atsiskaitymas

August 5, 2022

[1]:
```
import os
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
import seaborn as sns
from mpl_toolkits.mplot3d import axes3d
import imageio
import glob
import itertools
import tqdm
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
from sklearn import tree
import tensorflow as tf
```

[2]:
```
os.getcwd()
```

[2]:
```
'C:\\Users\\ariju\\Documents\\pamokos\\programavimas\\atsiskaitymas'
```

[3]:
```
os.listdir()
```

[3]:
```
['.ipynb_checkpoints',
 '2022-05-24 18_50_25-Greenshot.png',
 'accuracy_entropy.jpg',
 'accuracy_mean_s_e.jpg',
 'Arijus Skaisgirys',
 'atsiskaitymas.ipynb',
 'backup',
 'bandymas.xlsx',
 'CarBuyers.csv',
 'Car_sales.csv',
 'cheapest_cars.png',
 'check.csv',
 'chromium',
 'data',
 'expensive_cars.png',
 'gifas.gif',
```

```
 'kainu_pasiskirstymas.png',
 'loss_entropy.jpg',
 'loss_mean_s_e.jpg',
 'mfp',
 'mfp_naujas',
 'mobile_de',
 'most_popular_cars.png',
 'pasiskirstymasmfu.png',
 'patikrint.csv',
 'power_transmission.png',
 'price-predictor.dot',
 'price_power.png',
 'price_predicttion_tree_new.dot',
 'skelbimai',
 'usedCarsFinal.csv']
```

[4]:
```
data = pd.read_csv('CarBuyers.csv')
```

[5]:
```
data
```

[5]:

	Manufacturer	Model	Price	Transmission	Power	Engine CC	Fuel	Male	Female	Unknown	Total
0	Ford	Focus	30.619322	5.966102	94.033898	1497.169492	petrol	814172	422731	56,487	1293390
1	Ford	Fiesta	18.532143	5.714286	68.571429	1166.142857	petrol	554879	631666	54,057	1240602
2	Volkswagen	Golf	31.242154	6.164835	89.461538	1537.406593	petrol	483216	310604	47,563	841383
3	Renault	Clio	22.100000	5.615385	75.576923	1219.653846	petrol	241287	312556	28,004	581847
4	BMW	320i	47.848370	6.444444	126.111111	1995.777778	petrol	408016	115843	29,125	552984
…	…	…	…	…	…	…	…	…	…	…	…
6087	Land-Rover	Defender	108.747195	7.853659	207.609756	2304.975610	diesel	1,012	150	80	1,242
6088	Toyota	RAV4	43.548516	1.354839	137.774193	2261.193548	petrol	670	482	66	1,218
6089	Alfa-Romeo	Spider	55.200000	6.000000	163.500000	2696.500000	petrol	790	247	81	1,118
6090	Honda	Shuttle	30.081000	4.000000	110.000000	2254.000000	petrol	639	416	49	1,104
6091	Mitsubishi	Space	23.165158	3.947368	82.157895	1817.315789	petrol	721	251	40	1,012

[6092 rows x 11 columns]

[6]:
```
data.dtypes
```

[6]:
```
Manufacturer     object
Model            object
Price           float64
Transmission    float64
Power           float64
Engine CC       float64
Fuel             object
Male             object
Female           object
Unknown          object
Total            object
dtype: object
```

[7]:
```
class String_to_float:
    def __init__(self, y):
        self.y = y

    def comma_to_dot(self, x): # pakeicia , i . ir padaro floatu
        x = x.replace(',', '.')
        return float(x)

    def column_to_float(self): # lenteles stulpelio nerius pakeicia i float ,␣
 ↪jei yra kablelis skaiciui
        for i in self.y:
            data[i] = data[i].map(self.comma_to_dot)


string_to_float = String_to_float(['Male', 'Female', 'Unknown', 'Total'])
string_to_float.column_to_float()
```

[8]:
```
data.dtypes
```

[8]:
```
Manufacturer     object
Model            object
Price           float64
Transmission    float64
Power           float64
Engine CC       float64
Fuel             object
Male            float64
Female          float64
Unknown         float64
Total           float64
dtype: object
```

[9]:
```
data
```

[9]:

	Manufacturer	Model	Price	Transmission	Power	Engine CC	Fuel	Male	Female	Unknown	Total
0	Ford	Focus	30.619322	5.966102	94.033898	1497.169492	petrol	814172.000	422731.0	56.487	1293390.000
1	Ford	Fiesta	18.532143	5.714286	68.571429	1166.142857	petrol	554879.000	631666.0	54.057	1240602.000
2	Volkswagen	Golf	31.242154	6.164835	89.461538	1537.406593	petrol	483216.000	310604.0	47.563	841383.000
3	Renault	Clio	22.100000	5.615385	75.576923	1219.653846	petrol	241287.000	312556.0	28.004	581847.000
4	BMW	320i	47.848370	6.444444	126.111111	1995.777778	petrol	408016.000	115843.0	29.125	552984.000
…	…	…	…	…	…	…	…	…	…	…	…
6087	Land-Rover	Defender	108.747195	7.853659	207.609756	2304.975610	diesel	1.012	150.0	80.000	1.242
6088	Toyota	RAV4	43.548516	1.354839	137.774193	2261.193548	petrol	670.000	482.0	66.000	1.218
6089	Alfa-Romeo	Spider	55.200000	6.000000	163.500000	2696.500000	petrol	790.000	247.0	81.000	1.118
6090	Honda	Shuttle	30.081000	4.000000	110.000000	2254.000000	petrol	639.000	416.0	49.000	1.104
6091	Mitsubishi	Space	23.165158	3.947368	82.157895	1817.315789	petrol	721.000	251.0	40.000	1.012

[6092 rows x 11 columns]

[10]:
```
data = data.groupby(['Manufacturer', 'Model', 'Price', 'Transmission', 'Power',␣
↪'Engine CC', 'Fuel'], as_index=False).sum()
data
```

[10]:

	Manufacturer	Model	Price	Transmission	Power	Engine CC	Fuel	Male	Female	Unknown	Total
0	Abarth	500C	21.105625	5.000000	60.625000	1039.500000	petrol	1.000	1.0	0.000	2.000
1	Alfa-Romeo	145	17.427143	5.000000	87.714286	1696.428571	petrol	1.000	1.0	0.000	2.000
2	Alfa-Romeo	146	18.198429	5.000000	87.714286	1696.428571	petrol	1.000	1.0	0.000	2.000
3	Alfa-Romeo	147	25.343387	5.193548	95.096774	1802.774194	petrol	1.000	1.0	0.000	2.000
4	Alfa-Romeo	155	23.909333	5.000000	100.666667	2016.777778	petrol	1.000	1.0	0.000	2.000
..	…	…	…	…	…	…	…	…	…	…	…
497	Volvo	V50	36.524191	5.176471	113.352941	2106.500000	petrol	1.000	1.0	0.000	2.000
498	Volvo	V60	50.484130	7.304348	150.608696	1969.000000	petrol	1.000	1.0	0.000	2.000
499	Volvo	V70	50.961091	6.181818	135.290909	1971.163636	petrol	1.000	1.0	0.000	2.000
500	Volvo	XC70	58.469074	6.444444	148.518518	2174.037037	petrol	1.000	1.0	0.000	2.000
501	Volvo	XC90	85.829462	8.000000	213.153846	1969.000000	petrol	1.000	1.0	0.000	2.000

```
       Fuel      Male    Female   Unknown    Total
0    petrol     7.124   653.070   570.000   12.413
1    petrol  1754.267  6311.549  2186.000   44.034
2    petrol  1745.222  3780.461  2969.000   58.128
3    petrol   149.499    83.501  2215.074  246.278
4    petrol   883.005  4422.000  1191.000   34.473
..      …        …         …         …        …
497  petrol   154.491   449.406  1879.292  227.447
498  diesel     7.831   880.290   720.000   10.720
499  diesel   703.323   587.631  1478.078  928.874
500  diesel   839.749  2172.313  5608.000   83.607
501  petrol   164.061   781.948  1618.694  258.012

[502 rows x 11 columns]
```

[11]:
```
##############################################################################
↪populiariausi auto pagal firma
```

[12]:
```
data_1 = data.iloc[:, [0, -1]]
data_1
```

[12]:
```
    Manufacturer    Total
0         Abarth   12.413
1     Alfa-Romeo   44.034
2     Alfa-Romeo   58.128
3     Alfa-Romeo  246.278
4     Alfa-Romeo   34.473
..           …      …
497        Volvo  227.447
498        Volvo   10.720
499        Volvo  928.874
500        Volvo   83.607
501        Volvo  258.012

[502 rows x 2 columns]
```

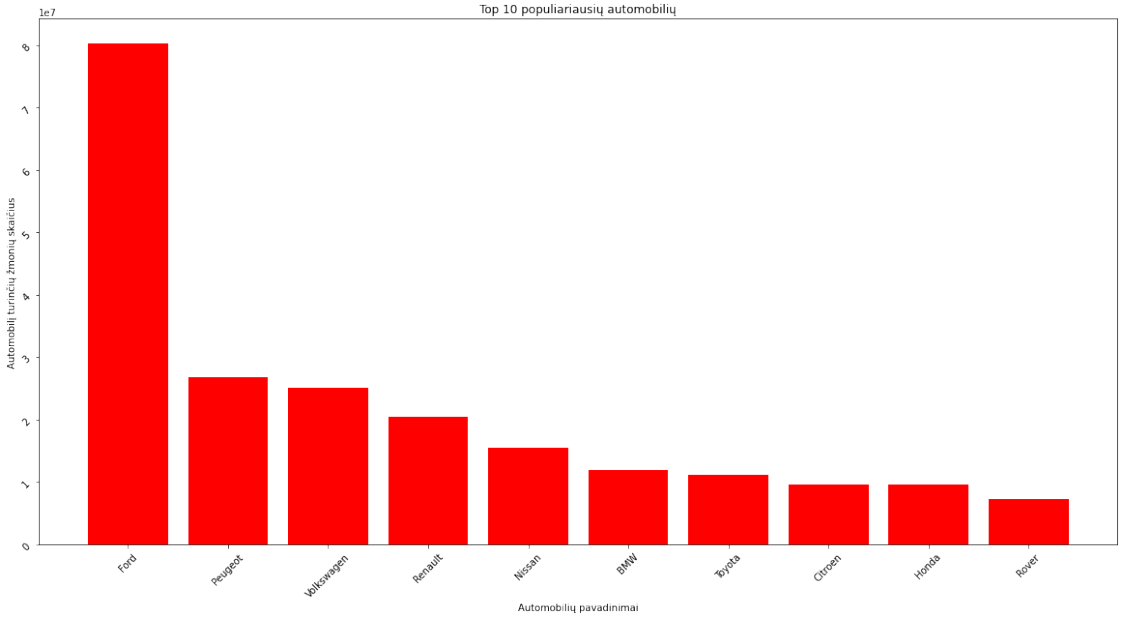
[13]:
```
data_1 = data_1.groupby(['Manufacturer'], as_index=False).sum()
data_1 = data_1.sort_values(['Total'], ascending=False)
data_1
```

