000  
1500/1500 [=====] - 0s - loss: 0.0755 - b  
inary\_accuracy: 0.9107  
Epoch 951/2000  
1500/1500 [=====] - 0s - loss: 0.0755 - b  
inary\_accuracy: 0.9113  
Epoch 952/2000  
1500/1500 [=====] - 0s - loss: 0.0755 - b  
inary\_accuracy: 0.9100  
Epoch 953/2000  
1500/1500 [=====] - 0s - loss: 0.0754 - b  
inary\_accuracy: 0.9113  
Epoch 954/2000  
1500/1500 [=====] - 0s - loss: 0.0755 - b  
inary\_accuracy: 0.9107  
Epoch 955/2000  
1500/1500 [=====] - 0s - loss: 0.0755 - b  
inary\_accuracy: 0.9100  
Epoch 956/2000  
1500/1500 [=====] - 0s - loss: 0.0754 - b  
inary\_accuracy: 0.9107  
Epoch 957/2000  
1500/1500 [=====] - 0s - loss: 0.0754 - b  
inary\_accuracy: 0.9107  
Epoch 958/2000  
1500/1500 [=====] - 0s - loss: 0.0754 - b  
inary\_accuracy: 0.9113  
Epoch 959/2000  
1500/1500 [=====] - 0s - loss: 0.0754 - b  
inary\_accuracy: 0.9120  
Epoch 960/2000  
1500/1500 [=====] - 0s - loss: 0.0753 - b

inary\_accuracy: 0.9113  
Epoch 961/2000  
1500/1500 [=====] - 0s - loss: 0.0754 - b  
inary\_accuracy: 0.9127  
Epoch 962/2000  
1500/1500 [=====] - 0s - loss: 0.0754 - b  
inary\_accuracy: 0.9113  
Epoch 963/2000  
1500/1500 [=====] - 0s - loss: 0.0754 - b  
inary\_accuracy: 0.9113  
Epoch 964/2000  
1500/1500 [=====] - 0s - loss: 0.0754 - b  
inary\_accuracy: 0.9100  
Epoch 965/2000  
1500/1500 [=====] - 0s - loss: 0.0754 - b  
inary\_accuracy: 0.9113  
Epoch 966/2000  
1500/1500 [=====] - 0s - loss: 0.0754 - b  
inary\_accuracy: 0.9100  
Epoch 967/2000  
1500/1500 [=====] - 0s - loss: 0.0754 - b  
inary\_accuracy: 0.9120  
Epoch 968/2000  
1500/1500 [=====] - 0s - loss: 0.0754 - b  
inary\_accuracy: 0.9120  
Epoch 969/2000  
1500/1500 [=====] - 0s - loss: 0.0753 - b  
inary\_accuracy: 0.9107  
Epoch 970/2000  
1500/1500 [=====] - 0s - loss: 0.0754 - b  
inary\_accuracy: 0.9107  
Epoch 971/2000  
1500/1500 [=====] - 0s - loss: 0.0753 - b  
inary\_accuracy: 0.9120  
Epoch 972/2000  
1500/1500 [=====] - 0s - loss: 0.0753 - b  
inary\_accuracy: 0.9113  
Epoch 973/2000  
1500/1500 [=====] - 0s - loss: 0.0753 - b  
inary\_accuracy: 0.9113  
Epoch 974/2000  
1500/1500 [=====] - 0s - loss: 0.0752 - b  
inary\_accuracy: 0.9113  
Epoch 975/2000  
1500/1500 [=====] - 0s - loss: 0.0753 - b  
inary\_accuracy: 0.9120  
Epoch 976/2000  
1500/1500 [=====] - 0s - loss: 0.0753 - b  
inary\_accuracy: 0.9113  
Epoch 977/2000  
1500/1500 [=====] - 0s - loss: 0.0752 - b  
inary\_accuracy: 0.9127  
Epoch 978/2000  
1500/1500 [=====] - 0s - loss: 0.0752 - b  
inary\_accuracy: 0.9120  
Epoch 979/2000  
1500/1500 [=====] - 0s - loss: 0.0752 - b

inary\_accuracy: 0.9120  
Epoch 980/2000  
1500/1500 [=====] - 0s - loss: 0.0753 - b  
inary\_accuracy: 0.9107  
Epoch 981/2000  
1500/1500 [=====] - 0s - loss: 0.0752 - b  
inary\_accuracy: 0.9107  
Epoch 982/2000  
1500/1500 [=====] - 0s - loss: 0.0753 - b  
inary\_accuracy: 0.9133  
Epoch 983/2000  
1500/1500 [=====] - 0s - loss: 0.0752 - b  
inary\_accuracy: 0.9133  
Epoch 984/2000  
1500/1500 [=====] - 0s - loss: 0.0751 - b  
inary\_accuracy: 0.9113  
Epoch 985/2000  
1500/1500 [=====] - 0s - loss: 0.0751 - b  
inary\_accuracy: 0.9127  
Epoch 986/2000  
1500/1500 [=====] - 0s - loss: 0.0752 - b  
inary\_accuracy: 0.9100  
Epoch 987/2000  
1500/1500 [=====] - 0s - loss: 0.0751 - b  
inary\_accuracy: 0.9100  
Epoch 988/2000  
1500/1500 [=====] - 0s - loss: 0.0752 - b  
inary\_accuracy: 0.9113  
Epoch 989/2000  
1500/1500 [=====] - 0s - loss: 0.0751 - b  
inary\_accuracy: 0.9120  
Epoch 990/2000  
1500/1500 [=====] - 0s - loss: 0.0751 - b  
inary\_accuracy: 0.9133  
Epoch 991/2000  
1500/1500 [=====] - 0s - loss: 0.0750 - b  
inary\_accuracy: 0.9113  
Epoch 992/2000  
1500/1500 [=====] - 0s - loss: 0.0751 - b  
inary\_accuracy: 0.9093  
Epoch 993/2000  
1500/1500 [=====] - 0s - loss: 0.0750 - b  
inary\_accuracy: 0.9107  
Epoch 994/2000  
1500/1500 [=====] - 0s - loss: 0.0751 - b  
inary\_accuracy: 0.9120  
Epoch 995/2000  
1500/1500 [=====] - 0s - loss: 0.0750 - b  
inary\_accuracy: 0.9120  
Epoch 996/2000  
1500/1500 [=====] - 0s - loss: 0.0750 - b  
inary\_accuracy: 0.9100  
Epoch 997/2000  
1500/1500 [=====] - 0s - loss: 0.0750 - b  
inary\_accuracy: 0.9127  
Epoch 998/2000  
1500/1500 [=====] - 0s - loss: 0.0750 - b



inary\_accuracy: 0.9120  
Epoch 999/2000  
1500/1500 [=====] - 0s - loss: 0.0750 - b  
inary\_accuracy: 0.9147  
Epoch 1000/2000  
1500/1500 [=====] - 0s - loss: 0.0750 - b  
inary\_accuracy: 0.9107  
Epoch 1001/2000  
1500/1500 [=====] - 0s - loss: 0.0750 - b  
inary\_accuracy: 0.9127  
Epoch 1002/2000  
1500/1500 [=====] - 0s - loss: 0.0750 - b  
inary\_accuracy: 0.9127  
Epoch 1003/2000  
1500/1500 [=====] - 0s - loss: 0.0749 - b  
inary\_accuracy: 0.9107  
Epoch 1004/2000  
1500/1500 [=====] - 0s - loss: 0.0749 - b  
inary\_accuracy: 0.9120  
Epoch 1005/2000  
1500/1500 [=====] - 0s - loss: 0.0749 - b  
inary\_accuracy: 0.9120  
Epoch 1006/2000  
1500/1500 [=====] - 0s - loss: 0.0749 - b  
inary\_accuracy: 0.9107  
Epoch 1007/2000  
1500/1500 [=====] - 0s - loss: 0.0749 - b  
inary\_accuracy: 0.9113  
Epoch 1008/2000  
1500/1500 [=====] - 0s - loss: 0.0749 - b  
inary\_accuracy: 0.9113  
Epoch 1009/2000  
1500/1500 [=====] - 0s - loss: 0.0748 - b  
inary\_accuracy: 0.9140  
Epoch 1010/2000  
1500/1500 [=====] - 0s - loss: 0.0749 - b  
inary\_accuracy: 0.9120  
Epoch 1011/2000  
1500/1500 [=====] - 0s - loss: 0.0749 - b  
inary\_accuracy: 0.9127 - ETA: 0s - loss: 0.0728 - binary\_accu  
acy: 0.916  
Epoch 1012/2000  
1500/1500 [=====] - 0s - loss: 0.0748 - b  
inary\_accuracy: 0.9133  
Epoch 1013/2000  
1500/1500 [=====] - 0s - loss: 0.0748 - b  
inary\_accuracy: 0.9113  
Epoch 1014/2000  
1500/1500 [=====] - 0s - loss: 0.0748 - b  
inary\_accuracy: 0.9127  
Epoch 1015/2000  
1500/1500 [=====] - 0s - loss: 0.0748 - b  
inary\_accuracy: 0.9120  
Epoch 1016/2000  
1500/1500 [=====] - 0s - loss: 0.0748 - b  
inary\_accuracy: 0.9100  
Epoch 1017/2000

1500/1500 [=====] - 0s - loss: 0.0748 - b  
inary\_accuracy: 0.9113  
Epoch 1018/2000  
1500/1500 [=====] - 0s - loss: 0.0748 - b  
inary\_accuracy: 0.9140  
Epoch 1019/2000  
1500/1500 [=====] - 0s - loss: 0.0748 - b  
inary\_accuracy: 0.9120  
Epoch 1020/2000  
1500/1500 [=====] - 0s - loss: 0.0748 - b  
inary\_accuracy: 0.9107  
Epoch 1021/2000  
1500/1500 [=====] - 0s - loss: 0.0747 - b  
inary\_accuracy: 0.9100  
Epoch 1022/2000  
1500/1500 [=====] - 0s - loss: 0.0747 - b  
inary\_accuracy: 0.9133  
Epoch 1023/2000  
1500/1500 [=====] - 0s - loss: 0.0748 - b  
inary\_accuracy: 0.9120  
Epoch 1024/2000  
1500/1500 [=====] - 0s - loss: 0.0747 - b  
inary\_accuracy: 0.9100  
Epoch 1025/2000  
1500/1500 [=====] - 0s - loss: 0.0748 - b  
inary\_accuracy: 0.9127  
Epoch 1026/2000  
1500/1500 [=====] - 0s - loss: 0.0746 - b  
inary\_accuracy: 0.9113  
Epoch 1027/2000  
1500/1500 [=====] - 0s - loss: 0.0747 - b  
inary\_accuracy: 0.9120  
Epoch 1028/2000  
1500/1500 [=====] - 0s - loss: 0.0746 - b  
inary\_accuracy: 0.9140  
Epoch 1029/2000  
1500/1500 [=====] - 0s - loss: 0.0746 - b  
inary\_accuracy: 0.9120  
Epoch 1030/2000  
1500/1500 [=====] - 0s - loss: 0.0747 - b  
inary\_accuracy: 0.9133  
Epoch 1031/2000  
1500/1500 [=====] - 0s - loss: 0.0747 - b  
inary\_accuracy: 0.9133  
Epoch 1032/2000  
1500/1500 [=====] - 0s - loss: 0.0746 - b  
inary\_accuracy: 0.9160  
Epoch 1033/2000  
1500/1500 [=====] - 0s - loss: 0.0746 - b  
inary\_accuracy: 0.9133  
Epoch 1034/2000  
1500/1500 [=====] - 0s - loss: 0.0746 - b  
inary\_accuracy: 0.9127  
Epoch 1035/2000  
1500/1500 [=====] - 0s - loss: 0.0746 - b  
inary\_accuracy: 0.9127  
Epoch 1036/2000

1500/1500 [=====] - 0s - loss: 0.0747 - b  
inary\_accuracy: 0.9113  
Epoch 1037/2000  
1500/1500 [=====] - 0s - loss: 0.0746 - b  
inary\_accuracy: 0.9113  
Epoch 1038/2000  
1500/1500 [=====] - 0s - loss: 0.0746 - b  
inary\_accuracy: 0.9127  
Epoch 1039/2000  
1500/1500 [=====] - 0s - loss: 0.0745 - b  
inary\_accuracy: 0.9120  
Epoch 1040/2000  
1500/1500 [=====] - 0s - loss: 0.0746 - b  
inary\_accuracy: 0.9140  
Epoch 1041/2000  
1500/1500 [=====] - 0s - loss: 0.0746 - b  
inary\_accuracy: 0.9120  
Epoch 1042/2000  
1500/1500 [=====] - 0s - loss: 0.0745 - b  
inary\_accuracy: 0.9127  
Epoch 1043/2000  
1500/1500 [=====] - 0s - loss: 0.0745 - b  
inary\_accuracy: 0.9140  
Epoch 1044/2000  
1500/1500 [=====] - 0s - loss: 0.0745 - b  
inary\_accuracy: 0.9127  
Epoch 1045/2000  
1500/1500 [=====] - 0s - loss: 0.0746 - b  
inary\_accuracy: 0.9133  
Epoch 1046/2000  
1500/1500 [=====] - 0s - loss: 0.0745 - b  
inary\_accuracy: 0.9133  
Epoch 1047/2000  
1500/1500 [=====] - 0s - loss: 0.0746 - b  
inary\_accuracy: 0.9147  
Epoch 1048/2000  
1500/1500 [=====] - 0s - loss: 0.0745 - b  
inary\_accuracy: 0.9133 - ETA: 0s - loss: 0.0744 - binary\_accu  
acy: 0.913  
Epoch 1049/2000  
1500/1500 [=====] - 0s - loss: 0.0744 - b  
inary\_accuracy: 0.9120  
Epoch 1050/2000  
1500/1500 [=====] - 0s - loss: 0.0745 - b  
inary\_accuracy: 0.9153  
Epoch 1051/2000  
1500/1500 [=====] - 0s - loss: 0.0745 - b  
inary\_accuracy: 0.9127  
Epoch 1052/2000  
1500/1500 [=====] - 0s - loss: 0.0745 - b  
inary\_accuracy: 0.9133  
Epoch 1053/2000  
1500/1500 [=====] - 0s - loss: 0.0744 - b  
inary\_accuracy: 0.9147  
Epoch 1054/2000  
1500/1500 [=====] - 0s - loss: 0.0745 - b  
inary\_accuracy: 0.9120

Epoch 1055/2000  
1500/1500 [=====] - 0s - loss: 0.0745 - binary\_accuracy: 0.9140  
Epoch 1056/2000  
1500/1500 [=====] - 0s - loss: 0.0744 - binary\_accuracy: 0.9147  
Epoch 1057/2000  
1500/1500 [=====] - 0s - loss: 0.0745 - binary\_accuracy: 0.9107  
Epoch 1058/2000  
1500/1500 [=====] - 0s - loss: 0.0745 - binary\_accuracy: 0.9140  
Epoch 1059/2000  
1500/1500 [=====] - 0s - loss: 0.0744 - binary\_accuracy: 0.9133  
Epoch 1060/2000  
1500/1500 [=====] - 0s - loss: 0.0744 - binary\_accuracy: 0.9140  
Epoch 1061/2000  
1500/1500 [=====] - 0s - loss: 0.0745 - binary\_accuracy: 0.9127  
Epoch 1062/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9120  
Epoch 1063/2000  
1500/1500 [=====] - 0s - loss: 0.0744 - binary\_accuracy: 0.9133  
Epoch 1064/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9140  
Epoch 1065/2000  
1500/1500 [=====] - 0s - loss: 0.0744 - binary\_accuracy: 0.9133  
Epoch 1066/2000  
1500/1500 [=====] - 0s - loss: 0.0744 - binary\_accuracy: 0.9100  
Epoch 1067/2000  
1500/1500 [=====] - 0s - loss: 0.0744 - binary\_accuracy: 0.9140  
Epoch 1068/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9147  
Epoch 1069/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9133  
Epoch 1070/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9127  
Epoch 1071/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9147  
Epoch 1072/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9113  
Epoch 1073/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9153

Epoch 1074/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9120  
Epoch 1075/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9140  
Epoch 1076/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9140  
Epoch 1077/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9120  
Epoch 1078/2000  
1500/1500 [=====] - 0s - loss: 0.0742 - binary\_accuracy: 0.9140  
Epoch 1079/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9140  
Epoch 1080/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9120  
Epoch 1081/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9120  
Epoch 1082/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9127  
Epoch 1083/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9113  
Epoch 1084/2000  
1500/1500 [=====] - 0s - loss: 0.0742 - binary\_accuracy: 0.9127  
Epoch 1085/2000  
1500/1500 [=====] - 0s - loss: 0.0742 - binary\_accuracy: 0.9120  
Epoch 1086/2000  
1500/1500 [=====] - 0s - loss: 0.0743 - binary\_accuracy: 0.9147  
Epoch 1087/2000  
1500/1500 [=====] - 0s - loss: 0.0742 - binary\_accuracy: 0.9113  
Epoch 1088/2000  
1500/1500 [=====] - 0s - loss: 0.0742 - binary\_accuracy: 0.9133  
Epoch 1089/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9120  
Epoch 1090/2000  
1500/1500 [=====] - 0s - loss: 0.0742 - binary\_accuracy: 0.9133  
Epoch 1091/2000  
1500/1500 [=====] - 0s - loss: 0.0742 - binary\_accuracy: 0.9120  
Epoch 1092/2000  
1500/1500 [=====] - 0s - loss: 0.0742 - binary\_accuracy: 0.9120

Epoch 1093/2000  
1500/1500 [=====] - 0s - loss: 0.0742 - binary\_accuracy: 0.9127  
Epoch 1094/2000  
1500/1500 [=====] - 0s - loss: 0.0742 - binary\_accuracy: 0.9133  
Epoch 1095/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9107  
Epoch 1096/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9120  
Epoch 1097/2000  
1500/1500 [=====] - 0s - loss: 0.0742 - binary\_accuracy: 0.9113  
Epoch 1098/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9140  
Epoch 1099/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9120  
Epoch 1100/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9133  
Epoch 1101/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9127  
Epoch 1102/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9140  
Epoch 1103/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9127  
Epoch 1104/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9133  
Epoch 1105/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9127  
Epoch 1106/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9133  
Epoch 1107/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9120  
Epoch 1108/2000  
1500/1500 [=====] - 0s - loss: 0.0740 - binary\_accuracy: 0.9127  
Epoch 1109/2000  
1500/1500 [=====] - 0s - loss: 0.0740 - binary\_accuracy: 0.9120  
Epoch 1110/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9133  
Epoch 1111/2000  
1500/1500 [=====] - 0s - loss: 0.0740 - binary\_accuracy: 0.9127

Epoch 1112/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9140  
Epoch 1113/2000  
1500/1500 [=====] - 0s - loss: 0.0740 - binary\_accuracy: 0.9127  
Epoch 1114/2000  
1500/1500 [=====] - 0s - loss: 0.0740 - binary\_accuracy: 0.9127  
Epoch 1115/2000  
1500/1500 [=====] - 0s - loss: 0.0740 - binary\_accuracy: 0.9127  
Epoch 1116/2000  
1500/1500 [=====] - 0s - loss: 0.0741 - binary\_accuracy: 0.9133  
Epoch 1117/2000  
1500/1500 [=====] - 0s - loss: 0.0740 - binary\_accuracy: 0.9120  
Epoch 1118/2000  
1500/1500 [=====] - 0s - loss: 0.0740 - binary\_accuracy: 0.9153  
Epoch 1119/2000  
1500/1500 [=====] - 0s - loss: 0.0740 - binary\_accuracy: 0.9120  
Epoch 1120/2000  
1500/1500 [=====] - 0s - loss: 0.0740 - binary\_accuracy: 0.9120  
Epoch 1121/2000  
1500/1500 [=====] - 0s - loss: 0.0740 - binary\_accuracy: 0.9133  
Epoch 1122/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9140  
Epoch 1123/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9153  
Epoch 1124/2000  
1500/1500 [=====] - 0s - loss: 0.0740 - binary\_accuracy: 0.9120  
Epoch 1125/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9127  
Epoch 1126/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9127  
Epoch 1127/2000  
1500/1500 [=====] - 0s - loss: 0.0740 - binary\_accuracy: 0.9133  
Epoch 1128/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9140  
Epoch 1129/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9133  
Epoch 1130/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9127

Epoch 1131/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9120  
Epoch 1132/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9147  
Epoch 1133/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9120  
Epoch 1134/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9140  
Epoch 1135/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9147  
Epoch 1136/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9127  
Epoch 1137/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9120  
Epoch 1138/2000  
1500/1500 [=====] - 0s - loss: 0.0739 - binary\_accuracy: 0.9100  
Epoch 1139/2000  
1500/1500 [=====] - 0s - loss: 0.0738 - binary\_accuracy: 0.9120  
Epoch 1140/2000  
1500/1500 [=====] - 0s - loss: 0.0738 - binary\_accuracy: 0.9120  
Epoch 1141/2000  
1500/1500 [=====] - 0s - loss: 0.0738 - binary\_accuracy: 0.9133  
Epoch 1142/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9113  
Epoch 1143/2000  
1500/1500 [=====] - 0s - loss: 0.0738 - binary\_accuracy: 0.9140  
Epoch 1144/2000  
1500/1500 [=====] - 0s - loss: 0.0738 - binary\_accuracy: 0.9127  
Epoch 1145/2000  
1500/1500 [=====] - 0s - loss: 0.0738 - binary\_accuracy: 0.9140  
Epoch 1146/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9160  
Epoch 1147/2000  
1500/1500 [=====] - 0s - loss: 0.0738 - binary\_accuracy: 0.9127  
Epoch 1148/2000  
1500/1500 [=====] - 0s - loss: 0.0738 - binary\_accuracy: 0.9133  
Epoch 1149/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9140



Epoch 1150/2000  
1500/1500 [=====] - 0s - loss: 0.0738 - binary\_accuracy: 0.9120  
Epoch 1151/2000  
1500/1500 [=====] - 0s - loss: 0.0738 - binary\_accuracy: 0.9127  
Epoch 1152/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9113  
Epoch 1153/2000  
1500/1500 [=====] - 0s - loss: 0.0738 - binary\_accuracy: 0.9133  
Epoch 1154/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9133  
Epoch 1155/2000  
1500/1500 [=====] - 0s - loss: 0.0738 - binary\_accuracy: 0.9127  
Epoch 1156/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9127  
Epoch 1157/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9113  
Epoch 1158/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9140  
Epoch 1159/2000  
1500/1500 [=====] - 0s - loss: 0.0738 - binary\_accuracy: 0.9120  
Epoch 1160/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9127  
Epoch 1161/2000  
1500/1500 [=====] - 0s - loss: 0.0736 - binary\_accuracy: 0.9113  
Epoch 1162/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9113  
Epoch 1163/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9140  
Epoch 1164/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9133  
Epoch 1165/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9120  
Epoch 1166/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9120  
Epoch 1167/2000  
1500/1500 [=====] - 0s - loss: 0.0736 - binary\_accuracy: 0.9127  
Epoch 1168/2000  
1500/1500 [=====] - 0s - loss: 0.0736 - binary\_accuracy: 0.9133

Epoch 1169/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9127  
Epoch 1170/2000  
1500/1500 [=====] - 0s - loss: 0.0736 - binary\_accuracy: 0.9127  
Epoch 1171/2000  
1500/1500 [=====] - 0s - loss: 0.0736 - binary\_accuracy: 0.9147  
Epoch 1172/2000  
1500/1500 [=====] - 0s - loss: 0.0736 - binary\_accuracy: 0.9107  
Epoch 1173/2000  
1500/1500 [=====] - 0s - loss: 0.0737 - binary\_accuracy: 0.9133  
Epoch 1174/2000  
1500/1500 [=====] - 0s - loss: 0.0736 - binary\_accuracy: 0.9127  
Epoch 1175/2000  
1500/1500 [=====] - 0s - loss: 0.0736 - binary\_accuracy: 0.9127  
Epoch 1176/2000  
1500/1500 [=====] - 0s - loss: 0.0736 - binary\_accuracy: 0.9120  
Epoch 1177/2000  
1500/1500 [=====] - 0s - loss: 0.0736 - binary\_accuracy: 0.9113  
Epoch 1178/2000  
1500/1500 [=====] - 0s - loss: 0.0735 - binary\_accuracy: 0.9120  
Epoch 1179/2000  
1500/1500 [=====] - 0s - loss: 0.0735 - binary\_accuracy: 0.9140  
Epoch 1180/2000  
1500/1500 [=====] - 0s - loss: 0.0735 - binary\_accuracy: 0.9113  
Epoch 1181/2000  
1500/1500 [=====] - 0s - loss: 0.0735 - binary\_accuracy: 0.9120  
Epoch 1182/2000  
1500/1500 [=====] - 0s - loss: 0.0735 - binary\_accuracy: 0.9133  
Epoch 1183/2000  
1500/1500 [=====] - 0s - loss: 0.0735 - binary\_accuracy: 0.9127  
Epoch 1184/2000  
1500/1500 [=====] - 0s - loss: 0.0735 - binary\_accuracy: 0.9140  
Epoch 1185/2000  
1500/1500 [=====] - 0s - loss: 0.0735 - binary\_accuracy: 0.9127  
Epoch 1186/2000  
1500/1500 [=====] - 0s - loss: 0.0735 - binary\_accuracy: 0.9140  
Epoch 1187/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9147

Epoch 1188/2000  
1500/1500 [=====] - 0s - loss: 0.0735 - binary\_accuracy: 0.9133

Epoch 1189/2000  
1500/1500 [=====] - 0s - loss: 0.0735 - binary\_accuracy: 0.9127

Epoch 1190/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9127

Epoch 1191/2000  
1500/1500 [=====] - 0s - loss: 0.0735 - binary\_accuracy: 0.9120

Epoch 1192/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9120

Epoch 1193/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9133

Epoch 1194/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9133

Epoch 1195/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9140

Epoch 1196/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9120

Epoch 1197/2000  
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Epoch 1198/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9127

Epoch 1199/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9133

Epoch 1200/2000  
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Epoch 1201/2000  
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Epoch 1203/2000  
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Epoch 1204/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9140

Epoch 1205/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9120

Epoch 1206/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9147

Epoch 1207/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9140  
Epoch 1208/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9127  
Epoch 1209/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9127  
Epoch 1210/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9127  
Epoch 1211/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9107  
Epoch 1212/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9127  
Epoch 1213/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9120  
Epoch 1214/2000  
1500/1500 [=====] - 0s - loss: 0.0734 - binary\_accuracy: 0.9127  
Epoch 1215/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9133  
Epoch 1216/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9127  
Epoch 1217/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9113  
Epoch 1218/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9147  
Epoch 1219/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9127  
Epoch 1220/2000  
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Epoch 1221/2000  
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Epoch 1222/2000  
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Epoch 1223/2000  
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Epoch 1224/2000  
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Epoch 1225/2000  
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Epoch 1226/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9140  
Epoch 1227/2000  
1500/1500 [=====] - 0s - loss: 0.0732 - binary\_accuracy: 0.9147  
Epoch 1228/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9127  
Epoch 1229/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9140  
Epoch 1230/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9153  
Epoch 1231/2000  
1500/1500 [=====] - 0s - loss: 0.0732 - binary\_accuracy: 0.9147  
Epoch 1232/2000  
1500/1500 [=====] - 0s - loss: 0.0732 - binary\_accuracy: 0.9127  
Epoch 1233/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9113  
Epoch 1234/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9120  
Epoch 1235/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9127  
Epoch 1236/2000  
1500/1500 [=====] - 0s - loss: 0.0732 - binary\_accuracy: 0.9140  
Epoch 1237/2000  
1500/1500 [=====] - 0s - loss: 0.0733 - binary\_accuracy: 0.9133  
Epoch 1238/2000  
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Epoch 1239/2000  
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Epoch 1240/2000  
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Epoch 1241/2000  
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Epoch 1242/2000  
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Epoch 1243/2000  
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Epoch 1244/2000  
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Epoch 1245/2000  
1500/1500 [=====] - 0s - loss: 0.0732 - binary\_accuracy: 0.9153  
Epoch 1246/2000  
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Epoch 1247/2000  
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Epoch 1248/2000  
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Epoch 1249/2000  
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Epoch 1250/2000  
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Epoch 1251/2000  
1500/1500 [=====] - 0s - loss: 0.0732 - binary\_accuracy: 0.9133  
Epoch 1252/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9140  
Epoch 1253/2000  
1500/1500 [=====] - 0s - loss: 0.0732 - binary\_accuracy: 0.9133  
Epoch 1254/2000  
1500/1500 [=====] - 0s - loss: 0.0732 - binary\_accuracy: 0.9147  
Epoch 1255/2000  
1500/1500 [=====] - 0s - loss: 0.0732 - binary\_accuracy: 0.9127  
Epoch 1256/2000  
1500/1500 [=====] - 0s - loss: 0.0732 - binary\_accuracy: 0.9133  
Epoch 1257/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9147  
Epoch 1258/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9140  
Epoch 1259/2000  
1500/1500 [=====] - 0s - loss: 0.0732 - binary\_accuracy: 0.9133  
Epoch 1260/2000  
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Epoch 1261/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9147  
Epoch 1262/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9140  
Epoch 1263/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9127