[13]:
```
    Manufacturer         Total
17          Ford  8.027580e+07
36       Peugeot  2.688234e+07
50    Volkswagen  2.510736e+07
38       Renault  2.048640e+07
34        Nissan  1.548595e+07
4            BMW  1.193343e+07
```

48	Toyota	1.107564e+07
8	Citroen	9.626473e+06
18	Honda	9.613328e+06
39	Rover	7.327669e+06
30	Mercedes	5.082870e+06
24	Land-Rover	4.321683e+06
3	Audi	4.112435e+06
42	Skoda	1.933191e+06
16	Fiat	1.446149e+06
41	Seat	8.891286e+05
29	Mazda	8.885507e+05
31	Mini	7.779585e+05
40	Saab	7.186725e+05
51	Volvo	5.240522e+05
19	Hyundai	1.102948e+05
21	Kia	1.076330e+05
20	Jaguar	1.030064e+05
46	Suzuki	4.087961e+03
32	Mitsubishi	2.160711e+03
45	Subaru	1.340194e+03
27	MG	1.057708e+03
1	Alfa-Romeo	1.049063e+03
37	Porsche	1.038770e+03
10	Daewoo	9.820730e+02
7	Chrysler	8.360680e+02
6	Chevrolet	5.222720e+02
43	Smart	3.899990e+02
11	Daihatsu	3.269050e+02
13	Datsun	2.824070e+02
22	Lada	2.745240e+02
49	Triumph	2.547010e+02
35	Opel	2.063590e+02
26	Lotus	1.246440e+02
33	Morris	8.636600e+01
2	Aston-Martin	8.573300e+01
44	Ssangyong	6.581300e+01
23	Lancia	6.417200e+01
5	Bentley	6.102100e+01
14	Dodge	5.765000e+01
25	Lexus	3.583700e+01
12	Daimler	3.434000e+01
9	Dacia	1.495600e+01
0	Abarth	1.241300e+01
47	TVR	1.203100e+01
15	Ferrari	1.121100e+01
28	Maserati	3.598000e+00

[14]:
```
data_1_1 = data_1.iloc[0:10, :]

fig, ax = plt.subplots(figsize=(20, 10))
plt.bar(data_1_1['Manufacturer'], data_1_1['Total'], color='r')
ax.set_xlabel('Automobilių pavadinimai')
ax.set_ylabel('Automobilį turinčių žmonių skaičius')
ax.tick_params(labelrotation=45)
ax.set_title('Top 10 populiariausių automobilių')
plt.savefig('most_popular_cars', dpi=100)
```



[15]:
```
########################################################################## male female pagal kaina pasiskirstymas
```

[16]:
```
data_2 = data.iloc[:, [2, -4, -3]]
data_2 = data_2.sort_values(['Price'])
data_2
```

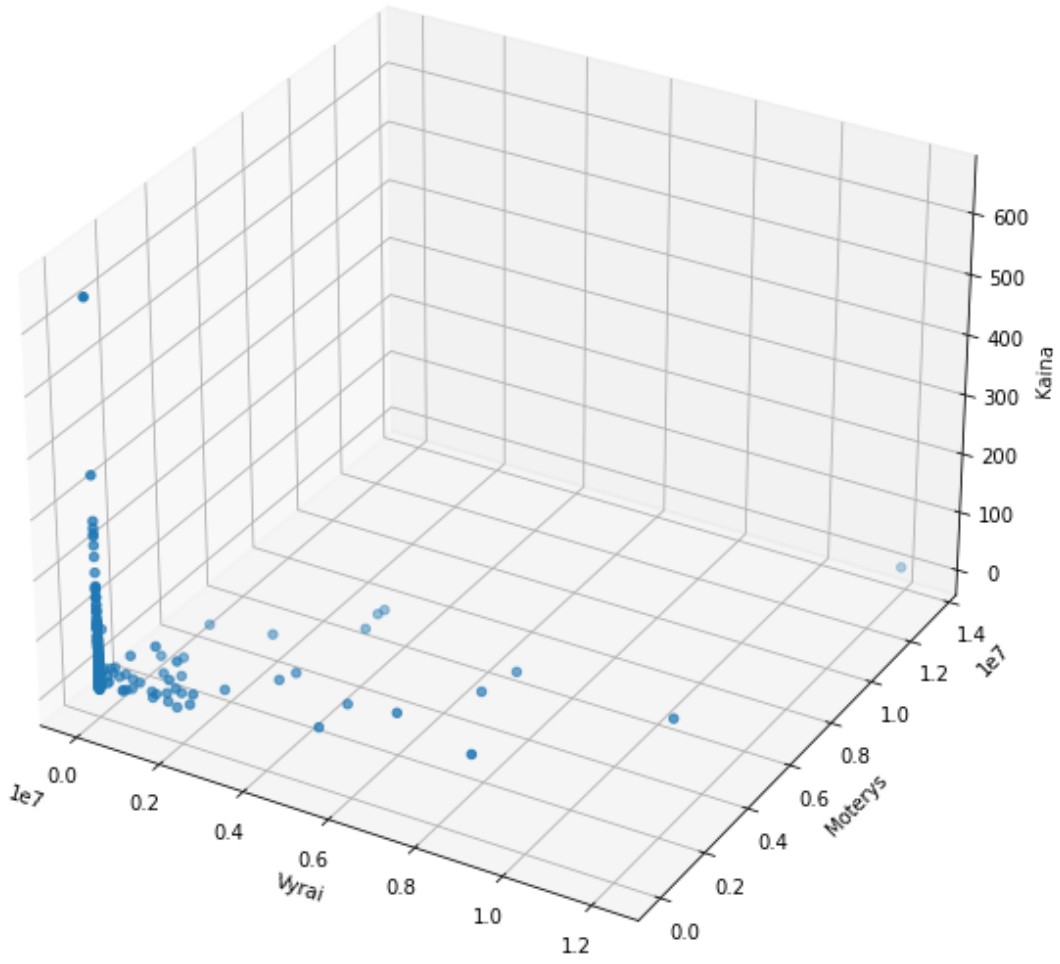
[16]:

	Price	Male	Female
397	3.332200	60.665	1152.319
111	3.781000	1525.677	1621.767
213	4.536000	1.295	361.000
396	4.626333	730.901	1846.300
171	4.968000	1671.380	1473.000
..	…	…	…
262	264.675000	143.077	2461.713
14	273.755000	24.625	1989.000
55	285.247000	52.397	5032.024

```
15    360.755000    25.375  2035.000
347   646.605000   999.378  2693.000

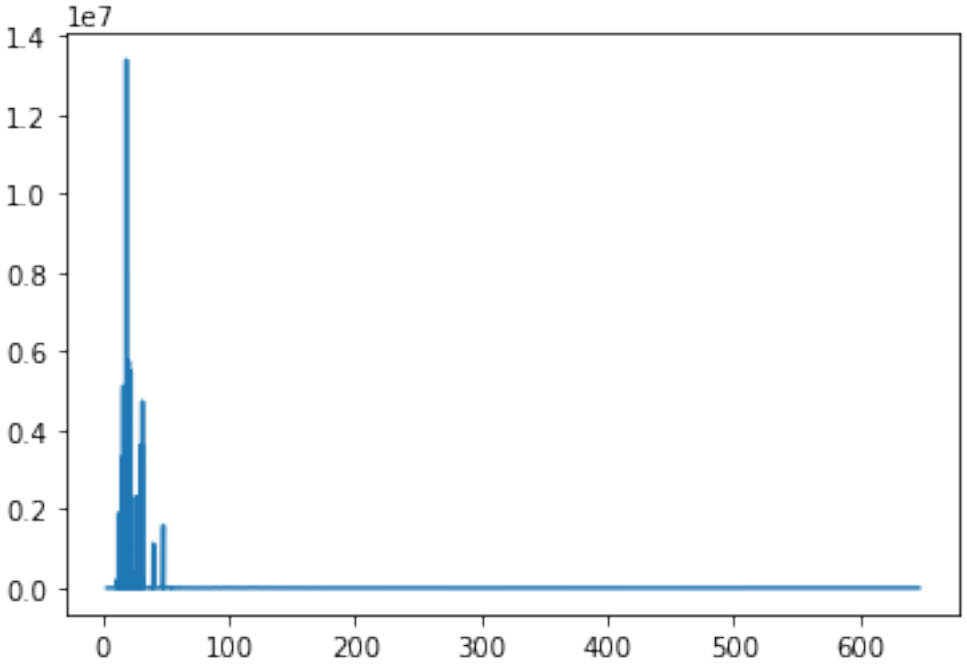
[502 rows x 3 columns]
```