Epoch 1264/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9147  
Epoch 1265/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9153  
Epoch 1266/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9133  
Epoch 1267/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9153  
Epoch 1268/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9140  
Epoch 1269/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9147  
Epoch 1270/2000  
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Epoch 1271/2000  
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Epoch 1272/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9133  
Epoch 1273/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9147  
Epoch 1274/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9140  
Epoch 1275/2000  
1500/1500 [=====] - 0s - loss: 0.0730 - binary\_accuracy: 0.9147  
Epoch 1276/2000  
1500/1500 [=====] - 0s - loss: 0.0730 - binary\_accuracy: 0.9133  
Epoch 1277/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9140  
Epoch 1278/2000  
1500/1500 [=====] - 0s - loss: 0.0730 - binary\_accuracy: 0.9140  
Epoch 1279/2000  
1500/1500 [=====] - 0s - loss: 0.0730 - binary\_accuracy: 0.9140  
Epoch 1280/2000  
1500/1500 [=====] - 0s - loss: 0.0731 - binary\_accuracy: 0.9160  
Epoch 1281/2000  
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Epoch 1282/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9133

Epoch 1283/2000  
1500/1500 [=====] - 0s - loss: 0.0730 - binary\_accuracy: 0.9147  
Epoch 1284/2000  
1500/1500 [=====] - 0s - loss: 0.0730 - binary\_accuracy: 0.9147  
Epoch 1285/2000  
1500/1500 [=====] - 0s - loss: 0.0730 - binary\_accuracy: 0.9147  
Epoch 1286/2000  
1500/1500 [=====] - 0s - loss: 0.0730 - binary\_accuracy: 0.9153  
Epoch 1287/2000  
1500/1500 [=====] - 0s - loss: 0.0730 - binary\_accuracy: 0.9140  
Epoch 1288/2000  
1500/1500 [=====] - 0s - loss: 0.0730 - binary\_accuracy: 0.9140  
Epoch 1289/2000  
1500/1500 [=====] - 0s - loss: 0.0730 - binary\_accuracy: 0.9140  
Epoch 1290/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9153  
Epoch 1291/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9140  
Epoch 1292/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9153  
Epoch 1293/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9140  
Epoch 1294/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9147  
Epoch 1295/2000  
1500/1500 [=====] - 0s - loss: 0.0730 - binary\_accuracy: 0.9140  
Epoch 1296/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9147  
Epoch 1297/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9140  
Epoch 1298/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9160  
Epoch 1299/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9140  
Epoch 1300/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9160  
Epoch 1301/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9140



Epoch 1302/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9160  
Epoch 1303/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9153  
Epoch 1304/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9153  
Epoch 1305/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9153  
Epoch 1306/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9147  
Epoch 1307/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9153  
Epoch 1308/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9167  
Epoch 1309/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9153  
Epoch 1310/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9160  
Epoch 1311/2000  
1500/1500 [=====] - 0s - loss: 0.0729 - binary\_accuracy: 0.9167  
Epoch 1312/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9160  
Epoch 1313/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9153  
Epoch 1314/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9153  
Epoch 1315/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9140  
Epoch 1316/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9147  
Epoch 1317/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9147  
Epoch 1318/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9160  
Epoch 1319/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9153  
Epoch 1320/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9153

Epoch 1321/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9167

Epoch 1322/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9147

Epoch 1323/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9147

Epoch 1324/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9153

Epoch 1325/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9153

Epoch 1326/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9153

Epoch 1327/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9160

Epoch 1328/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9147

Epoch 1329/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9160

Epoch 1330/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9160

Epoch 1331/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9160

Epoch 1332/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9167

Epoch 1333/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9160

Epoch 1334/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9147

Epoch 1335/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9153

Epoch 1336/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9153

Epoch 1337/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9160

Epoch 1338/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9160

Epoch 1339/2000  
1500/1500 [=====] - 0s - loss: 0.0728 - binary\_accuracy: 0.9180

Epoch 1340/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9160  
Epoch 1341/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9160  
Epoch 1342/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9153  
Epoch 1343/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9160  
Epoch 1344/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9193  
Epoch 1345/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9160  
Epoch 1346/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9167  
Epoch 1347/2000  
1500/1500 [=====] - 0s - loss: 0.0727 - binary\_accuracy: 0.9153  
Epoch 1348/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9153  
Epoch 1349/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9140  
Epoch 1350/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9160  
Epoch 1351/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9140  
Epoch 1352/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9180  
Epoch 1353/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9173  
Epoch 1354/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9153  
Epoch 1355/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9167  
Epoch 1356/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9167  
Epoch 1357/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9160  
Epoch 1358/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9160

Epoch 1359/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9153  
Epoch 1360/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9160  
Epoch 1361/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9160  
Epoch 1362/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9173  
Epoch 1363/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9160  
Epoch 1364/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9153  
Epoch 1365/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9160  
Epoch 1366/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9160  
Epoch 1367/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9147  
Epoch 1368/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9167  
Epoch 1369/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9173  
Epoch 1370/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9167  
Epoch 1371/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9153  
Epoch 1372/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9160  
Epoch 1373/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9160  
Epoch 1374/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9160  
Epoch 1375/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9160  
Epoch 1376/2000  
1500/1500 [=====] - 0s - loss: 0.0726 - binary\_accuracy: 0.9147  
Epoch 1377/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9173

Epoch 1378/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9167  
Epoch 1379/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9160  
Epoch 1380/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9167  
Epoch 1381/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9167  
Epoch 1382/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9160  
Epoch 1383/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9167  
Epoch 1384/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9147  
Epoch 1385/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9153  
Epoch 1386/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9167  
Epoch 1387/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9160  
Epoch 1388/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9167  
Epoch 1389/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9180  
Epoch 1390/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9173  
Epoch 1391/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9153  
Epoch 1392/2000  
1500/1500 [=====] - 0s - loss: 0.0725 - binary\_accuracy: 0.9147  
Epoch 1393/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9167  
Epoch 1394/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9167  
Epoch 1395/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9160  
Epoch 1396/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9180

Epoch 1397/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9173  
Epoch 1398/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9153  
Epoch 1399/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9160  
Epoch 1400/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9187  
Epoch 1401/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9173  
Epoch 1402/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9160  
Epoch 1403/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9160  
Epoch 1404/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9153  
Epoch 1405/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9167  
Epoch 1406/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9147  
Epoch 1407/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9167  
Epoch 1408/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9173  
Epoch 1409/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9153  
Epoch 1410/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9153  
Epoch 1411/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9173  
Epoch 1412/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9167  
Epoch 1413/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9173  
Epoch 1414/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9160  
Epoch 1415/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9180

Epoch 1416/2000  
1500/1500 [=====] - 0s - loss: 0.0724 - binary\_accuracy: 0.9147  
Epoch 1417/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9180  
Epoch 1418/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9180  
Epoch 1419/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9140  
Epoch 1420/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9153  
Epoch 1421/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9167  
Epoch 1422/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9173  
Epoch 1423/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9160  
Epoch 1424/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9167  
Epoch 1425/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9173  
Epoch 1426/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9173  
Epoch 1427/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9160  
Epoch 1428/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9160  
Epoch 1429/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9167  
Epoch 1430/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9173  
Epoch 1431/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9160  
Epoch 1432/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9160  
Epoch 1433/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9167  
Epoch 1434/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9173

Epoch 1435/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9167

Epoch 1436/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9180

Epoch 1437/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9167

Epoch 1438/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9173

Epoch 1439/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9167

Epoch 1440/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9160

Epoch 1441/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9167

Epoch 1442/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9173

Epoch 1443/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9173

Epoch 1444/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9153

Epoch 1445/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9173

Epoch 1446/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9160

Epoch 1447/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9167

Epoch 1448/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9193

Epoch 1449/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9173

Epoch 1450/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9173

Epoch 1451/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9173

Epoch 1452/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9180

Epoch 1453/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9173



Epoch 1454/2000  
1500/1500 [=====] - 0s - loss: 0.0723 - binary\_accuracy: 0.9160  
Epoch 1455/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9167  
Epoch 1456/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9187  
Epoch 1457/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9187  
Epoch 1458/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9180  
Epoch 1459/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9147  
Epoch 1460/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9153  
Epoch 1461/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9160  
Epoch 1462/2000  
1500/1500 [=====] - 0s - loss: 0.0722 - binary\_accuracy: 0.9180  
Epoch 1463/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9173  
Epoch 1464/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9180  
Epoch 1465/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9187  
Epoch 1466/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9167  
Epoch 1467/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9147  
Epoch 1468/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9173  
Epoch 1469/2000  
1500/1500 [=====] - 0s - loss: 0.0720 - binary\_accuracy: 0.9187  
Epoch 1470/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9173  
Epoch 1471/2000  
1500/1500 [=====] - 0s - loss: 0.0720 - binary\_accuracy: 0.9167  
Epoch 1472/2000  
1500/1500 [=====] - 0s - loss: 0.0720 - binary\_accuracy: 0.9193

Epoch 1473/2000  
1500/1500 [=====] - 0s - loss: 0.0720 - binary\_accuracy: 0.9167

Epoch 1474/2000  
1500/1500 [=====] - 0s - loss: 0.0721 - binary\_accuracy: 0.9153

Epoch 1475/2000  
1500/1500 [=====] - 0s - loss: 0.0720 - binary\_accuracy: 0.9193

Epoch 1476/2000  
1500/1500 [=====] - 0s - loss: 0.0720 - binary\_accuracy: 0.9180

Epoch 1477/2000  
1500/1500 [=====] - 0s - loss: 0.0720 - binary\_accuracy: 0.9160

Epoch 1478/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - binary\_accuracy: 0.9173

Epoch 1479/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - binary\_accuracy: 0.9160

Epoch 1480/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - binary\_accuracy: 0.9173

Epoch 1481/2000  
1500/1500 [=====] - 0s - loss: 0.0720 - binary\_accuracy: 0.9167

Epoch 1482/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - binary\_accuracy: 0.9180

Epoch 1483/2000  
1500/1500 [=====] - 0s - loss: 0.0720 - binary\_accuracy: 0.9173

Epoch 1484/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - binary\_accuracy: 0.9173

Epoch 1485/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - binary\_accuracy: 0.9180

Epoch 1486/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - binary\_accuracy: 0.9167

Epoch 1487/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - binary\_accuracy: 0.9180

Epoch 1488/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - binary\_accuracy: 0.9167

Epoch 1489/2000  
1500/1500 [=====] - 0s - loss: 0.0720 - binary\_accuracy: 0.9173

Epoch 1490/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - binary\_accuracy: 0.9167

Epoch 1491/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - binary\_accuracy: 0.9173

Epoch 1492/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9173  
Epoch 1493/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - b  
inary\_accuracy: 0.9180  
Epoch 1494/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - b  
inary\_accuracy: 0.9173  
Epoch 1495/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - b  
inary\_accuracy: 0.9173  
Epoch 1496/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - b  
inary\_accuracy: 0.9180  
Epoch 1497/2000  
1500/1500 [=====] - ETA: 0s - loss: 0.071  
4 - binary\_accuracy: 0.916 - 0s - loss: 0.0719 - binary\_accuracy:  
0.9153  
Epoch 1498/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - b  
inary\_accuracy: 0.9180  
Epoch 1499/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9167  
Epoch 1500/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - b  
inary\_accuracy: 0.9180  
Epoch 1501/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9180  
Epoch 1502/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9167  
Epoch 1503/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9173  
Epoch 1504/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9180  
Epoch 1505/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - b  
inary\_accuracy: 0.9180  
Epoch 1506/2000  
1500/1500 [=====] - 0s - loss: 0.0719 - b  
inary\_accuracy: 0.9187  
Epoch 1507/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9173  
Epoch 1508/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9173  
Epoch 1509/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b  
inary\_accuracy: 0.9173  
Epoch 1510/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b

inary\_accuracy: 0.9173  
Epoch 1511/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9187  
Epoch 1512/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9167  
Epoch 1513/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9173  
Epoch 1514/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b  
inary\_accuracy: 0.9173  
Epoch 1515/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9167  
Epoch 1516/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b  
inary\_accuracy: 0.9180  
Epoch 1517/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9173  
Epoch 1518/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b  
inary\_accuracy: 0.9193  
Epoch 1519/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9187  
Epoch 1520/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b  
inary\_accuracy: 0.9167  
Epoch 1521/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b  
inary\_accuracy: 0.9193  
Epoch 1522/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9173  
Epoch 1523/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b  
inary\_accuracy: 0.9193  
Epoch 1524/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9173  
Epoch 1525/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b  
inary\_accuracy: 0.9173  
Epoch 1526/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b  
inary\_accuracy: 0.9180  
Epoch 1527/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b  
inary\_accuracy: 0.9173  
Epoch 1528/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9193  
Epoch 1529/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b

inary\_accuracy: 0.9187  
Epoch 1530/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9187  
Epoch 1531/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b  
inary\_accuracy: 0.9173  
Epoch 1532/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b  
inary\_accuracy: 0.9180  
Epoch 1533/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b  
inary\_accuracy: 0.9167  
Epoch 1534/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9193  
Epoch 1535/2000  
1500/1500 [=====] - 0s - loss: 0.0718 - b  
inary\_accuracy: 0.9187  
Epoch 1536/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9173  
Epoch 1537/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9180  
Epoch 1538/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9193  
Epoch 1539/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9167  
Epoch 1540/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9180  
Epoch 1541/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9187  
Epoch 1542/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9193  
Epoch 1543/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9180  
Epoch 1544/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9173  
Epoch 1545/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9180  
Epoch 1546/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9167  
Epoch 1547/2000  
1500/1500 [=====] - 0s - loss: 0.0717 - b  
inary\_accuracy: 0.9180  
Epoch 1548/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b

inary\_accuracy: 0.9173  
Epoch 1549/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9167  
Epoch 1550/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9187  
Epoch 1551/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9180  
Epoch 1552/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9193  
Epoch 1553/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9167  
Epoch 1554/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9173  
Epoch 1555/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9180  
Epoch 1556/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9167  
Epoch 1557/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9173  
Epoch 1558/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9187  
Epoch 1559/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9173  
Epoch 1560/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9180  
Epoch 1561/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9187  
Epoch 1562/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9180  
Epoch 1563/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9167  
Epoch 1564/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9193  
Epoch 1565/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9167  
Epoch 1566/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9167  
Epoch 1567/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b