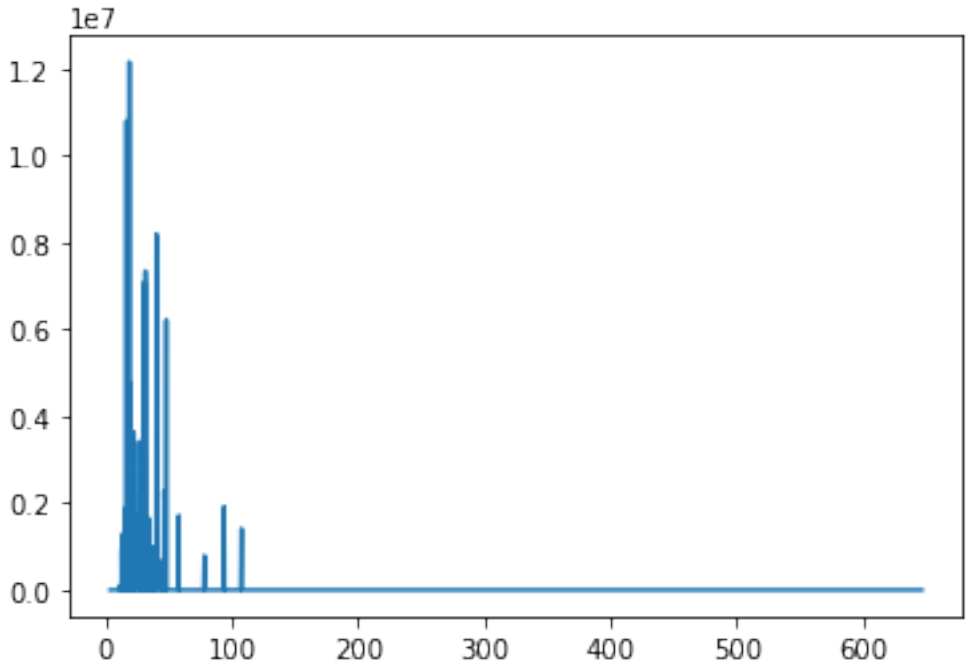
[17]:
```
fig, ax  = plt.subplots(figsize=(10, 10), subplot_kw={"projection": "3d"})
ax.scatter(data_2['Male'], data_2['Female'], data_2['Price'])
ax.set_xlabel('Vyrai')
ax.set_ylabel('Moterys')
ax.set_zlabel('Kaina')
plt.savefig('kainu_pasiskirstymas', dpi=100)
```



[18]:
```
# padaryt kad butu 2 grafikai ir jie greta sudeti butu. Tada braizytu kaina ir␣
↪kiek vyru/moteru isigije uz ta kaina masinas
```

[19]:
```
plt.plot(data_2['Price'], data_2['Female'])
plt.show()
plt.plot(data_2['Price'], data_2['Male'])
plt.show()
```





[20]:
```
data_2['Female'].max()
```

[20]: 13391971.0

[21]:
```
data_2['Male'].max()
```

[21]: 12150919.0

[22]:
```
data_2['Price'].max()
```

[22]: 646.605

[1]:
```
class Graphics_plot:
    def __init__(self, data_x, data_y1, data_y2, x_name, y1_name, y2_name):
        self.data_x = data_x
        self.data_y1 = data_y1
        self.data_y2 = data_y2
        self.x_name = x_name
        self.y1_name = y1_name
        self.y2_name = y2_name

    def limits_y_axis(self): # suvienodina masteli y asiu
        y1_list = []
        y2_list = []
        for i in self.data_y1:
```

```
            y1_list.append(i)
        for j in self.data_y2:
            y2_list.append(j)
        if np.array(y2_list).max() >= np.array(y1_list).max():
            y_lim_max = np.array(y2_list).max() + np.array(y2_list).mean()/10
        else:
            y_lim_max = np.array(y1_list).max() + np.array(y1_list).mean()/10
        if np.array(y2_list).min() <= np.array(y1_list).min():
            y_lim_min = np.array(y2_list).min() - np.array(y2_list).mean()/10
        else:
            y_lim_min = np.array(y1_list).min() - np.array(y1_list).mean()/10
        return y_lim_min, ', ', y_lim_max

    def limits_x_axis(self): # suvienodina masteli x asiu
        x1_list = []
        x2_list = []
        for i in self.data_x1:
            x1_list.append(i)
        for j in self.data_x2:
            x2_list.append(j)
        if np.array(x2_list).max() >= np.array(x1_list).max():
            x_lim_max = np.array(x2_list).max() + np.array(x2_list).mean()/10
        else:
            x_lim_max = np.array(x1_list).max() + np.array(x1_list).mean()/10
        if np.array(x2_list).min() <= np.array(x1_list).min():
            x_lim_min = np.array(x2_list).min() - np.array(x2_list).mean()/10
        else:
            x_lim_min = np.array(x1_list).min() - np.array(x1_list).mean()/10
        return x_lim_min, ', ', x_lim_max

    def plot(self, name):
        path = r"C:
↪\Users\ariju\Documents\pamokos\programavimas\atsiskaitymas\mfp_naujas"
        if not os.path.exists(path):
            os.mkdir(path)
        fig, (ax1, ax2) = plt.subplots(1, 2, figsize=(10, 4))
        ax1.scatter(self.data_x, self.data_y1, linewidth=3, color='b', alpha=1)
        ax2.scatter(self.data_x, self.data_y2, linewidth=3, marker='d',␣
↪color='r', alpha=1)
        ax1.spines["right"].set_visible(False)
        ax1.spines["top"].set_visible(False)
        ax2.spines["right"].set_visible(False)
        ax2.spines["top"].set_visible(False)
        ax1.tick_params(axis="y", direction="in")
        ax1.tick_params(axis="x", direction="in")
        ax2.tick_params(axis="y", direction="in")
        ax2.tick_params(axis="x", direction="in")
```

```
        ax1.set_xlabel (self.x_name, size=10, font="Arial")
        ax1.set_ylabel(self.y1_name, size=10, font="Arial")
        ax2.set_xlabel (self.x_name, size=10, font="Arial")
        ax2.set_ylabel(self.y2_name, size=10, font="Arial")
        ax1.set_xlim(3.3, 647)
        ax1.set_ylim(60, 2700)
        ax2.set_xlim(3.3, 647)
        ax2.set_ylim(60, 2700)
        # ax1.set_xlim(self.limits_x_axis)
        # ax1.set_ylim(self.limits_y_axis)
        # ax2.set_xlim(self.limits_y_axis)
        # ax2.set_ylim(self.limits_y_axis)
        plt.savefig(os.path.join(path, f'{name}.png'), dpi=200)
        plt.close()




def separate_graphs(data, x, y1, y2, x_name, y1_name, y2_name): # x, y1, y2␣
 ↪stulpeliu pavadinimai, data - duomenu dataframe'o pavadinimas, c_n -␣
 ↪stulpelio numeris is kurio imamas eiluciu skaicius
    NUM = 1
    lim = int(data.shape[0])
    for i in tqdm.tqdm(range(0, lim + 1)):
        graphics_plot = Graphics_plot(x.iloc[0:i],
                                      y1.iloc[0:i],
                                      y2.iloc[0:i],
                                      x_name,
                                      y1_name,
                                      y2_name
                                     )
        name = '{num:02d}'.format(num=NUM)
        NUM += 1
        graphics_plot.plot(name)

separate_graphs(data_2,
                data_2['Price'],
                data_2['Male'],
                data_2['Female'],
                'Kaina * 10^3 [EUR]',
                'Vyrai',
                'Moterys'
               )
```

[24]:
```
filenames = glob.glob(r'C:
 ↪\Users\ariju\Documents\pamokos\programavimas\atsiskaitymas\mfp_naujas\*.png')
filenames = sorted(filenames)
```

```
images = []
for filename in tqdm.tqdm(filenames):
    image = imageio.imread(filename)
    images.append(image)

imageio.mimsave(r'C:
 ↪\Users\ariju\Documents\pamokos\programavimas\atsiskaitymas\gifas.gif',␣
 ↪images, fps=30, duration=0.5)
```

[25]:
```
############################################################## pabraizyt modeliu␣
 ↪top 10 pagal piguma ir palygint su top10 perkamiausiu
```

[26]:
```
data_3 = data.iloc[:, [0, 2]]
data_3 = data_3.groupby(['Manufacturer'], as_index=False).mean()
data_3 = data_3.sort_values(['Price'])
data_3
```

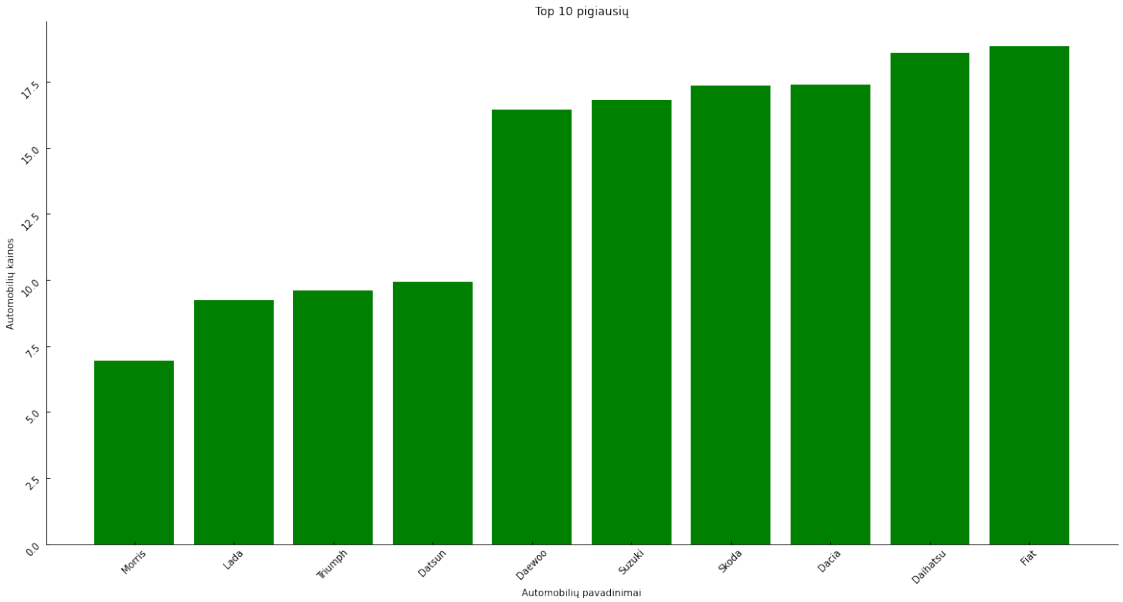
[26]:

	Manufacturer	Price
33	Morris	6.938000
22	Lada	9.230933
49	Triumph	9.593667
13	Datsun	9.933169
10	Daewoo	16.442375
46	Suzuki	16.796190
42	Skoda	17.340498
9	Dacia	17.398333
11	Daihatsu	18.593025
16	Fiat	18.852969
39	Rover	20.042730
43	Smart	20.549341
0	Abarth	21.105625
41	Seat	22.185178
38	Renault	23.042933
35	Opel	23.083011
6	Chevrolet	23.324335
21	Kia	24.828111
8	Citroen	25.429163
19	Hyundai	25.909890
29	Mazda	25.957820
36	Peugeot	26.496910
23	Lancia	28.596276
32	Mitsubishi	28.718452
18	Honda	29.707111
48	Toyota	29.987245
17	Ford	31.488367
27	MG	31.712500
1	Alfa-Romeo	33.566362

```
31          Mini   34.143247
50    Volkswagen   37.015100
14         Dodge   37.415083
45        Subaru   37.476506
40          Saab   38.441615
34        Nissan   41.709880
7       Chrysler   42.210109
51         Volvo   42.714411
44     Ssangyong   47.138946
30      Mercedes   66.462009
25         Lexus   66.559947
26         Lotus   73.608167
3           Audi   74.302643
4            BMW   87.993440
47           TVR   89.443500
12       Daimler   90.406667
24    Land-Rover   91.933370
20        Jaguar  110.875494
37       Porsche  184.446424
15       Ferrari  230.242625
28      Maserati  245.168000
2   Aston-Martin  264.444333
5         Bentley  285.247000
```

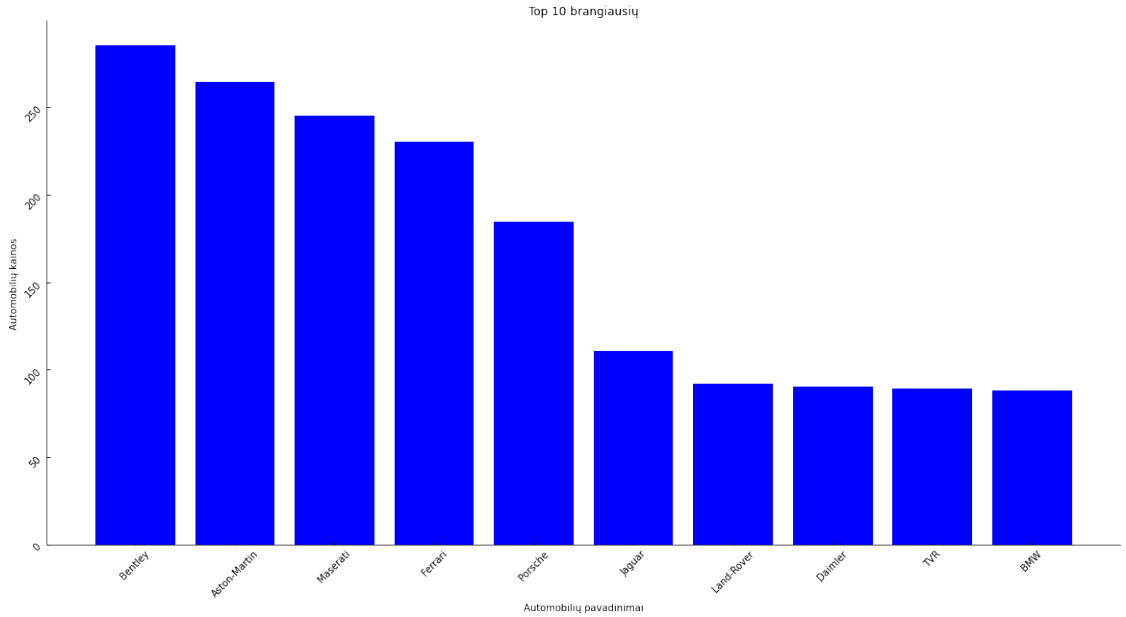
[27]:
```
data_3_10 = data_3.iloc[0:10, :]

fig, ax = plt.subplots(figsize=(20, 10))
plt.bar(data_3_10['Manufacturer'], data_3_10['Price'], color='g')
ax.set_xlabel('Automobilių pavadinimai')
ax.set_ylabel('Automobilių kainos')
ax.tick_params(labelrotation=45, direction="in")
ax.spines["right"].set_visible(False)
ax.spines["top"].set_visible(False)
ax.set_title('Top 10 pigiausių')
plt.savefig('cheapest_cars', dpi=200)
```



[28]:
```
data_3_exp = data_3.iloc[-10:, :].sort_values(['Price'], ascending=False)

fig, ax = plt.subplots(figsize=(20, 10))
plt.bar(data_3_exp['Manufacturer'], data_3_exp['Price'], color='b')
ax.set_xlabel('Automobilių pavadinimai')
ax.set_ylabel('Automobilių kainos')
ax.tick_params(labelrotation=45, direction="in")
ax.spines["right"].set_visible(False)
ax.spines["top"].set_visible(False)
ax.set_title('Top 10 brangiausių')
plt.savefig('expensive_cars', dpi=200)
```



[29]:
```
#################### Transmission nuo Power priklausomybe
```

[30]:
```
data_4 = data.iloc[:, [3, 4]]
data_4
```

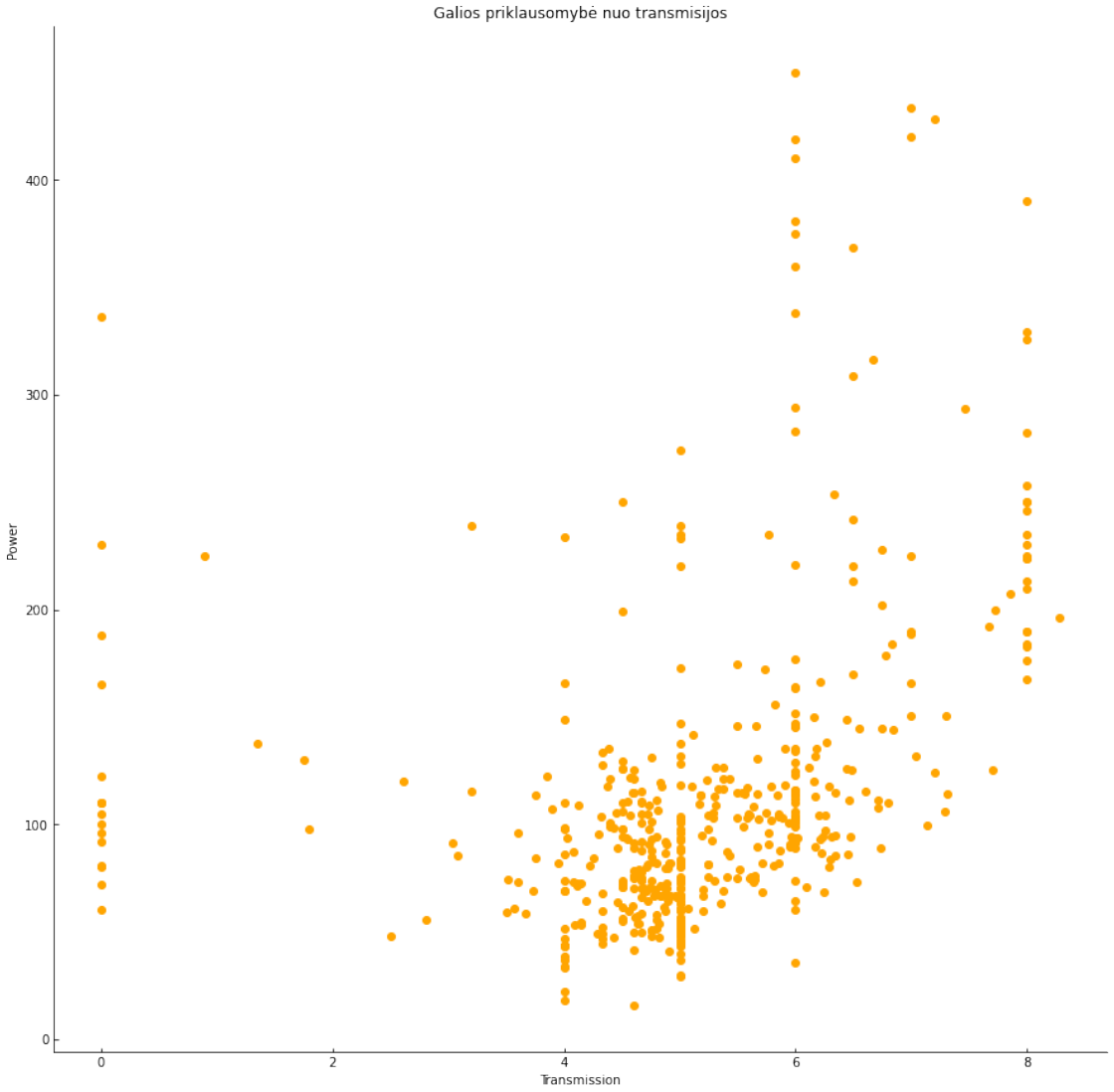
[30]:

	Transmission	Power
0	5.000000	60.625000
1	5.000000	87.714286
2	5.000000	87.714286
3	5.193548	95.096774
4	5.000000	100.666667
..	…	…
497	5.176471	113.352941
498	7.304348	150.608696
499	6.181818	135.290909
500	6.444444	148.518518
501	8.000000	213.153846

[502 rows x 2 columns]

[31]:
```
fig, ax = plt.subplots(figsize=(15, 15))
plt.scatter(data_4['Transmission'], data_4['Power'], color='orange')
ax.set_xlabel('Transmission')
ax.set_ylabel('Power')
ax.tick_params(direction="in")
ax.spines["right"].set_visible(False)
ax.spines["top"].set_visible(False)
```

```
ax.set_title('Galios priklausomybė nuo transmisijos')
plt.savefig('power_transmission', dpi=200)
```