inary\_accuracy: 0.9180  
Epoch 1568/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9173  
Epoch 1569/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9180  
Epoch 1570/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9187  
Epoch 1571/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9187  
Epoch 1572/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9187  
Epoch 1573/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9180  
Epoch 1574/2000  
1500/1500 [=====] - 0s - loss: 0.0714 - b  
inary\_accuracy: 0.9180  
Epoch 1575/2000  
1500/1500 [=====] - 0s - loss: 0.0716 - b  
inary\_accuracy: 0.9193  
Epoch 1576/2000  
1500/1500 [=====] - 0s - loss: 0.0714 - b  
inary\_accuracy: 0.9187  
Epoch 1577/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9187  
Epoch 1578/2000  
1500/1500 [=====] - 0s - loss: 0.0714 - b  
inary\_accuracy: 0.9173  
Epoch 1579/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9180  
Epoch 1580/2000  
1500/1500 [=====] - 0s - loss: 0.0714 - b  
inary\_accuracy: 0.9187  
Epoch 1581/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9187  
Epoch 1582/2000  
1500/1500 [=====] - 0s - loss: 0.0715 - b  
inary\_accuracy: 0.9180  
Epoch 1583/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b  
inary\_accuracy: 0.9173  
Epoch 1584/2000  
1500/1500 [=====] - 0s - loss: 0.0714 - b  
inary\_accuracy: 0.9180  
Epoch 1585/2000  
1500/1500 [=====] - 0s - loss: 0.0714 - b  
inary\_accuracy: 0.9180  
Epoch 1586/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b

inary\_accuracy: 0.9187  
Epoch 1587/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b  
inary\_accuracy: 0.9173  
Epoch 1588/2000  
1500/1500 [=====] - 0s - loss: 0.0714 - b  
inary\_accuracy: 0.9187  
Epoch 1589/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b  
inary\_accuracy: 0.9187  
Epoch 1590/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9180  
Epoch 1591/2000  
1500/1500 [=====] - 0s - loss: 0.0714 - b  
inary\_accuracy: 0.9193  
Epoch 1592/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b  
inary\_accuracy: 0.9187  
Epoch 1593/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b  
inary\_accuracy: 0.9180  
Epoch 1594/2000  
1500/1500 [=====] - 0s - loss: 0.0714 - b  
inary\_accuracy: 0.9187  
Epoch 1595/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b  
inary\_accuracy: 0.9187  
Epoch 1596/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b  
inary\_accuracy: 0.9187  
Epoch 1597/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b  
inary\_accuracy: 0.9193  
Epoch 1598/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b  
inary\_accuracy: 0.9187  
Epoch 1599/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b  
inary\_accuracy: 0.9187  
Epoch 1600/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9180  
Epoch 1601/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b  
inary\_accuracy: 0.9193  
Epoch 1602/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9180  
Epoch 1603/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9180  
Epoch 1604/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b  
inary\_accuracy: 0.9180  
Epoch 1605/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b



inary\_accuracy: 0.9180  
Epoch 1606/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9187  
Epoch 1607/2000  
1500/1500 [=====] - 0s - loss: 0.0713 - b  
inary\_accuracy: 0.9180  
Epoch 1608/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9193  
Epoch 1609/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9193  
Epoch 1610/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9187  
Epoch 1611/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9187  
Epoch 1612/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9200  
Epoch 1613/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9187  
Epoch 1614/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9187  
Epoch 1615/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9193  
Epoch 1616/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9187  
Epoch 1617/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9173  
Epoch 1618/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9180  
Epoch 1619/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9187  
Epoch 1620/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9193  
Epoch 1621/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9187  
Epoch 1622/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9180  
Epoch 1623/2000  
1500/1500 [=====] - 0s - loss: 0.0712 - b  
inary\_accuracy: 0.9187  
Epoch 1624/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b

inary\_accuracy: 0.9187  
Epoch 1625/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9180  
Epoch 1626/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9173  
Epoch 1627/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9180  
Epoch 1628/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9180  
Epoch 1629/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9180  
Epoch 1630/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9180  
Epoch 1631/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9187  
Epoch 1632/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9180  
Epoch 1633/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9173  
Epoch 1634/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9180  
Epoch 1635/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9187  
Epoch 1636/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9187  
Epoch 1637/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9193  
Epoch 1638/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9187  
Epoch 1639/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9187  
Epoch 1640/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9180  
Epoch 1641/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9187  
Epoch 1642/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9180  
Epoch 1643/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b

inary\_accuracy: 0.9187  
Epoch 1644/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9180  
Epoch 1645/2000  
1500/1500 [=====] - 0s - loss: 0.0711 - b  
inary\_accuracy: 0.9180  
Epoch 1646/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9180  
Epoch 1647/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9173  
Epoch 1648/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9180  
Epoch 1649/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9180  
Epoch 1650/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9173  
Epoch 1651/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9173  
Epoch 1652/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9187  
Epoch 1653/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9180  
Epoch 1654/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9187  
Epoch 1655/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9187  
Epoch 1656/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9187  
Epoch 1657/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9173  
Epoch 1658/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9180  
Epoch 1659/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9173  
Epoch 1660/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9193  
Epoch 1661/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9180  
Epoch 1662/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b

inary\_accuracy: 0.9180  
Epoch 1663/2000  
1500/1500 [=====] - 0s - loss: 0.0710 - b  
inary\_accuracy: 0.9180  
Epoch 1664/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9180  
Epoch 1665/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9180  
Epoch 1666/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9180  
Epoch 1667/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9180  
Epoch 1668/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9180  
Epoch 1669/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9187  
Epoch 1670/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9193  
Epoch 1671/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9173  
Epoch 1672/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9187  
Epoch 1673/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9180  
Epoch 1674/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9187  
Epoch 1675/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9173  
Epoch 1676/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9187  
Epoch 1677/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9180  
Epoch 1678/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9187  
Epoch 1679/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9180  
Epoch 1680/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9173  
Epoch 1681/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b

inary\_accuracy: 0.9187  
Epoch 1682/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9187  
Epoch 1683/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9167  
Epoch 1684/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9160  
Epoch 1685/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9167  
Epoch 1686/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9180  
Epoch 1687/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9180  
Epoch 1688/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9173  
Epoch 1689/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9187  
Epoch 1690/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9173  
Epoch 1691/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9193  
Epoch 1692/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9180  
Epoch 1693/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9180  
Epoch 1694/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9167  
Epoch 1695/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9167  
Epoch 1696/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9187  
Epoch 1697/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9180  
Epoch 1698/2000  
1500/1500 [=====] - 0s - loss: 0.0709 - b  
inary\_accuracy: 0.9180  
Epoch 1699/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9180  
Epoch 1700/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b

inary\_accuracy: 0.9187  
Epoch 1701/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9187  
Epoch 1702/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9180  
Epoch 1703/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9173  
Epoch 1704/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9167  
Epoch 1705/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9167  
Epoch 1706/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9167  
Epoch 1707/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9173  
Epoch 1708/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9180  
Epoch 1709/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9167  
Epoch 1710/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9173  
Epoch 1711/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9173  
Epoch 1712/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9167  
Epoch 1713/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9173  
Epoch 1714/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9180  
Epoch 1715/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9173  
Epoch 1716/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9180  
Epoch 1717/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9173  
Epoch 1718/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9167  
Epoch 1719/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b

inary\_accuracy: 0.9187  
Epoch 1720/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9173  
Epoch 1721/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9180  
Epoch 1722/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9173  
Epoch 1723/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9187  
Epoch 1724/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9180  
Epoch 1725/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9187  
Epoch 1726/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9193  
Epoch 1727/2000  
1500/1500 [=====] - 0s - loss: 0.0708 - b  
inary\_accuracy: 0.9167  
Epoch 1728/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9173  
Epoch 1729/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9173  
Epoch 1730/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9180  
Epoch 1731/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9187  
Epoch 1732/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9180  
Epoch 1733/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9173  
Epoch 1734/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9180  
Epoch 1735/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9180  
Epoch 1736/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9187  
Epoch 1737/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9187  
Epoch 1738/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b

inary\_accuracy: 0.9173  
Epoch 1739/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9180  
Epoch 1740/2000  
1500/1500 [=====] - 0s - loss: 0.0707 - b  
inary\_accuracy: 0.9167  
Epoch 1741/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9173  
Epoch 1742/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9173  
Epoch 1743/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9167  
Epoch 1744/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9187  
Epoch 1745/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9173  
Epoch 1746/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9180  
Epoch 1747/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9160  
Epoch 1748/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9160  
Epoch 1749/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9180  
Epoch 1750/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9193  
Epoch 1751/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9180  
Epoch 1752/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9180  
Epoch 1753/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9167  
Epoch 1754/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9180  
Epoch 1755/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9173  
Epoch 1756/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9180  
Epoch 1757/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b



inary\_accuracy: 0.9167  
Epoch 1758/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9173  
Epoch 1759/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9180  
Epoch 1760/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9160  
Epoch 1761/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9180  
Epoch 1762/2000  
1500/1500 [=====] - 0s - loss: 0.0706 - b  
inary\_accuracy: 0.9173  
Epoch 1763/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9173  
Epoch 1764/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9173  
Epoch 1765/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9173  
Epoch 1766/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9180  
Epoch 1767/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9173  
Epoch 1768/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9187  
Epoch 1769/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9187  
Epoch 1770/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9180  
Epoch 1771/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9180  
Epoch 1772/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9180  
Epoch 1773/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1774/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1775/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9167  
Epoch 1776/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b

inary\_accuracy: 0.9187  
Epoch 1777/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9187  
Epoch 1778/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9173  
Epoch 1779/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9153  
Epoch 1780/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9173  
Epoch 1781/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9173  
Epoch 1782/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9187  
Epoch 1783/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9180  
Epoch 1784/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9167  
Epoch 1785/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9167  
Epoch 1786/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9167  
Epoch 1787/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9173  
Epoch 1788/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9173  
Epoch 1789/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1790/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9180  
Epoch 1791/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9167  
Epoch 1792/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1793/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9187  
Epoch 1794/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1795/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b

inary\_accuracy: 0.9167  
Epoch 1796/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9173  
Epoch 1797/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9173  
Epoch 1798/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1799/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9167  
Epoch 1800/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1801/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1802/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9173  
Epoch 1803/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9173  
Epoch 1804/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1805/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1806/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1807/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9187  
Epoch 1808/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1809/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9167  
Epoch 1810/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1811/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9167  
Epoch 1812/2000  
1500/1500 [=====] - 0s - loss: 0.0705 - b  
inary\_accuracy: 0.9160  
Epoch 1813/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1814/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b

inary\_accuracy: 0.9167  
Epoch 1815/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1816/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9173  
Epoch 1817/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9160  
Epoch 1818/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9167  
Epoch 1819/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1820/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1821/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9167  
Epoch 1822/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9167  
Epoch 1823/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1824/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9167  
Epoch 1825/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1826/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1827/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9160  
Epoch 1828/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1829/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9180  
Epoch 1830/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9167  
Epoch 1831/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9153  
Epoch 1832/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9180  
Epoch 1833/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b

inary\_accuracy: 0.9180  
Epoch 1834/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9180  
Epoch 1835/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9187  
Epoch 1836/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9167  
Epoch 1837/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9160  
Epoch 1838/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1839/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9167  
Epoch 1840/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9187  
Epoch 1841/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1842/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9167  
Epoch 1843/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1844/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9167  
Epoch 1845/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9180  
Epoch 1846/2000  
1500/1500 [=====] - 0s - loss: 0.0704 - b  
inary\_accuracy: 0.9167  
Epoch 1847/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1848/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9173  
Epoch 1849/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9173  
Epoch 1850/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9173  
Epoch 1851/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9180  
Epoch 1852/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b

inary\_accuracy: 0.9173  
Epoch 1853/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9180  
Epoch 1854/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9153  
Epoch 1855/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1856/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9160  
Epoch 1857/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1858/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1859/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9180  
Epoch 1860/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1861/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1862/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9167  
Epoch 1863/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1864/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9180  
Epoch 1865/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1866/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9173  
Epoch 1867/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9180  
Epoch 1868/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9180  
Epoch 1869/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9173  
Epoch 1870/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9160  
Epoch 1871/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b

inary\_accuracy: 0.9173  
Epoch 1872/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1873/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9180  
Epoch 1874/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1875/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9180  
Epoch 1876/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9153  
Epoch 1877/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1878/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9167  
Epoch 1879/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9173  
Epoch 1880/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9180  
Epoch 1881/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1882/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9167  
Epoch 1883/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9180  
Epoch 1884/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1885/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9173  
Epoch 1886/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9167  
Epoch 1887/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9180  
Epoch 1888/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1889/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1890/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b

inary\_accuracy: 0.9160  
Epoch 1891/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9173  
Epoch 1892/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1893/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9173  
Epoch 1894/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1895/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1896/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9173  
Epoch 1897/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9180  
Epoch 1898/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1899/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9160  
Epoch 1900/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9173  
Epoch 1901/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9167  
Epoch 1902/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9173  
Epoch 1903/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1904/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9180  
Epoch 1905/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9187  
Epoch 1906/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9153  
Epoch 1907/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9173  
Epoch 1908/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9140  
Epoch 1909/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b



inary\_accuracy: 0.9160  
Epoch 1910/2000  
1500/1500 [=====] - 0s - loss: 0.0703 - b  
inary\_accuracy: 0.9173  
Epoch 1911/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1912/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1913/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1914/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9173  
Epoch 1915/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9180  
Epoch 1916/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9160  
Epoch 1917/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9180  
Epoch 1918/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9160  
Epoch 1919/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9187  
Epoch 1920/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9167  
Epoch 1921/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9173  
Epoch 1922/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9160  
Epoch 1923/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9173  
Epoch 1924/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1925/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9187  
Epoch 1926/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9173  
Epoch 1927/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9173  
Epoch 1928/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b

inary\_accuracy: 0.9160  
Epoch 1929/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9173  
Epoch 1930/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9167  
Epoch 1931/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9173  
Epoch 1932/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9167  
Epoch 1933/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9173  
Epoch 1934/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9160  
Epoch 1935/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9153  
Epoch 1936/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9160  
Epoch 1937/2000  
1500/1500 [=====] - 0s - loss: 0.0702 - b  
inary\_accuracy: 0.9153  
Epoch 1938/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9160  
Epoch 1939/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9173  
Epoch 1940/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9180  
Epoch 1941/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9147  
Epoch 1942/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9167  
Epoch 1943/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9160  
Epoch 1944/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9160  
Epoch 1945/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9153  
Epoch 1946/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9160  
Epoch 1947/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b

inary\_accuracy: 0.9167  
Epoch 1948/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9153  
Epoch 1949/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9173  
Epoch 1950/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9167  
Epoch 1951/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9160  
Epoch 1952/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9180  
Epoch 1953/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9153  
Epoch 1954/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9147  
Epoch 1955/2000  
1500/1500 [=====] - 0s - loss: 0.0699 - b  
inary\_accuracy: 0.9173  
Epoch 1956/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9153  
Epoch 1957/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9173  
Epoch 1958/2000  
1500/1500 [=====] - 0s - loss: 0.0699 - b  
inary\_accuracy: 0.9160  
Epoch 1959/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9160  
Epoch 1960/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9167  
Epoch 1961/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9153  
Epoch 1962/2000  
1500/1500 [=====] - 0s - loss: 0.0699 - b  
inary\_accuracy: 0.9173  
Epoch 1963/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9173  
Epoch 1964/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9153  
Epoch 1965/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9160  
Epoch 1966/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b

inary\_accuracy: 0.9167  
Epoch 1967/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9167  
Epoch 1968/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9160  
Epoch 1969/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9167  
Epoch 1970/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9160  
Epoch 1971/2000  
1500/1500 [=====] - 0s - loss: 0.0699 - b  
inary\_accuracy: 0.9167  
Epoch 1972/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9160  
Epoch 1973/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9160  
Epoch 1974/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9147  
Epoch 1975/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9167  
Epoch 1976/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9173  
Epoch 1977/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9160  
Epoch 1978/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9153  
Epoch 1979/2000  
1500/1500 [=====] - 0s - loss: 0.0701 - b  
inary\_accuracy: 0.9173  
Epoch 1980/2000  
1500/1500 [=====] - 0s - loss: 0.0699 - b  
inary\_accuracy: 0.9147  
Epoch 1981/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9160  
Epoch 1982/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9153  
Epoch 1983/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9167  
Epoch 1984/2000  
1500/1500 [=====] - 0s - loss: 0.0698 - b  
inary\_accuracy: 0.9153  
Epoch 1985/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b

inary\_accuracy: 0.9147  
Epoch 1986/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9153  
Epoch 1987/2000  
1500/1500 [=====] - 0s - loss: 0.0699 - b  
inary\_accuracy: 0.9147  
Epoch 1988/2000  
1500/1500 [=====] - 0s - loss: 0.0699 - b  
inary\_accuracy: 0.9160  
Epoch 1989/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9160  
Epoch 1990/2000  
1500/1500 [=====] - 0s - loss: 0.0698 - b  
inary\_accuracy: 0.9153  
Epoch 1991/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9167  
Epoch 1992/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9153  
Epoch 1993/2000  
1500/1500 [=====] - 0s - loss: 0.0699 - b  
inary\_accuracy: 0.9147  
Epoch 1994/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9160  
Epoch 1995/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9160  
Epoch 1996/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9153  
Epoch 1997/2000  
1500/1500 [=====] - 0s - loss: 0.0699 - b  
inary\_accuracy: 0.9160  
Epoch 1998/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9147  
Epoch 1999/2000  
1500/1500 [=====] - 0s - loss: 0.0700 - b  
inary\_accuracy: 0.9153  
Epoch 2000/2000  
1500/1500 [=====] - 0s - loss: 0.0699 - b  
inary\_accuracy: 0.9173

In [178]:

```
print("\n ##### Tempo de Treinamento da Rede Feed-Forward #####\n")
print ("\n\t ----- Computation time = " + str(t2 - t1) + "s -----")
print("\n #####\n")
```

```
##### Tempo de Treinamento da Rede Feed-Forward #####
```

```
----- Computation time = 249.7193069999994s -----
```

```
#####
##
```

In [179]:

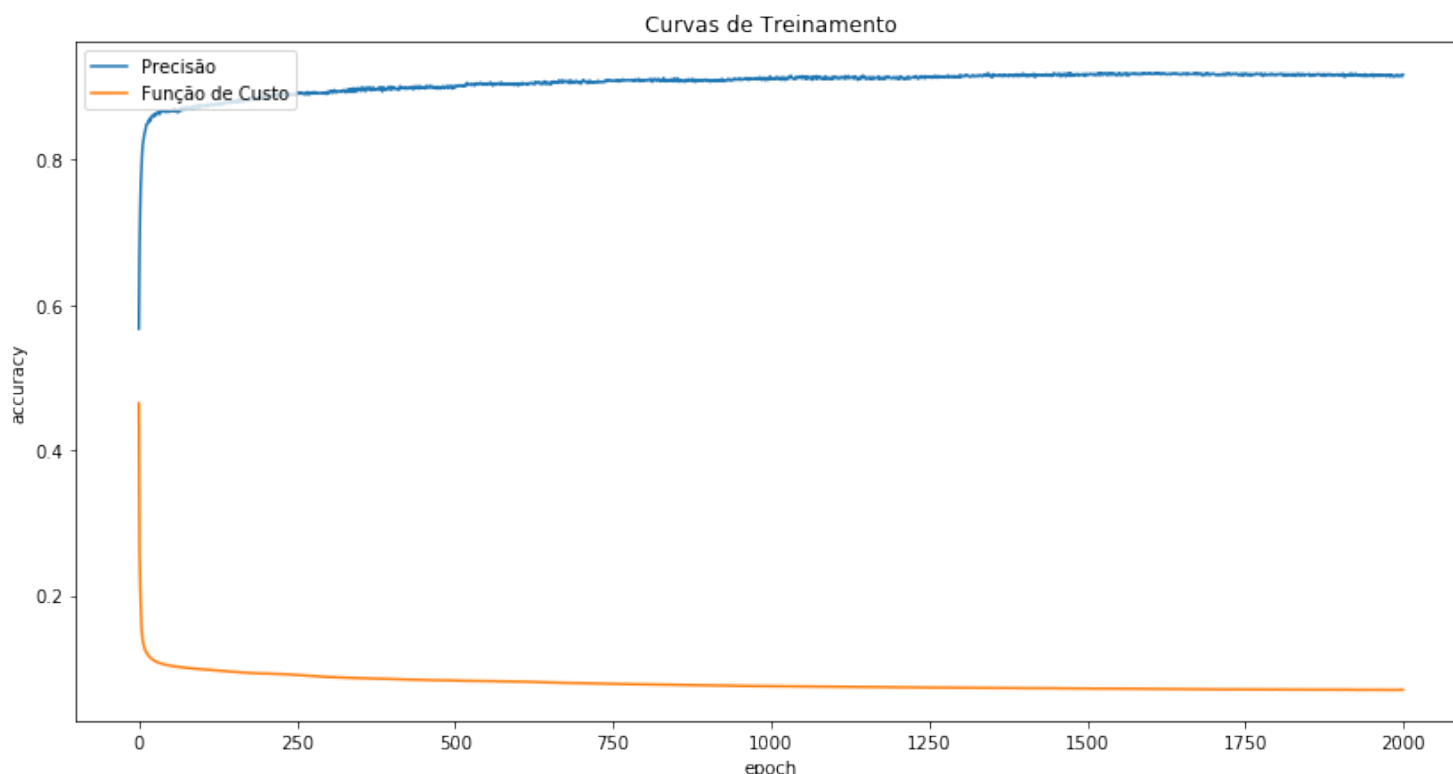
```
# Obtendo as métricas para exibir o Gráfico
metrics = history.history
metrics.keys()
```

Out[179]:

```
dict_keys(['loss', 'binary_accuracy'])
```

In [180]:

```
plt.figure(figsize=(14,7))
plt.plot(metrics['binary_accuracy'])
plt.plot(metrics['loss'])
plt.title('Curvas de Treinamento')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.legend(['Precisão', 'Função de Custo'], loc='upper left')
plt.show();
```



## Modelo de Classificação *TESTE*

In [181]:

```
dataTest = pd.read_csv("am-T3-dados/credtest.txt", sep='\t', header=None)
dataTest.head()
```

Out[181]:

|   | 0 | 1 | 2    | 3 | 4   | 5  | 6   | 7 | 8  | 9  | 10  | 11 |
|---|---|---|------|---|-----|----|-----|---|----|----|-----|----|
| 0 | 0 | 2 | 500  | 1 | 618 | 10 | 85  | 0 | 36 | 6  | 0   | 0  |
| 1 | 1 | 0 | 813  | 0 | 552 | 4  | 119 | 0 | 43 | 48 | 119 | 1  |
| 2 | 3 | 0 | 350  | 0 | 488 | 12 | 66  | 0 | 43 | 0  | 0   | 1  |
| 3 | 1 | 0 | 1530 | 0 | 381 | 1  | 398 | 0 | 28 | 48 | 0   | 1  |
| 4 | 0 | 0 | 688  | 1 | 396 | 10 | 60  | 0 | 49 | 72 | 0   | 1  |

### Criando as matrizes $P$ e $T$

In [182]:

```
P = dataTest.iloc[:, :11].as_matrix()
Test = dataTest.iloc[:, 11:].as_matrix()

P.shape , Test.shape
```

Out[182]:

```
((577, 11), (577, 1))
```

In [183]:

```
PTest = normalizaFeatures(P)
PTest
```

Out[183]:

```
array([[ -0.77125493,   3.69396032,  -0.49166148, ...,  -0.38533555,
        -0.46487844,  -0.29246359],
       [  0.63701752,  -0.21689308,  -0.13429618, ...,   0.13449421,
         0.37416707,   1.01944778],
       [  3.4535624 ,  -0.21689308,  -0.66292281, ...,   0.13449421,
       -0.58474208,  -0.29246359],
       ...,
       [ -0.77125493,   5.64938702,   0.30755803, ...,  -0.16255137,
        -0.46487844,  -0.29246359],
       [  0.63701752,  -0.21689308,  -0.37748727, ...,  -0.60811973,
        -0.46487844,  -0.29246359],
       [ -0.77125493,  -0.21689308,  -0.14913883, ...,  -0.90516531,
        -0.46487844,  -0.29246359]])
```

## Avaliação de Predição

In [184]:

```
PTest.shape , Test.shape
```

Out[184]:

```
((577, 11), (577, 1))
```

In [185]:

```
PredicTest = model.predict(PTest).round()  
print('Acurácia: ', accuracy_score(Test, PredicTest))
```

```
Acurácia:  0.882149046794
```

## Matriz de Confusão

In [186]:

```
PredicTest.shape
```

Out[186]:

```
(577, 1)
```

In [196]:

```
# Obtendo a Matriz Confusão  
matrizConfusao = confusion_matrix(Test, PredicTest)  
np.set_printoptions(precision=2)  
matrizConfusao, Test.shape , PredicTest.shape  
  
matrizConfusao.shape
```

Out[196]:

```
(3, 3)
```

In [197]:

```
# Plot non-normalized confusion matrix  
plt.figure(figsize=(14,7))  
plot_confusion_matrix(matrizConfusao, classes=['Honrado', 'Caloteiro'])  
  
# Plot normalized confusion matrix  
plt.figure(figsize=(14,7))  
plot_confusion_matrix(matrizConfusao, classes=['Honrado', 'Caloteiro'], normal  
ize=True)  
plt.show()
```