[32]:
```
################## Price Power priklausomybe
```

[33]:
```
data_5 = data.iloc[:, [2, 4]]
data_5
```

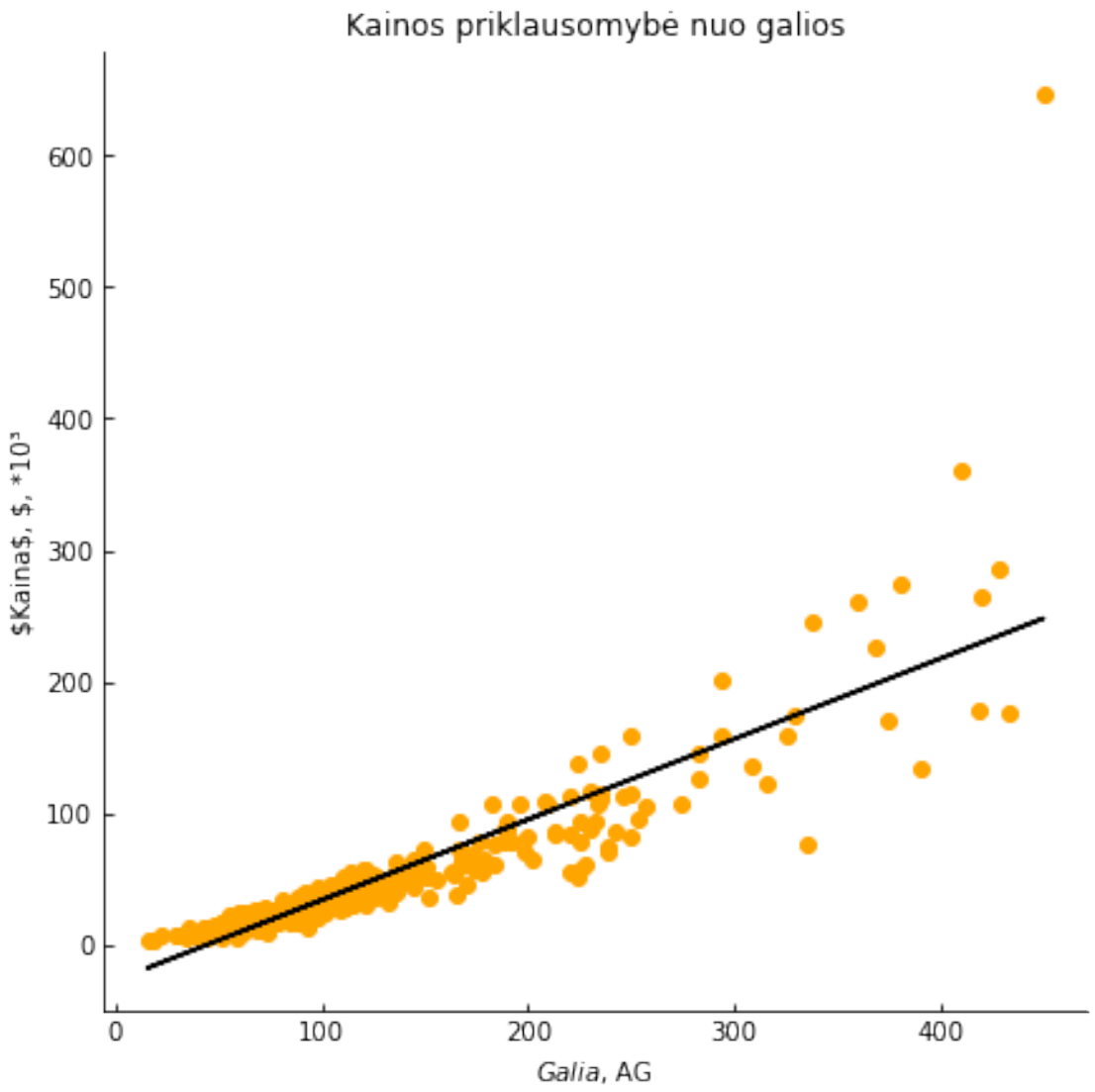
[33]:

	Price	Power
0	21.105625	60.625000
1	17.427143	87.714286
2	18.198429	87.714286
3	25.343387	95.096774

```
4    23.909333  100.666667
..         …          …
497  36.524191  113.352941
498  50.484130  150.608696
499  50.961091  135.290909
500  58.469074  148.518518
501  85.829462  213.153846

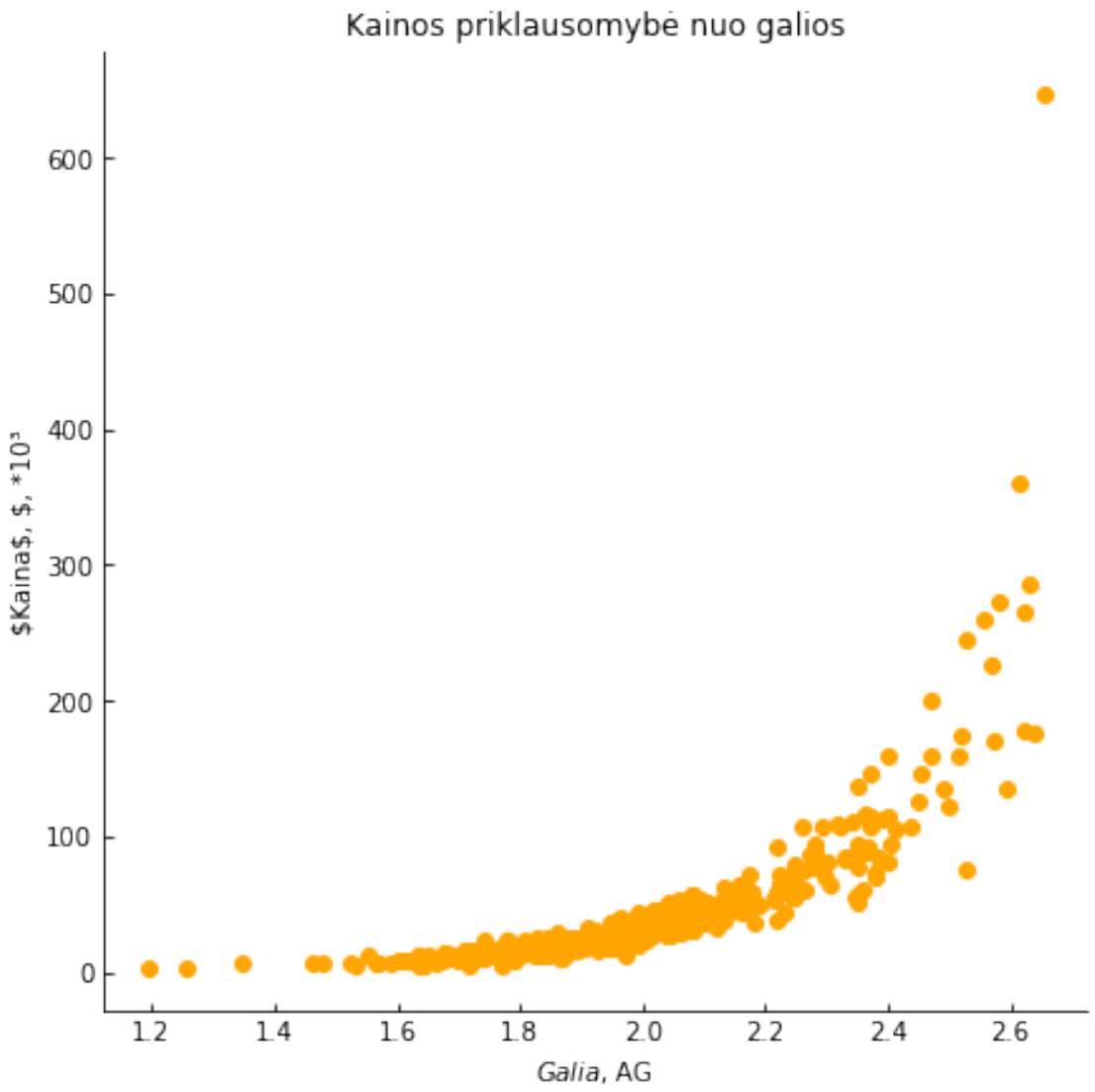
[502 rows x 2 columns]
```

[34]:
```
fig, ax = plt.subplots(figsize=(7, 7))
plt.scatter(data_5['Power'], data_5['Price'], color='orange')
ax.set_xlabel('$Galia$, AG')
ax.set_ylabel('$Kaina$, $, *10^3')
ax.tick_params(direction="in")
ax.spines["right"].set_visible(False)
ax.spines["top"].set_visible(False)
ax.set_title('Kainos priklausomybė nuo galios')
function = np.poly1d(np.polyfit(data_5['Power'], data_5['Price'], 1))
ax.plot(data_5['Power'], function(data_5['Power']), color="black")
plt.savefig('price_power', dpi=200)
```



[35]:
```
fig, ax = plt.subplots(figsize=(7, 7))
plt.scatter(np.log10(data_5['Power']), data_5['Price'], color='orange')
ax.set_xlabel('$Galia$, AG')
ax.set_ylabel('$Kaina$, $, *10³')
ax.tick_params(direction="in")
ax.spines["right"].set_visible(False)
ax.spines["top"].set_visible(False)
ax.set_title('Kainos priklausomybė nuo galios')
```

[35]:
```
Text(0.5, 1.0, 'Kainos priklausomybė nuo galios')
```



[36]:
```
data
```

[36]:

	Manufacturer	Model	Price	Transmission	Power	Engine CC	\
0	Abarth	500C	21.105625	5.000000	60.625000	1039.500000	
1	Alfa-Romeo	145	17.427143	5.000000	87.714286	1696.428571	
2	Alfa-Romeo	146	18.198429	5.000000	87.714286	1696.428571	
3	Alfa-Romeo	147	25.343387	5.193548	95.096774	1802.774194	
4	Alfa-Romeo	155	23.909333	5.000000	100.666667	2016.777778	
..	…	…	…	…	…	…	
497	Volvo	V50	36.524191	5.176471	113.352941	2106.500000	
498	Volvo	V60	50.484130	7.304348	150.608696	1969.000000	
499	Volvo	V70	50.961091	6.181818	135.290909	1971.163636	
500	Volvo	XC70	58.469074	6.444444	148.518518	2174.037037	

```
501        Volvo  XC90  85.829462      8.000000  213.153846  1969.000000

       Fuel      Male    Female   Unknown    Total
0    petrol     7.124   653.070   570.000   12.413
1    petrol  1754.267  6311.549  2186.000   44.034
2    petrol  1745.222  3780.461  2969.000   58.128
3    petrol   149.499    83.501  2215.074  246.278
4    petrol   883.005  4422.000  1191.000   34.473
..      …       …        …        …       …
497  petrol   154.491   449.406  1879.292  227.447
498  diesel     7.831   880.290   720.000   10.720
499  diesel   703.323   587.631  1478.078  928.874
500  diesel   839.749  2172.313  5608.000   83.607
501  petrol   164.061   781.948  1618.694  258.012

[502 rows x 11 columns]
```