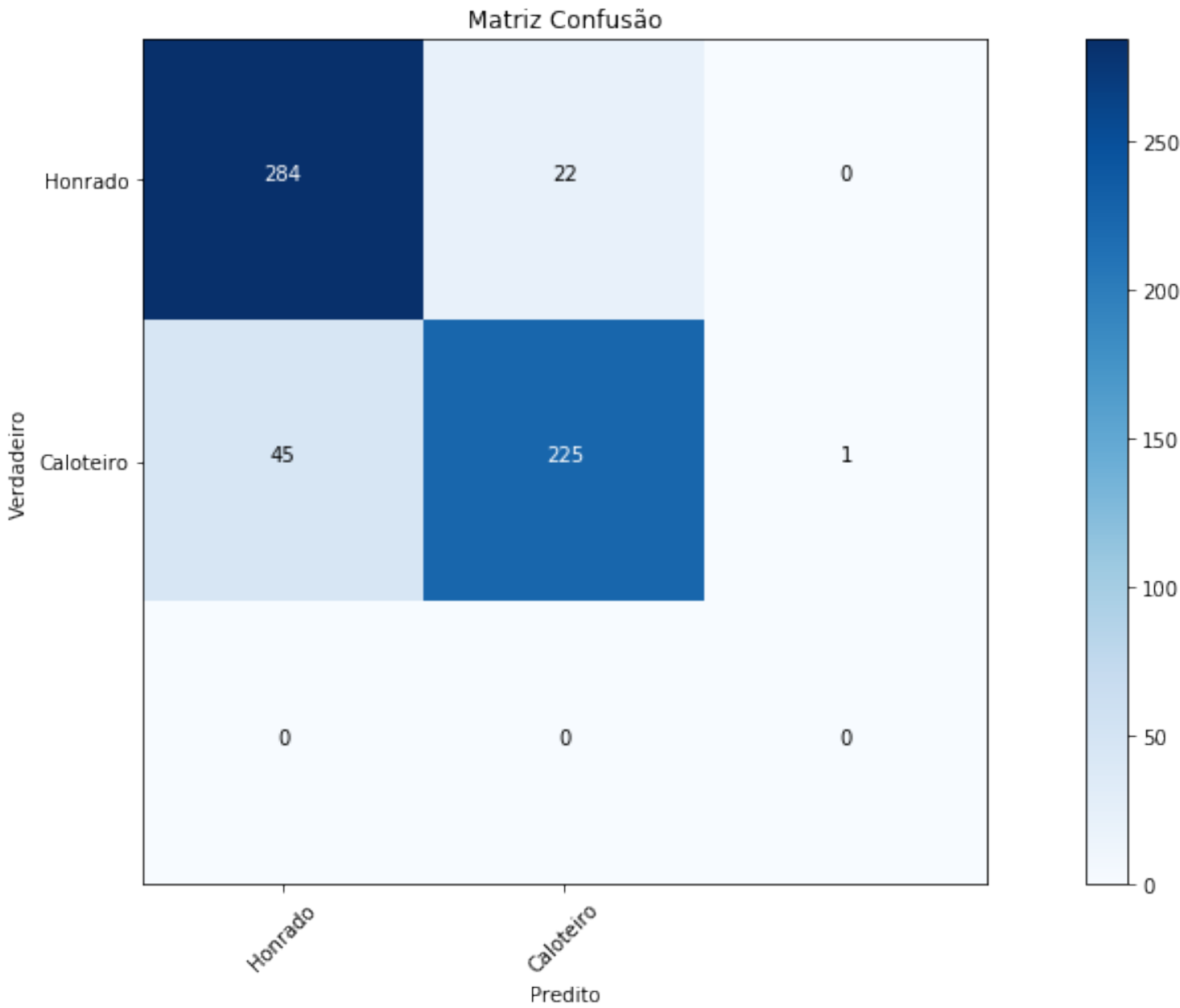
Matriz Confusão

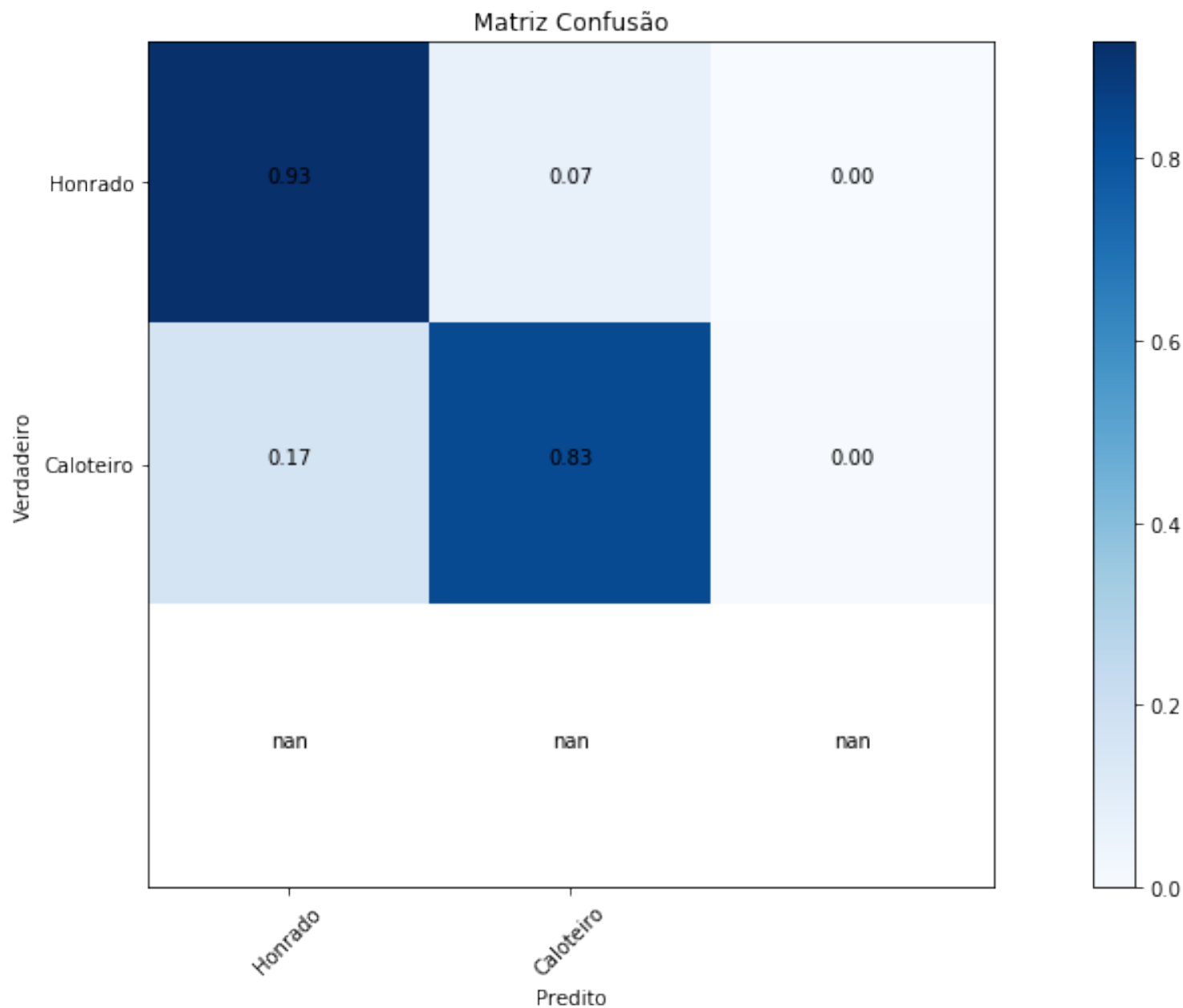
```
[[284  22   0]
 [ 45 225   1]
 [  0   0   0]]
```

Matriz Confusão Normalizada

```
[[ 0.93  0.07  0.  ]
 [ 0.17  0.83  0.  ]
 [ nan   nan   nan]]
```

/anaconda/lib/python3.6/site-packages/ipykernel\_launcher.py:14: RuntimeWarning: invalid value encountered in true\_divide





# Redes Convolucionais

Nesta parte, você irá treinar modelos de redes neurais artificiais para classificar imagens. Em particular, dada uma imagem, seus modelos deverão indicar se a imagem contém um gato ou não. São fornecidos os conjuntos de imagens para treinamento e para teste (arquivos **train\_catvnoncat.h5** e **test\_catvnoncat.h5**). É também fornecido o código para a leitura dos arquivos correspondentes (veja listagem a seguir; veja também a seção de créditos no fim deste documento).

In [198]:

```
import numpy as np
import h5py
```

In [199]:

```
def load_dataset():
    train_dataset = h5py.File('am-T3-dados/train_catvnoncat.h5', "r")
    train_set_x_orig = np.array(train_dataset["train_set_x"][:])
    train_set_y_orig = np.array(train_dataset["train_set_y"][:])

    test_dataset = h5py.File('am-T3-dados/test_catvnoncat.h5', "r")
    test_set_x_orig = np.array(test_dataset["test_set_x"][:])
    test_set_y_orig = np.array(test_dataset["test_set_y"][:])

    classes = np.array(test_dataset["list_classes"][:])
    train_set_y_orig = train_set_y_orig.reshape((1, train_set_y_orig.shape[0]))
    test_set_y_orig = test_set_y_orig.reshape((1, test_set_y_orig.shape[0]))

    return train_set_x_orig, train_set_y_orig, test_set_x_orig, test_set_y_orig, classes
```

Após ler os conjuntos de dados, você deve treinar dois modelos utilizando o **Keras**, conforme descrito a seguir:

- Uma rede completamente conectada de uma **única camada oculta** e com uma **camada de saída de duas unidades** com softmax.
- Uma rede convolucional.

Em ambos os casos acima, você deverá selecionar os hiperparâmetros e arquitetura de rede. Procure se basear nos exemplos de código e nas arquiteturas de rede apresentadas em aula. Em seu relatório, apresente os detalhes acerca da definição de cada uma dessas redes, assim como o desempenho encontrado em cada um dos casos.

In [200]:

```
treino_X, treino_Y, teste_X, teste_Y, classes = load_dataset()
```

In [201]:

```
treino_X.shape, treino_Y.shape, teste_X.shape, teste_Y.shape, classes.shape
```

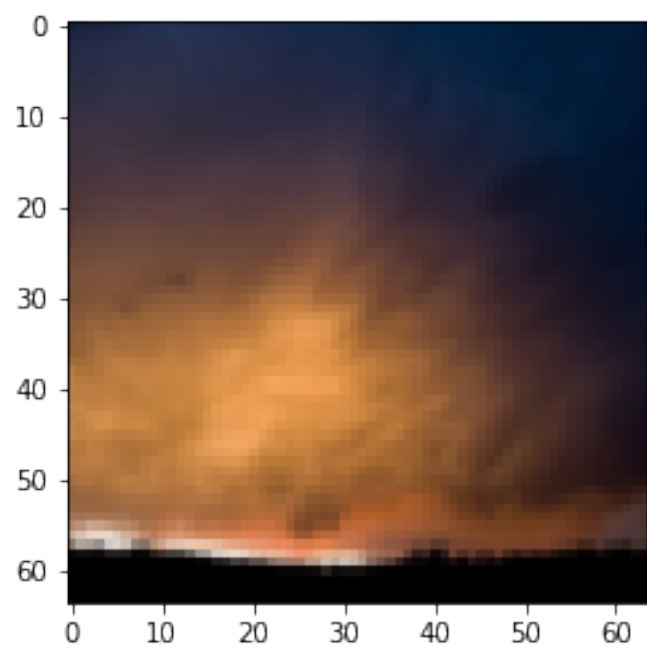
Out[201]:

```
((209, 64, 64, 3), (1, 209), (50, 64, 64, 3), (1, 50), (2,))
```

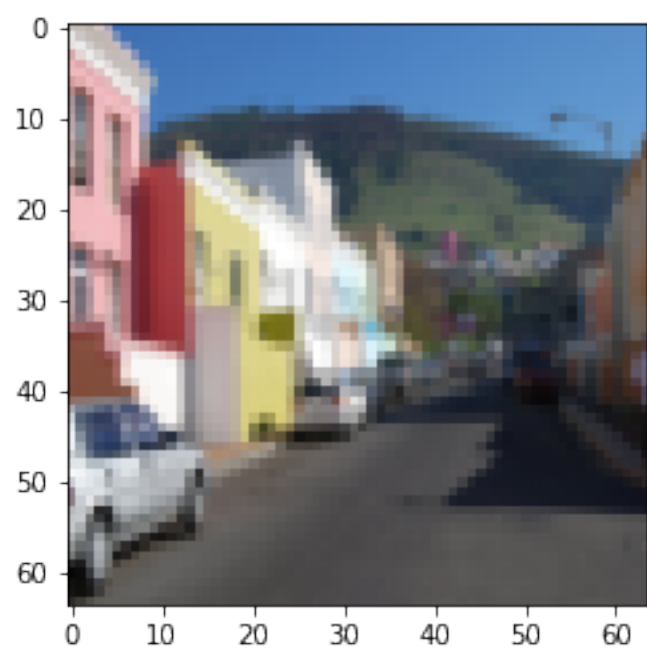
In [210]:

```
# Identificando as imagens do Dataset
for idx in range(5):
    imagem = treino_X[idx]
    plt.imshow(imagem)
    print ("Amostra["+str(idx)+"]": "+classes[np.squeeze(treino_Y[:, idx])].decode("utf-8"))
    plt.show()
```

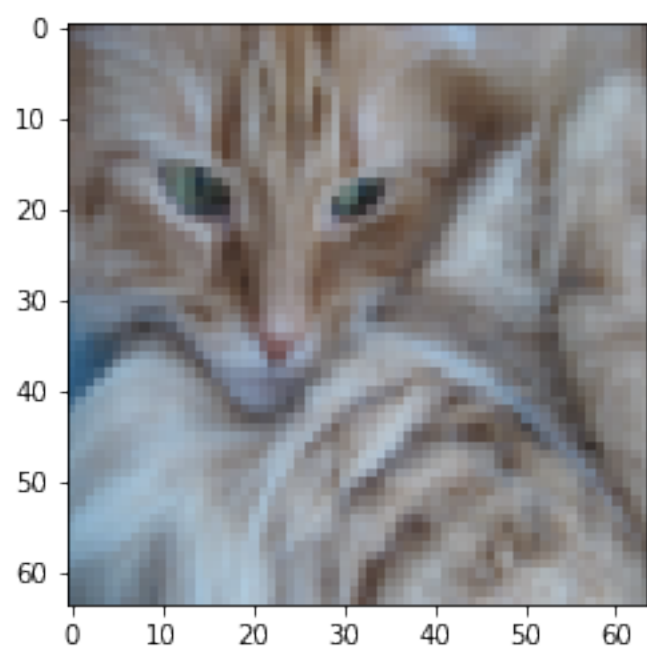
Amostra[0]: non-cat



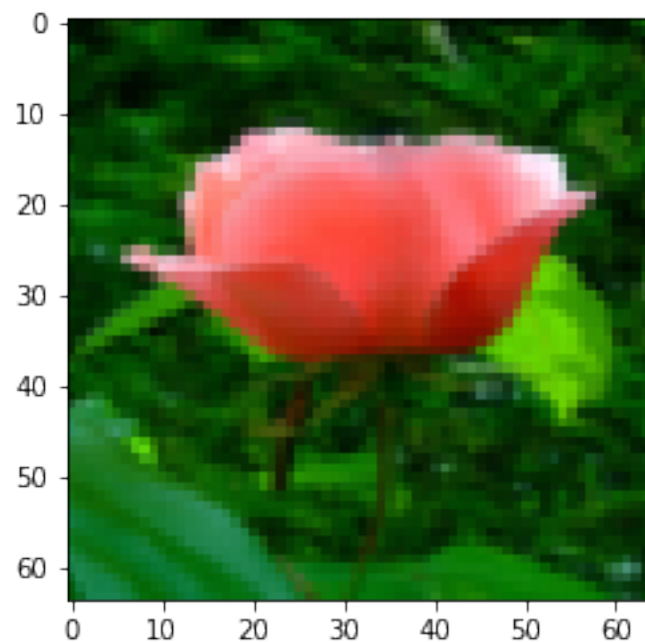
Amostra[1]: non-cat



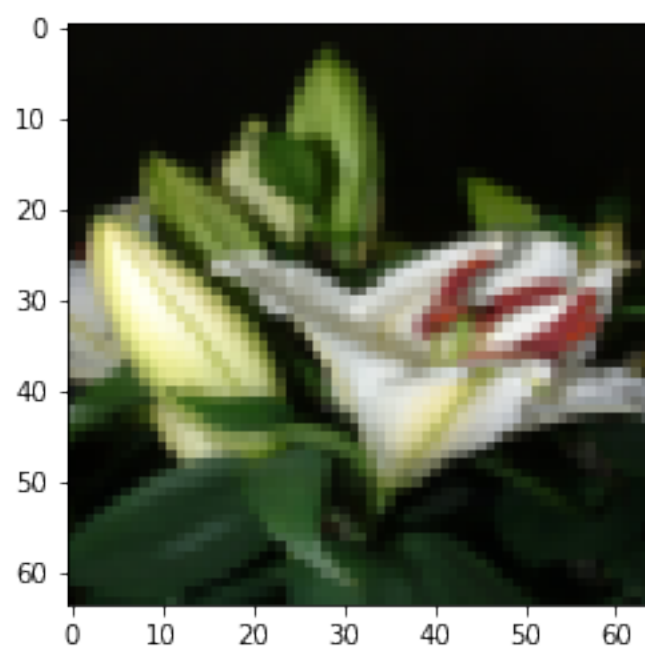
Amostra[2]: cat



Amostra[3]: non-cat



Amostra[4]: non-cat



## Caso 1: Rede Completamente Conectada: única camada oculta e saída com softmax

In [211]:

```
flatten_x_train = treino_X.reshape((treino_X.shape[0], -1))
flatten_x_test = teste_X.reshape((teste_X.shape[0], -1))

# Convertendo os alvos em matriz com dimensão de número de classes
train_set_y = keras.utils.to_categorical(treino_Y, classes.size)
test_set_y = keras.utils.to_categorical(teste_Y, classes.size)

flatten_x_train.shape , flatten_x_test.shape , train_set_y.shape , test_set_y.
shape
```

Out[211]:

```
((209, 12288), (50, 12288), (209, 2), (50, 2))
```

In [212]:

```
RANDOM = keras.initializers.RandomNormal(seed = 656)
ADADELTA = keras.optimizers.Adadelta()
ERRO = keras.losses.categorical_crossentropy

model = Sequential()
model.add(Dense(3, input_shape=flatten_x_train.shape[1:], kernel_initializer=RANDOM, activation='relu'))
model.add(Dense(5, activation='sigmoid'))
model.add(Dense(2, activation='softmax'))

t1 = time.process_time()
model.compile(loss=ERRO, optimizer=ADADELTA, metrics=['binary_accuracy'])
history = model.fit(flatten_x_train, train_set_y, epochs=200, verbose=0)
t2 = time.process_time()

score = model.evaluate(flatten_x_test, test_set_y, verbose=0)
print('Custo do Teste:', score[0])
print('Precisão do Teste:', score[1])
```