[37]:
```
predict_data = data.iloc[:, [2, 4, 5]]
predict_data
```

[37]:
```
         Price       Power    Engine CC
0    21.105625   60.625000  1039.500000
1    17.427143   87.714286  1696.428571
2    18.198429   87.714286  1696.428571
3    25.343387   95.096774  1802.774194
4    23.909333  100.666667  2016.777778
..         …         …         …
497  36.524191  113.352941  2106.500000
498  50.484130  150.608696  1969.000000
499  50.961091  135.290909  1971.163636
500  58.469074  148.518518  2174.037037
501  85.829462  213.153846  1969.000000

[502 rows x 3 columns]
```

[38]:
```
predict_data['Price'].mean()
```

[38]:
```
41.50487473874703
```

[39]:
```
predict_data = predict_data.round()
```

[40]:
```
predict_data.loc[predict_data['Price'] <= 40 , 'Price'] = 0 # maziau lygu 40k -␣
↪0
predict_data.loc[predict_data['Price'] > 40 , 'Price'] = 1 # daugiau uz 40k - 1
```

[41]:
```
predict_data = predict_data.astype(int)
```

[42]:
```
predict_data = predict_data.sort_values(['Price'], ascending=True)
```

[43]:
```
predict_data
```

[43]:
```
     Price  Power  Engine CC
0        0     61       1040
323      0     67       1699
322      0     56       1607
320      0     73       1242
319      0     80       1536
..     …    …         …
253      1    106       1545
82       1    123       1832
251      1    136       2972
258      1    144       2418
501      1    213       1969

[502 rows x 3 columns]
```

[44]:
```
X_input = predict_data.drop(columns=['Price']).values
Y_output = predict_data['Price'].values

X_input_train, X_input_test, Y_output_train, Y_output_test =␣
 ↪train_test_split(X_input, Y_output, test_size=0.2)

model = DecisionTreeClassifier()
model.fit(X_input_train, Y_output_train)
predictions = model.predict(X_input_test)

score = accuracy_score(Y_output_test, predictions)
score
```

[44]:
```
0.8811881188118812
```

[45]:
```
# X_input = predict_data.drop(columns=['Price'])␣
 ↪################################ padaro kodas medi tikimybini
# Y_output = predict_data['Price']

# model = DecisionTreeClassifier()
# model.fit(X_input.values, Y_output.values)

# # Y_output = Y_output.astype(str)

# tree.export_graphviz(model,
#                      out_file='price-predictor.dot',
#                      feature_names=['Power', 'Engine CC'],
#                      class_names=sorted(Y_output.unique()),
```

```
#                       label='all',
#                       rounded=True,
#                       filled=True
#                      )
```

[46]:
```
X_input = predict_data.drop(columns=['Price'])
Y_output = predict_data['Price']

model = DecisionTreeClassifier()
model.fit(X_input.values, Y_output.values)

predictions = model.predict([[132, 1850]])

if predictions == 0:
    print('Automobilis kainuoja ne daugiau 40.000€')
else:
    print('Automobilis kainuoja daugiau nei 40.000€')
```

```
Automobilis kainuoja daugiau nei 40.000€
```

[47]:
```
data
```

[47]:
```
    Manufacturer Model      Price  Transmission       Power    Engine CC  \
0         Abarth  500C  21.105625      5.000000   60.625000  1039.500000
1     Alfa-Romeo   145  17.427143      5.000000   87.714286  1696.428571
2     Alfa-Romeo   146  18.198429      5.000000   87.714286  1696.428571
3     Alfa-Romeo   147  25.343387      5.193548   95.096774  1802.774194
4     Alfa-Romeo   155  23.909333      5.000000  100.666667  2016.777778
..           …   …        …            …          …           …
497       Volvo   V50  36.524191      5.176471  113.352941  2106.500000
498       Volvo   V60  50.484130      7.304348  150.608696  1969.000000
499       Volvo   V70  50.961091      6.181818  135.290909  1971.163636
500       Volvo  XC70  58.469074      6.444444  148.518518  2174.037037
501       Volvo  XC90  85.829462      8.000000  213.153846  1969.000000

       Fuel      Male    Female   Unknown    Total
0    petrol     7.124   653.070   570.000   12.413
1    petrol  1754.267  6311.549  2186.000   44.034
2    petrol  1745.222  3780.461  2969.000   58.128
3    petrol   149.499    83.501  2215.074  246.278
4    petrol   883.005  4422.000  1191.000   34.473
..      …        …         …         …        …
497  petrol   154.491   449.406  1879.292  227.447
498  diesel     7.831   880.290   720.000   10.720
499  diesel   703.323   587.631  1478.078  928.874
500  diesel   839.749  2172.313  5608.000   83.607
501  petrol   164.061   781.948  1618.694  258.012
```

```
[502 rows x 11 columns]
```

[48]:
```
data_gender = data.iloc[:, [7, 8, 9]]
data_gender = data_gender.sum()

data_gender
```

[48]:
```
Male       1.181561e+08
Female     6.936266e+07
Unknown    1.198816e+06
dtype: float64
```

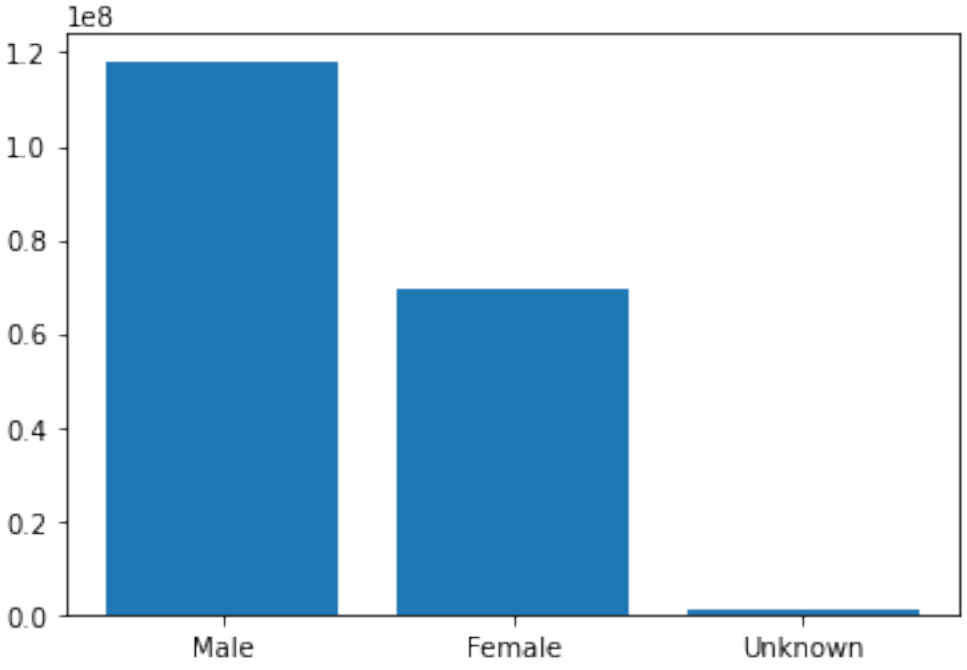
[49]:
```
data_gender= pd.DataFrame({'Gender':['Male', 'Female', 'Unknown']})
data_gender['Count']= data_gender['Gender'].apply(lambda x: data[x].sum())

data_gender
```

[49]:

	Gender	Count
0	Male	1.181561e+08
1	Female	6.936266e+07
2	Unknown	1.198816e+06

[50]:
```
plt.bar(data_gender['Gender'], data_gender['Count'])
plt.savefig('pasiskirstymasmfu', dpi=200)
```



[51]:
```
################################### NAUJI DUOMENYS
```

[52]:
```
data_audi = pd.read_csv('skelbimai/audi.csv', usecols=[0, 1, 2, 4, 5, 7, 8])
data_bmw = pd.read_csv('skelbimai/bmw.csv', usecols=[0, 1, 2, 4, 5, 7, 8])
data_ford = pd.read_csv('skelbimai/ford.csv', usecols=[0, 1, 2, 4, 5, 7, 8])
data_hyundai = pd.read_csv('skelbimai/hyundi.csv', usecols=[0, 1, 2, 4, 5, 7,␣
↪8])
data_mercedes = pd.read_csv('skelbimai/merc.csv', usecols=[0, 1, 2, 4, 5, 7, 8])
data_skoda = pd.read_csv('skelbimai/skoda.csv', usecols=[0, 1, 2, 4, 5, 7, 8])
data_toyota = pd.read_csv('skelbimai/toyota.csv', usecols=[0, 1, 2, 4, 5, 7, 8])
data_vauxhall = pd.read_csv('skelbimai/vauxhall.csv', usecols=[0, 1, 2, 4, 5,␣
↪7, 8])
data_vw = pd.read_csv('skelbimai/vw.csv', usecols=[0, 1, 2, 4, 5, 7, 8])
```

[53]:
```
data_list = [data_audi, data_bmw, data_ford, data_hyundai, data_mercedes,␣
↪data_skoda, data_toyota, data_vauxhall, data_vw]
new_names_list = ['Audi', 'Bmw', 'Ford', 'Hyundai', 'Mercedes', 'Skoda',␣
↪'Toyota', 'Vauxhall', 'Volkswagen']
```

[54]:
```
# Gallon Per Hour (GPH) = (specific fuel consumption x HP)/Fuel Specific Weight
# diesel --> power = (7.2 * 60 / mpg) / 0.045 * 0.7457
# petrol --> power = (6.1 * 60 / mpg) / 0.55 * 0.7457
```

[55]:
```
class New_data_cleaning:
    def __init__(self, data_name):
        self.data_name = data_name

    def rename_column_values(self, col_title, new_col_values_name):
        self.data_name.loc[self.data_name[col_title] != new_col_values_name,␣
↪col_title] = new_col_values_name

    def miles_to_km(self, col_title):
        self.data_name[col_title] = self.data_name[col_title] * 1.61
        self.data_name[col_title] = self.data_name[col_title].round()

    def pounds_to_eur(self, col_title):
        self.data_name[col_title] = self.data_name[col_title] * 1.17
        self.data_name[col_title] = self.data_name[col_title].round()

    def mpg_to_power(self, col_title_with_fuel, col_title_with_mpg):
        self.data_name.loc[self.data_name[col_title_with_fuel] == 'Petrol',␣
↪col_title_with_mpg] = ((6.1 * (60 / self.data_name[col_title_with_mpg])) / 0.
↪045) * 0.7457
        self.data_name.loc[self.data_name[col_title_with_fuel] == 'Diesel',␣
↪col_title_with_mpg] = ((7.2 * (60 / self.data_name[col_title_with_mpg])) / 0.
↪055) * 0.7457
```

```
        self.data_name.drop(self.data_name.loc[self.
↪data_name[col_title_with_fuel] == 'Hybrid'].index, inplace=True)
        self.data_name.drop(self.data_name.loc[self.
↪data_name[col_title_with_fuel] == 'Other'].index, inplace=True)
        self.data_name.drop(self.data_name.loc[self.
↪data_name[col_title_with_fuel] == 'Electric'].index, inplace=True)
        self.data_name[col_title_with_mpg] = self.data_name[col_title_with_mpg].
↪round()

for i in tqdm.tqdm(range(0, 9)):
    new_data_cleaning = New_data_cleaning(data_list[i])
    new_data_cleaning.rename_column_values('model', new_names_list[i])
    new_data_cleaning.miles_to_km('mileage')
    new_data_cleaning.pounds_to_eur('price')
    new_data_cleaning.mpg_to_power('fuelType', 'mpg')
```

```
100%|
    | 9/9 [00:00<00:00, 108.38it/s]
```

[56]:
```
data_cars = pd.concat(data_list)
data_cars
```

[56]:

	model	year	price	mileage	fuelType	mpg	engineSize
0	Audi	2017	14625.0	25333.0	Petrol	109.0	1.4
1	Audi	2016	19305.0	58287.0	Diesel	91.0	2.0
2	Audi	2016	12870.0	48213.0	Petrol	109.0	1.4
3	Audi	2017	19656.0	41783.0	Diesel	87.0	2.0
4	Audi	2019	20241.0	3217.0	Petrol	122.0	1.0
…	…	…	…	…	…	…	…
15152	Volkswagen	2012	7008.0	119140.0	Diesel	99.0	2.0
15153	Volkswagen	2008	2105.0	141844.0	Petrol	131.0	1.2
15154	Volkswagen	2009	1860.0	112700.0	Petrol	144.0	1.4
15155	Volkswagen	2006	1462.0	133153.0	Petrol	131.0	1.2
15156	Volkswagen	2007	2685.0	119140.0	Petrol	131.0	1.2

[95856 rows x 7 columns]

[57]:
```
data_cars = data_cars.rename(columns={'model': 'Manufacturer',
                                      'year': 'Year',
                                      'price': 'Price',
                                      'mileage': 'Distance_km',
                                      'fuelType': 'Fuel',
                                      'mpg': 'Power',
                                      'engineSize': 'Engine_size'
                                     })
data_cars
```

[57]:

	Manufacturer	Year	Price	Distance_km	Fuel	Power	Engine_size
0	Audi	2017	14625.0	25333.0	Petrol	109.0	1.4
1	Audi	2016	19305.0	58287.0	Diesel	91.0	2.0
2	Audi	2016	12870.0	48213.0	Petrol	109.0	1.4
3	Audi	2017	19656.0	41783.0	Diesel	87.0	2.0
4	Audi	2019	20241.0	3217.0	Petrol	122.0	1.0
…	…	…	…	…	…	…	
15152	Volkswagen	2012	7008.0	119140.0	Diesel	99.0	2.0
15153	Volkswagen	2008	2105.0	141844.0	Petrol	131.0	1.2
15154	Volkswagen	2009	1860.0	112700.0	Petrol	144.0	1.4
15155	Volkswagen	2006	1462.0	133153.0	Petrol	131.0	1.2
15156	Volkswagen	2007	2685.0	119140.0	Petrol	131.0	1.2

[95856 rows x 7 columns]

[58]:
```
data.drop(data.loc[data['Fuel'] == ('automatic' or 'Automatic' or 'other' or␣
 ↪'Other')].index, inplace=True)
data
```

[58]:

	Manufacturer	Model	Price	Transmission	Power	Engine CC	\
0	Abarth	500C	21.105625	5.000000	60.625000	1039.500000	
1	Alfa-Romeo	145	17.427143	5.000000	87.714286	1696.428571	
2	Alfa-Romeo	146	18.198429	5.000000	87.714286	1696.428571	
3	Alfa-Romeo	147	25.343387	5.193548	95.096774	1802.774194	
4	Alfa-Romeo	155	23.909333	5.000000	100.666667	2016.777778	
..	…	…	…	…	…	…	
497	Volvo	V50	36.524191	5.176471	113.352941	2106.500000	
498	Volvo	V60	50.484130	7.304348	150.608696	1969.000000	
499	Volvo	V70	50.961091	6.181818	135.290909	1971.163636	
500	Volvo	XC70	58.469074	6.444444	148.518518	2174.037037	
501	Volvo	XC90	85.829462	8.000000	213.153846	1969.000000	

	Fuel	Male	Female	Unknown	Total
0	petrol	7.124	653.070	570.000	12.413
1	petrol	1754.267	6311.549	2186.000	44.034
2	petrol	1745.222	3780.461	2969.000	58.128
3	petrol	149.499	83.501	2215.074	246.278
4	petrol	883.005	4422.000	1191.000	34.473
..	…	…	…	…	…
497	petrol	154.491	449.406	1879.292	227.447
498	diesel	7.831	880.290	720.000	10.720
499	diesel	703.323	587.631	1478.078	928.874
500	diesel	839.749	2172.313	5608.000	83.607
501	petrol	164.061	781.948	1618.694	258.012

[497 rows x 11 columns]

[59]:
```
data_add = data.drop(columns=['Model', 'Transmission', 'Male', 'Female',␣
↪'Unknown', 'Total'])
```

[60]:
```
data_add = data_add.rename(columns={'Engine CC': 'Engine_size'})
data_add['Engine_size'] = data_add['Engine_size'] * 0.06101 * 0.01639
data_add['Price'] = data_add['Price'] * 1000
data_add['Price'] = data_add['Price'].round()
data_add['Power'] = data_add['Power'].round()
data_add['Engine_size'] = data_add['Engine_size'].round()
data_add['Fuel'] = data_add['Fuel'].str.capitalize()
```

[61]:
```
data_add
```

[61]:

	Manufacturer	Price	Power	Engine_size	Fuel
0	Abarth	21106.0	61.0	1.0	Petrol
1	Alfa-Romeo	17427.0	88.0	2.0	Petrol
2	Alfa-Romeo	18198.0	88.0	2.0	Petrol
3	Alfa-Romeo	25343.0	95.0	2.0	Petrol
4	Alfa-Romeo	23909.0	101.0	2.0	Petrol
..	…	…	…	…	…
497	Volvo	36524.0	113.0	2.0	Petrol
498	Volvo	50484.0	151.0	2.0	Diesel
499	Volvo	50961.0	135.0	2.0	Diesel
500	Volvo	58469.0	149.0	2.0	Diesel
501	Volvo	85829.0	213.0	2.0	Petrol

[497 rows x 5 columns]

[62]:
```
class Manage_cols():
    def __init__(self, df):
        self.df = df

    def add_new_col(self, new_col_location, new_col_name, new_col_value):
        self.df.insert(loc=new_col_location,
                       column=new_col_name,
                       value=new_col_value
                       )

    def swap_columns(self, col_1, col_2):
        col_list = list(self.df.columns)
        x, y = col_list.index(col_1), col_list.index(col_2)
        col_list[y], col_list[x] = col_list[x], col_list[y]
        self.df = self.df[col_list]
        return self.df

manage_cols = Manage_cols(data_add)
manage_cols.add_new_col(1, 'Year', 2022)
```

```
manage_cols.add_new_col(3, 'Distance_km', 0)
data_add = manage_cols.swap_columns('Power', 'Fuel')
data_add = manage_cols.swap_columns('Engine_size', 'Power')
```

[63]:
```
data_add
```

[63]:

	Manufacturer	Year	Price	Distance_km	Fuel	Power	Engine_size
0	Abarth	2022	21106.0	0	Petrol	61.0	1.0
1	Alfa-Romeo	2022	17427.0	0	Petrol	88.0	2.0
2	Alfa-Romeo	2022	18198.0	0	Petrol	88.0	2.0
3	Alfa-Romeo	2022	25343.0	0	Petrol	95.0	2.0
4	Alfa-Romeo	2022	23909.0	0	Petrol	101.0	2.0
..	…	…	…	…	…	…	…
497	Volvo	2022	36524.0	0	Petrol	113.0	2.0
498	Volvo	2022	50484.0	0	Diesel	151.0	2.0
499	Volvo	2022	50961.0	0	Diesel	135.0	2.0
500	Volvo	2022	58469.0	0	Diesel	149.0	2.0
501	Volvo	2022	85829.0	0	Petrol	213.0	2.0

[497 rows x 7 columns]

[64]:
```
data_cars
```

[64]:

	Manufacturer	Year	Price	Distance_km	Fuel	Power	Engine_size
0	Audi	2017	14625.0	25333.0	Petrol	109.0	1.4
1	Audi	2016	19305.0	58287.0	Diesel	91.0	2.0
2	Audi	2016	12870.0	48213.0	Petrol	109.0	1.4
3	Audi	2017	19656.0	41783.0	Diesel	87.0	2.0
4	Audi	2019	20241.0	3217.0	Petrol	122.0	1.0
…	…	…	…	…	…	…	…
15152	Volkswagen	2012	7008.0	119140.0	Diesel	99.0	2.0
15153	Volkswagen	2008	2105.0	141844.0	Petrol	131.0	1.2
15154	Volkswagen	2009	1860.0	112700.0	Petrol	144.0	1.4
15155	Volkswagen	2006	1462.0	133153.0	Petrol	131.0	1.2
15156	Volkswagen	2007	2685.0	119140.0	Petrol	131.0	1.2