Custo do Teste: 0.846456818581  
Precisão do Teste: 0.34

In [213]:

```
print("\n ##### Tempo de Treinamento da Rede Completamente Conectada (Cat  
vsNocat) #####\n")
print ("\n\t ----- Computation time = " + str(t2 - t1) + "s -----")
print("\n  
#####  
#####\n")
```

##### Tempo de Treinamento da Rede Completamente Conectada (  
CatvsNocat) #####

----- Computation time = 10.947392999998556s -----

#####  
#####

In [214]:

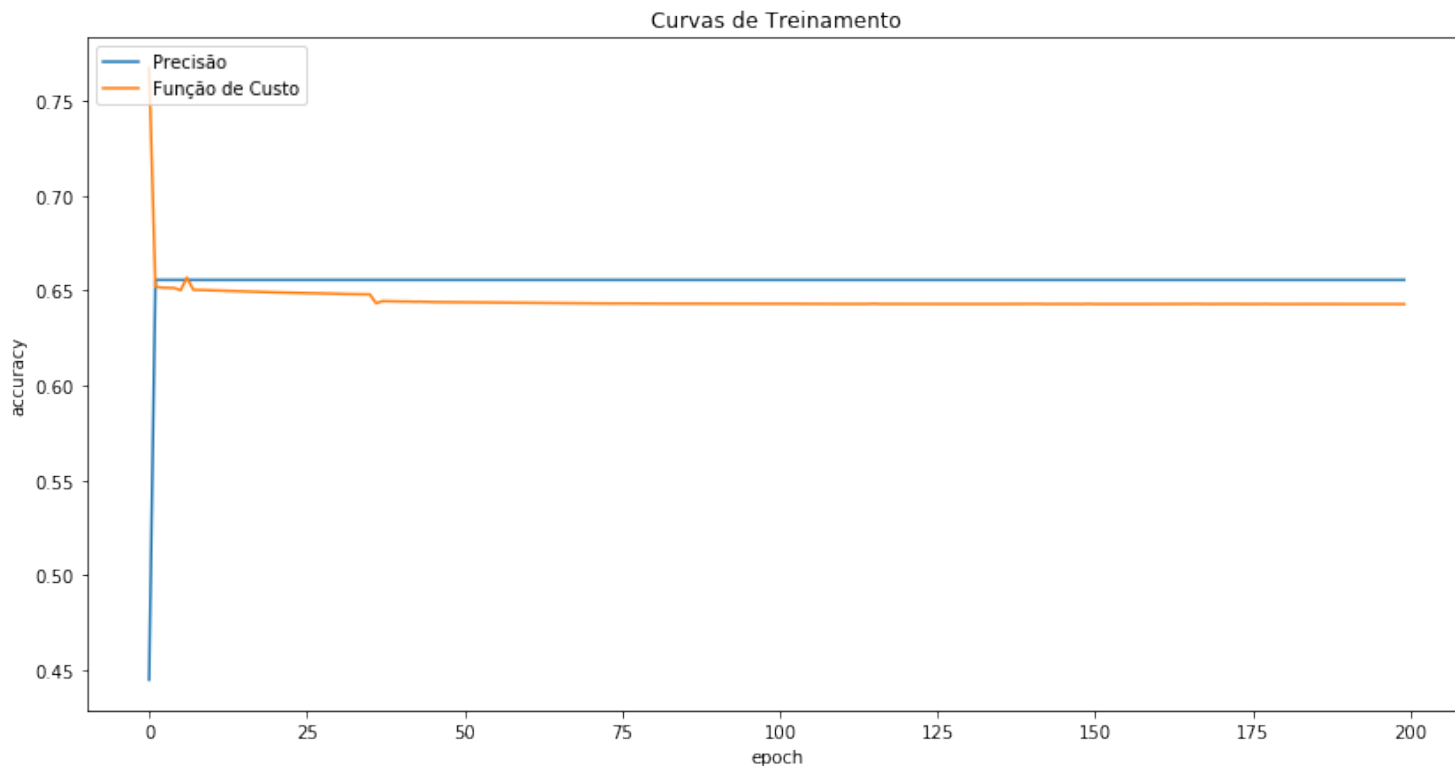
```
# Obtendo as métricas para exibir o Gráfico
metrics = history.history
metrics.keys()
```

Out[214]:

```
dict_keys(['loss', 'binary_accuracy'])
```

In [215]:

```
plt.figure(figsize=(14,7))
plt.plot(metrics['binary_accuracy'])
plt.plot(metrics['loss'])
plt.title('Curvas de Treinamento')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.legend(['Precisão', 'Função de Custo'], loc='upper left')
plt.show();
```



In [216]:

```
PredicTest = model.predict(flatten_x_test).round()
print('Acurácia: ', accuracy_score(test_set_y, PredicTest))
```

Acurácia: 0.34

## Caso 2: Rede Convolutacional

**Reutilização da Metodologia utilizada no MNIST**  
**([https://github.com/fchollet/keras/blob/master/examples/mnist\\_cnn.py](https://github.com/fchollet/keras/blob/master/examples/mnist_cnn.py))**  
**para o dataset CATVSNON-CAT**

In [141]:

```
# Carregando o dataset
x_train , y_train , x_test , y_test, classes = load_dataset()

x_train.shape , y_train.shape , x_test.shape , y_test.shape , classes
```

Out[141]:

```
((209, 64, 64, 3),
 (1, 209),
 (50, 64, 64, 3),
 (1, 50),
 array([b'non-cat', b'cat'],
      dtype='<S7'))
```

In [142]:

```
#
NCLASS = classes.size    # Quantidade de Classes
DIMY = x_train.shape[1]  # Dimensão X da Imagem
DIMX = x_train.shape[2]  # Dimensão Y da Imagem

if K.image_data_format() == 'channels_first':
    x_train = x_train.reshape(x_train.shape[0], 3, DIMX, DIMY)
    x_test = x_test.reshape(x_test.shape[0], 3, DIMX, DIMY)
    input_shape = (3, DIMX, DIMY)
else:
    x_train = x_train.reshape(x_train.shape[0], DIMX, DIMY, 3)
    x_test = x_test.reshape(x_test.shape[0], DIMX, DIMY, 3)
    input_shape = (DIMX, DIMY, 3)

x_train = x_train.astype('float32')
x_test = x_test.astype('float32')
x_train /= 255
x_test /= 255
print('x_train shape:', x_train.shape)
print(x_train.shape[0], 'train samples')
print(x_test.shape[0], 'test samples')

# Converte os vetores alvo em matrizes de dimensão equivalente ao número de classes
y_train = keras.utils.to_categorical(y_train, NCLASS)
y_test = keras.utils.to_categorical(y_test, NCLASS)

x_train.shape , y_train.shape , x_test.shape , y_test.shape
```

```
x_train shape: (209, 64, 64, 3)
209 train samples
50 test samples
```

Out[142]:

```
((209, 64, 64, 3), (209, 2), (50, 64, 64, 3), (50, 2))
```



# Iniciando Treinamento

In [146]:

```
BTHSIZE = 64                                     # Definindo um valor de batch_size
CROSSENTROPY = keras.losses.categorical_crossentropy # Função de custo
ADADELTA = keras.optimizers.Adadelta()           # Função de minimização

model = Sequential()
model.add(Conv2D(32, kernel_size=(4, 4), activation='relu', input_shape=input_shape))
model.add(Conv2D(64, (4, 4), activation='relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))
model.add(Flatten())
model.add(Dense(128, activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(2, activation='softmax'))

t1 = time.process_time()
model.compile(loss=CROSSENTROPY, optimizer=ADADELTA, metrics=['accuracy'])
history = model.fit(x_train, y_train, batch_size=BTHSIZE, epochs=80, verbose=1,
                    validation_data=(x_test, y_test))
t2 = time.process_time()

score = model.evaluate(x_test, y_test, verbose=0)
print('Custo do Teste:', score[0])
print('Precisão do Teste:', score[1])

print("\n ##### Tempo de Treinamento da Rede Convolucional (CatvsNocat) #
#####\n")
print ("\n\t ----- Computation time = " + str(t2 - t1) + "s -----")
print("\n
#####\n")
```

Train on 209 samples, validate on 50 samples

Epoch 1/80

209/209 [=====] - 4s - loss: 0.7577 - acc  
: 0.5789 - val\_loss: 0.7462 - val\_acc: 0.3400

Epoch 2/80

209/209 [=====] - 3s - loss: 0.6185 - acc  
: 0.6507 - val\_loss: 0.7748 - val\_acc: 0.3400

Epoch 3/80

209/209 [=====] - 3s - loss: 0.5790 - acc  
: 0.6651 - val\_loss: 0.6604 - val\_acc: 0.4200

Epoch 4/80

209/209 [=====] - 3s - loss: 0.5400 - acc  
: 0.7321 - val\_loss: 0.6198 - val\_acc: 0.6000

Epoch 5/80

209/209 [=====] - 3s - loss: 0.5816 - acc  
: 0.6890 - val\_loss: 0.6468 - val\_acc: 0.5000

Epoch 6/80

209/209 [=====] - 3s - loss: 0.4950 - acc

```
: 0.7512 - val_loss: 0.9131 - val_acc: 0.3400
Epoch 7/80
209/209 [=====] - 3s - loss: 0.5661 - acc
: 0.6268 - val_loss: 0.6473 - val_acc: 0.4800
Epoch 8/80
209/209 [=====] - 3s - loss: 0.4549 - acc
: 0.7560 - val_loss: 0.6620 - val_acc: 0.5400
Epoch 9/80
209/209 [=====] - 3s - loss: 0.4091 - acc
: 0.7847 - val_loss: 1.2469 - val_acc: 0.3400
Epoch 10/80
209/209 [=====] - 3s - loss: 0.4651 - acc
: 0.7560 - val_loss: 0.5158 - val_acc: 0.8200
Epoch 11/80
209/209 [=====] - 3s - loss: 0.5567 - acc
: 0.6746 - val_loss: 0.8342 - val_acc: 0.3400
Epoch 12/80
209/209 [=====] - 3s - loss: 0.3956 - acc
: 0.7895 - val_loss: 0.5115 - val_acc: 0.8800
Epoch 13/80
209/209 [=====] - 4s - loss: 0.3518 - acc
: 0.8660 - val_loss: 1.4162 - val_acc: 0.3400
Epoch 14/80
209/209 [=====] - 4s - loss: 0.4479 - acc
: 0.7416 - val_loss: 0.6025 - val_acc: 0.6800
Epoch 15/80
209/209 [=====] - 4s - loss: 0.3332 - acc
: 0.8660 - val_loss: 0.3814 - val_acc: 0.8600
Epoch 16/80
209/209 [=====] - 4s - loss: 0.3700 - acc
: 0.7990 - val_loss: 0.4205 - val_acc: 0.9400
Epoch 17/80
209/209 [=====] - 4s - loss: 0.2892 - acc
: 0.9282 - val_loss: 0.3799 - val_acc: 0.9400
Epoch 18/80
209/209 [=====] - 4s - loss: 0.2831 - acc
: 0.8900 - val_loss: 0.4214 - val_acc: 0.8200
Epoch 19/80
209/209 [=====] - 4s - loss: 0.6286 - acc
: 0.7703 - val_loss: 1.0829 - val_acc: 0.3400
Epoch 20/80
209/209 [=====] - 3s - loss: 0.3659 - acc
: 0.8421 - val_loss: 0.6733 - val_acc: 0.6000
Epoch 21/80
209/209 [=====] - 3s - loss: 0.2865 - acc
: 0.8852 - val_loss: 0.3429 - val_acc: 0.9400
Epoch 22/80
209/209 [=====] - 3s - loss: 0.2542 - acc
: 0.9091 - val_loss: 0.6406 - val_acc: 0.7000
Epoch 23/80
209/209 [=====] - 3s - loss: 0.2237 - acc
: 0.9139 - val_loss: 0.3822 - val_acc: 0.8200
Epoch 24/80
209/209 [=====] - 3s - loss: 0.4290 - acc
: 0.7943 - val_loss: 0.6677 - val_acc: 0.6200
Epoch 25/80
209/209 [=====] - 3s - loss: 0.2198 - acc
```