[95856 rows x 7 columns]

[65]:
```
data_cars = pd.concat([data_add, data_cars])
data_cars
```

[65]:

	Manufacturer	Year	Price	Distance_km	Fuel	Power	Engine_size
0	Abarth	2022	21106.0	0.0	Petrol	61.0	1.0
1	Alfa-Romeo	2022	17427.0	0.0	Petrol	88.0	2.0
2	Alfa-Romeo	2022	18198.0	0.0	Petrol	88.0	2.0
3	Alfa-Romeo	2022	25343.0	0.0	Petrol	95.0	2.0
4	Alfa-Romeo	2022	23909.0	0.0	Petrol	101.0	2.0

```
…             …    …       …           …       …     …           …
15152   Volkswagen  2012   7008.0     119140.0  Diesel   99.0          2.0
15153   Volkswagen  2008   2105.0     141844.0  Petrol  131.0          1.2
15154   Volkswagen  2009   1860.0     112700.0  Petrol  144.0          1.4
15155   Volkswagen  2006   1462.0     133153.0  Petrol  131.0          1.2
15156   Volkswagen  2007   2685.0     119140.0  Petrol  131.0          1.2

[96353 rows x 7 columns]
```

[66]:
```
car_names = []
for i in data_cars['Manufacturer']:
    if i not in car_names:
        car_names.append(i)
```

[67]:
```
# car_names = []
# [car_names.append(i) for i in data_cars['Manufacturer'] if i not in car_names]
```

[68]:
```
car_names
```

[68]:
```
['Abarth',
 'Alfa-Romeo',
 'Aston-Martin',
 'Audi',
 'BMW',
 'Bentley',
 'Chevrolet',
 'Chrysler',
 'Citroen',
 'Dacia',
 'Daewoo',
 'Daihatsu',
 'Daimler',
 'Datsun',
 'Dodge',
 'Ferrari',
 'Fiat',
 'Ford',
 'Honda',
 'Hyundai',
 'Jaguar',
 'Kia',
 'Lada',
 'Lancia',
 'Land-Rover',
 'Lexus',
 'Lotus',
 'MG',
```

```
 'Maserati',
 'Mazda',
 'Mercedes',
 'Mini',
 'Mitsubishi',
 'Morris',
 'Nissan',
 'Opel',
 'Peugeot',
 'Porsche',
 'Renault',
 'Rover',
 'Saab',
 'Seat',
 'Skoda',
 'Smart',
 'Ssangyong',
 'Subaru',
 'Suzuki',
 'TVR',
 'Toyota',
 'Triumph',
 'Volkswagen',
 'Volvo',
 'Bmw',
 'Vauxhall']
```

[69]:
```
################### neuroninis tinklas
```

[70]:
```
data_cars = data_cars.drop(columns=['Manufacturer'])
```

[71]:
```
data_cars.loc[data_cars['Fuel'] == 'Petrol', 'Fuel'] = 0 # petrol = 0
data_cars.loc[data_cars['Fuel'] == 'Diesel', 'Fuel'] = 1 # diesel = 1
```

[72]:
```
# manufacturer_name_to_id = {}
# idx = 0
# for i in car_names:
#     manufacturer_name_to_id.update({i: idx})
#     idx += 1
```

[73]:
```
# manufacturer_name_to_id
```

[74]:
```
data_cars.dtypes
```

[74]:
```
Year            int64
Price         float64
Distance_km   float64
```

```
Fuel            object
Power          float64
Engine_size    float64
dtype: object
```

[75]:
```
data_cars['Year'] = data_cars['Year'].astype('float')
data_cars['Fuel'] = data_cars['Fuel'].astype('float')
```

[76]:
```
# data_cars['Year'] = data_cars['Year'] / 2022
# data_cars['Price'] = data_cars['Price'] / 646605
# data_cars['Distance_km'] = data_cars['Distance_km'] / 520030
# data_cars['Engine_size'] = data_cars['Engine_size'] / 6.6
# data_cars['Power'] = data_cars['Power'] / 20217
```

[77]:
```
data_cars
```

[77]:

	Year	Price	Distance_km	Fuel	Power	Engine_size
0	2022.0	21106.0	0.0	0.0	61.0	1.0
1	2022.0	17427.0	0.0	0.0	88.0	2.0
2	2022.0	18198.0	0.0	0.0	88.0	2.0
3	2022.0	25343.0	0.0	0.0	95.0	2.0
4	2022.0	23909.0	0.0	0.0	101.0	2.0
…	…	…	…	…	…	…
15152	2012.0	7008.0	119140.0	1.0	99.0	2.0
15153	2008.0	2105.0	141844.0	0.0	131.0	1.2
15154	2009.0	1860.0	112700.0	0.0	144.0	1.4
15155	2006.0	1462.0	133153.0	0.0	131.0	1.2
15156	2007.0	2685.0	119140.0	0.0	131.0	1.2

[96353 rows x 6 columns]

[78]:
```
print(data_cars['Price'].max())
print(data_cars['Price'].mean())
print(data_cars['Price'].min())
```

```
646605.0
19680.81250194597
526.0
```

[79]:
```
# (0-5] k --> 0
# (5-10] k --> 1
# (10-15] k --> 2
# (15-20] k --> 3
# (20-25] k --> 4
# (25-35] k --> 5
# (35<=] k --> 6
```

[80]:
```
def price_to_index(start, end, idx):
    data_cars.loc[(data_cars['Price']  > start) & (data_cars['Price'] <= end),␣
 ↪'Price'] = idx

# price_to_index(0, 5000, 0)
# price_to_index(5000, 10000, 1)
# price_to_index(10000, 15000, 2)
# price_to_index(15000, 20000, 3)
# price_to_index(20000, 25000, 4)
# price_to_index(25000, 35000, 5)
# price_to_index(35000, 5000000, 6)
```

[81]:
```
price_to_index(0, 20000, 0)
price_to_index(20000, 200000000, 1)
```

[82]:
```
data_cars
```

[82]:

	Year	Price	Distance_km	Fuel	Power	Engine_size
0	2022.0	1.0	0.0	0.0	61.0	1.0
1	2022.0	0.0	0.0	0.0	88.0	2.0
2	2022.0	0.0	0.0	0.0	88.0	2.0
3	2022.0	1.0	0.0	0.0	95.0	2.0
4	2022.0	1.0	0.0	0.0	101.0	2.0
…	…	…	…	…	…	…
15152	2012.0	0.0	119140.0	1.0	99.0	2.0
15153	2008.0	0.0	141844.0	0.0	131.0	1.2
15154	2009.0	0.0	112700.0	0.0	144.0	1.4
15155	2006.0	0.0	133153.0	0.0	131.0	1.2
15156	2007.0	0.0	119140.0	0.0	131.0	1.2

[96353 rows x 6 columns]

[83]:
```
tf.convert_to_tensor(data_cars)
```

[83]:
```
<tf.Tensor: shape=(96353, 6), dtype=float64, numpy=
array([[2.02200e+03, 1.00000e+00, 0.00000e+00, 0.00000e+00, 6.10000e+01,
        1.00000e+00],
       [2.02200e+03, 0.00000e+00, 0.00000e+00, 0.00000e+00, 8.80000e+01,
        2.00000e+00],
       [2.02200e+03, 0.00000e+00, 0.00000e+00, 0.00000e+00, 8.80000e+01,
        2.00000e+00],
       …,
       [2.00900e+03, 0.00000e+00, 1.12700e+05, 0.00000e+00, 1.44000e+02,
        1.40000e+00],
       [2.00600e+03, 0.00000e+00, 1.33153e+05, 0.00000e+00, 1.31000e+02,
        1.20000e+00],
       [2.00700e+03, 0.00000e+00, 1.19140e+05, 0.00000e+00, 1.31000e+02,
```

```
        1.20000e+00]])>
```

[84]:
```
normalizer = tf.keras.layers.Normalization(axis=-1)
normalizer.adapt(data_cars.drop(columns=['Price']))
```

[85]:
```
normalizer(data_cars.drop(columns=['Price']).iloc[:3])
```

[85]:
```
<tf.Tensor: shape=(3, 5), dtype=float32, numpy=
array([[ 2.2651272 , -1.081996  , -0.86067873, -0.75479716, -1.1706171 ],
       [ 2.2651272 , -1.081996  , -0.86067873, -0.38674808,  0.5978566 ],
       [ 2.2651272 , -1.081996  , -0.86067873, -0.38674808,  0.5978566 ]],
      dtype=float32)>
```

[86]:
```
x_data = data_cars.drop(columns=['Price'])
y_data = data_cars['Price']

x_train, x_test, y_train, y_test = train_test_split(x_data, y_data, test_size=0.
↪3)
```

[87]:
```
data_cars.shape
```

[87]:
```
(96353, 6)
```

[88]:
```
n = 50

model = tf.keras.Sequential([
    normalizer,
    tf.keras.layers.Dense(units=round((n+1)/2), activation='relu'),
    tf.keras.layers.Dropout(rate=0.2),
    tf.keras.layers.Dense(units=round((n+1)/4), activation='relu'),
    tf.keras.layers.Dropout(rate=0.2),
    tf.keras.layers.Dense(units=1, activation='relu')
])

model.compile(loss=tf.keras.losses.BinaryCrossentropy(from_logits=True),
              optimizer='adam',
              metrics=['accuracy'])

val_accuracy_list = []

while len(val_accuracy_list) < 10:
    history = model.fit(x_train,
                        y_train,
                        batch_size=50,
                        epochs=100,
                        validation_data=(x_test, y_test))
    val_accuracy_list.append(history.history['val_accuracy'])
```

```
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5790 -
accuracy: 0.8475 - val_loss: 0.5567 - val_accuracy: 0.8710
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5610 -
accuracy: 0.8684 - val_loss: 0.5549 - val_accuracy: 0.8735
Epoch 