: 0.9522 - val\_loss: 0.3825 - val\_acc: 0.8800  
Epoch 26/80  
209/209 [=====] - 3s - loss: 0.1711 - acc  
: 0.9665 - val\_loss: 0.8144 - val\_acc: 0.5400  
Epoch 27/80  
209/209 [=====] - 3s - loss: 0.1963 - acc  
: 0.9330 - val\_loss: 0.4790 - val\_acc: 0.8000  
Epoch 28/80  
209/209 [=====] - 3s - loss: 0.1767 - acc  
: 0.9330 - val\_loss: 0.4509 - val\_acc: 0.7800  
Epoch 29/80  
209/209 [=====] - 3s - loss: 0.2187 - acc  
: 0.9043 - val\_loss: 0.8545 - val\_acc: 0.5800  
Epoch 30/80  
209/209 [=====] - 3s - loss: 0.2280 - acc  
: 0.8900 - val\_loss: 0.4324 - val\_acc: 0.8200  
Epoch 31/80  
209/209 [=====] - 3s - loss: 0.1138 - acc  
: 0.9856 - val\_loss: 0.4470 - val\_acc: 0.8400  
Epoch 32/80  
209/209 [=====] - 3s - loss: 0.0961 - acc  
: 0.9809 - val\_loss: 0.5286 - val\_acc: 0.8000  
Epoch 33/80  
209/209 [=====] - 3s - loss: 0.1266 - acc  
: 0.9665 - val\_loss: 0.4757 - val\_acc: 0.8800  
Epoch 34/80  
209/209 [=====] - 3s - loss: 0.1347 - acc  
: 0.9761 - val\_loss: 0.5845 - val\_acc: 0.7800  
Epoch 35/80  
209/209 [=====] - 3s - loss: 0.0815 - acc  
: 0.9904 - val\_loss: 0.4055 - val\_acc: 0.8800  
Epoch 36/80  
209/209 [=====] - 3s - loss: 0.0659 - acc  
: 0.9952 - val\_loss: 0.4330 - val\_acc: 0.8800  
Epoch 37/80  
209/209 [=====] - 3s - loss: 0.0532 - acc  
: 0.9952 - val\_loss: 0.7794 - val\_acc: 0.7400  
Epoch 38/80  
209/209 [=====] - 3s - loss: 0.1128 - acc  
: 0.9665 - val\_loss: 0.4017 - val\_acc: 0.9000  
Epoch 39/80  
209/209 [=====] - 3s - loss: 0.0455 - acc  
: 1.0000 - val\_loss: 0.7341 - val\_acc: 0.7800  
Epoch 40/80  
209/209 [=====] - 3s - loss: 0.0350 - acc  
: 1.0000 - val\_loss: 0.7489 - val\_acc: 0.7600  
Epoch 41/80  
209/209 [=====] - 3s - loss: 0.3799 - acc  
: 0.8373 - val\_loss: 0.5017 - val\_acc: 0.8200  
Epoch 42/80  
209/209 [=====] - 3s - loss: 0.0794 - acc  
: 1.0000 - val\_loss: 0.4584 - val\_acc: 0.8200  
Epoch 43/80  
209/209 [=====] - 3s - loss: 0.0566 - acc  
: 0.9904 - val\_loss: 0.4740 - val\_acc: 0.8200  
Epoch 44/80  
209/209 [=====] - 3s - loss: 0.0412 - acc

```
: 1.0000 - val_loss: 0.4378 - val_acc: 0.8600
Epoch 45/80
209/209 [=====] - 3s - loss: 0.0361 - acc
: 0.9952 - val_loss: 0.5970 - val_acc: 0.7800
Epoch 46/80
209/209 [=====] - 3s - loss: 0.0301 - acc
: 1.0000 - val_loss: 0.6201 - val_acc: 0.7800
Epoch 47/80
209/209 [=====] - 3s - loss: 0.0347 - acc
: 0.9952 - val_loss: 0.6131 - val_acc: 0.8000
Epoch 48/80
209/209 [=====] - 3s - loss: 0.0367 - acc
: 0.9952 - val_loss: 0.4509 - val_acc: 0.8600
Epoch 49/80
209/209 [=====] - 3s - loss: 0.0256 - acc
: 1.0000 - val_loss: 0.5600 - val_acc: 0.8200
Epoch 50/80
209/209 [=====] - 3s - loss: 0.0236 - acc
: 1.0000 - val_loss: 0.5676 - val_acc: 0.8400
Epoch 51/80
209/209 [=====] - 3s - loss: 0.0176 - acc
: 1.0000 - val_loss: 0.4613 - val_acc: 0.8600
Epoch 52/80
209/209 [=====] - 3s - loss: 0.0237 - acc
: 1.0000 - val_loss: 0.5891 - val_acc: 0.8200
Epoch 53/80
209/209 [=====] - 3s - loss: 0.0140 - acc
: 1.0000 - val_loss: 0.5225 - val_acc: 0.8600
Epoch 54/80
209/209 [=====] - 3s - loss: 0.0122 - acc
: 1.0000 - val_loss: 0.5587 - val_acc: 0.8800
Epoch 55/80
209/209 [=====] - 3s - loss: 0.0134 - acc
: 1.0000 - val_loss: 0.5213 - val_acc: 0.8200
Epoch 56/80
209/209 [=====] - 3s - loss: 0.0313 - acc
: 0.9952 - val_loss: 0.5680 - val_acc: 0.8800
Epoch 57/80
209/209 [=====] - 3s - loss: 0.0109 - acc
: 1.0000 - val_loss: 0.5698 - val_acc: 0.8800
Epoch 58/80
209/209 [=====] - 3s - loss: 0.0099 - acc
: 1.0000 - val_loss: 0.4884 - val_acc: 0.8800
Epoch 59/80
209/209 [=====] - 3s - loss: 0.0254 - acc
: 0.9952 - val_loss: 0.5625 - val_acc: 0.8400
Epoch 60/80
209/209 [=====] - 3s - loss: 0.0092 - acc
: 1.0000 - val_loss: 0.7118 - val_acc: 0.7800
Epoch 61/80
209/209 [=====] - 3s - loss: 0.0096 - acc
: 1.0000 - val_loss: 0.5022 - val_acc: 0.8600
Epoch 62/80
209/209 [=====] - 3s - loss: 0.0094 - acc
: 1.0000 - val_loss: 0.5719 - val_acc: 0.8600
Epoch 63/80
209/209 [=====] - 3s - loss: 0.0070 - acc
```

```
: 1.0000 - val_loss: 0.5503 - val_acc: 0.8800
Epoch 64/80
209/209 [=====] - 3s - loss: 0.0064 - acc
: 1.0000 - val_loss: 0.5227 - val_acc: 0.8600
Epoch 65/80
209/209 [=====] - 4s - loss: 0.0095 - acc
: 1.0000 - val_loss: 0.6060 - val_acc: 0.8600
Epoch 66/80
209/209 [=====] - 4s - loss: 0.0068 - acc
: 1.0000 - val_loss: 0.6708 - val_acc: 0.8400
Epoch 67/80
209/209 [=====] - 3s - loss: 0.0089 - acc
: 0.9952 - val_loss: 0.8469 - val_acc: 0.7800
Epoch 68/80
209/209 [=====] - 3s - loss: 0.0095 - acc
: 1.0000 - val_loss: 0.5504 - val_acc: 0.8600
Epoch 69/80
209/209 [=====] - 3s - loss: 0.0078 - acc
: 1.0000 - val_loss: 0.8137 - val_acc: 0.7800
Epoch 70/80
209/209 [=====] - 3s - loss: 0.0061 - acc
: 1.0000 - val_loss: 0.6778 - val_acc: 0.8600
Epoch 71/80
209/209 [=====] - 3s - loss: 0.0053 - acc
: 1.0000 - val_loss: 0.7447 - val_acc: 0.8000
Epoch 72/80
209/209 [=====] - 3s - loss: 0.0040 - acc
: 1.0000 - val_loss: 0.5760 - val_acc: 0.8600
Epoch 73/80
209/209 [=====] - 3s - loss: 0.0055 - acc
: 1.0000 - val_loss: 1.5056 - val_acc: 0.6600
Epoch 74/80
209/209 [=====] - 3s - loss: 0.1073 - acc
: 0.9426 - val_loss: 0.5223 - val_acc: 0.8600
Epoch 75/80
209/209 [=====] - 4s - loss: 0.0126 - acc
: 1.0000 - val_loss: 0.5692 - val_acc: 0.8400
Epoch 76/80
209/209 [=====] - 4s - loss: 0.0083 - acc
: 1.0000 - val_loss: 0.5514 - val_acc: 0.8400
Epoch 77/80
209/209 [=====] - 3s - loss: 0.0073 - acc
: 1.0000 - val_loss: 0.6046 - val_acc: 0.8400
Epoch 78/80
209/209 [=====] - 3s - loss: 0.0062 - acc
: 1.0000 - val_loss: 0.6417 - val_acc: 0.8600
Epoch 79/80
209/209 [=====] - 3s - loss: 0.0048 - acc
: 1.0000 - val_loss: 0.6284 - val_acc: 0.8600
Epoch 80/80
209/209 [=====] - 3s - loss: 0.0042 - acc
: 1.0000 - val_loss: 0.6469 - val_acc: 0.8600
Custo do Teste: 0.646850271225
Precisão do Teste: 0.860000002384
```

```
##### Tempo de Treinamento da Rede Convolucional (CatvsNocat) #####
```

----- Computation time = 1779.4386220000015s -----

```
#####  
#####
```

In [147]:

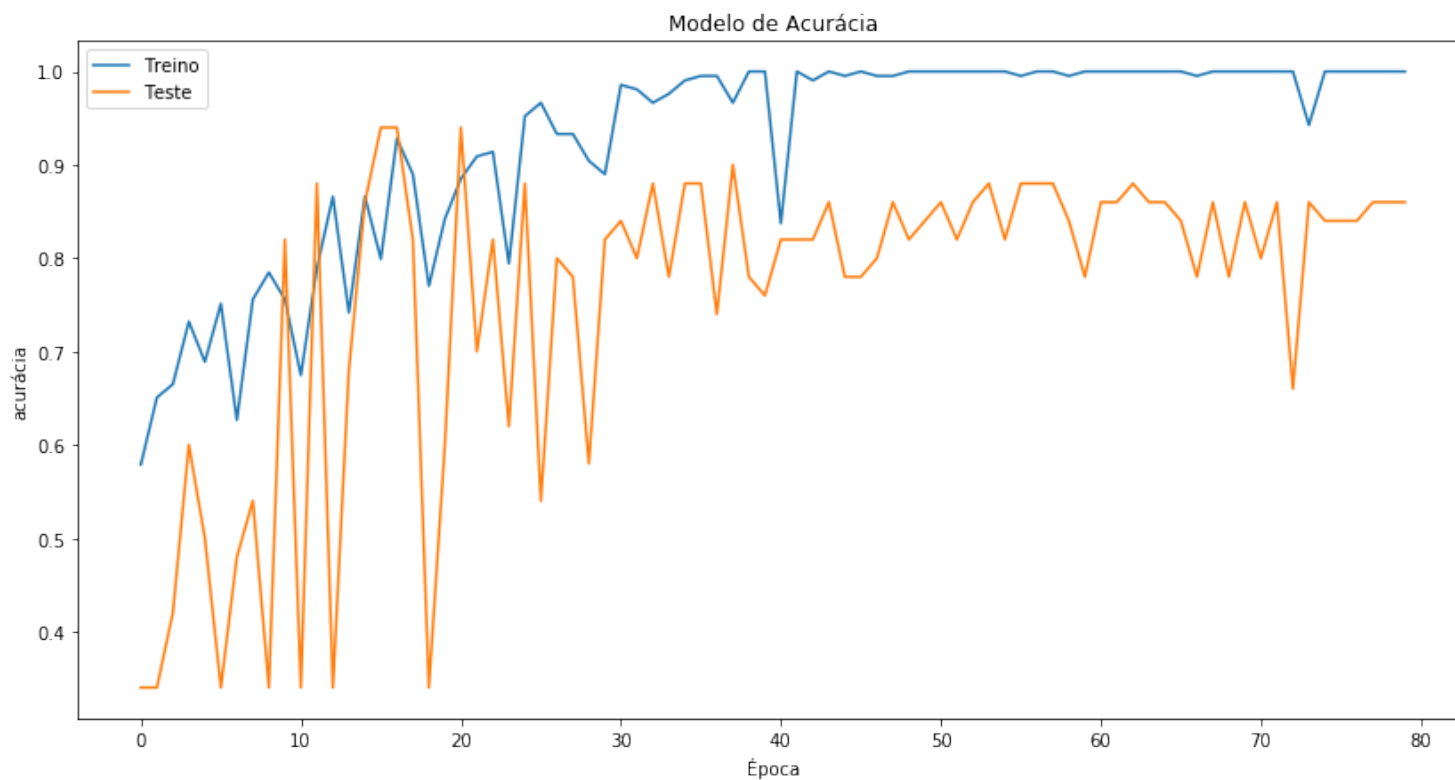
```
# Obtendo as métricas para exibir o Gráfico  
metrics = history.history  
metrics.keys()
```

Out[147]:

```
dict_keys(['val_loss', 'val_acc', 'loss', 'acc'])
```

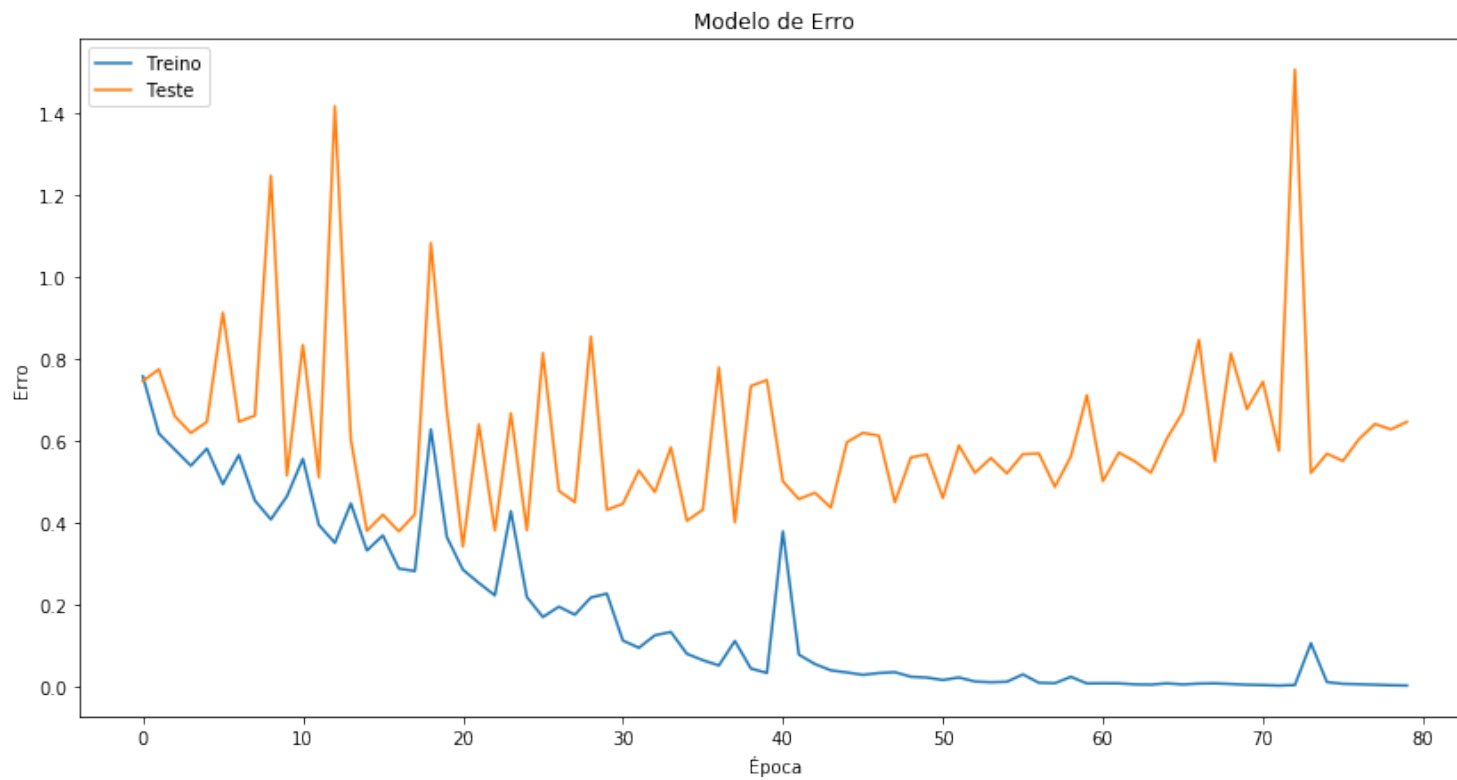
In [150]:

```
plt.figure(figsize=(14,7))  
plt.plot(metrics['acc'])  
plt.plot(metrics['val_acc'])  
plt.title('Modelo de Acurácia')  
plt.ylabel('acurácia')  
plt.xlabel('Época')  
plt.legend(['Treino', 'Teste'], loc='upper left')  
plt.show();
```



In [151]:

```
plt.figure(figsize=(14,7))
plt.plot(metrics['loss'])
plt.plot(metrics['val_loss'])
plt.title('Modelo de Erro')
plt.ylabel('Erro')
plt.xlabel('Época')
plt.legend(['Treino', 'Teste'], loc='upper left')
plt.show();
```



In [ ]: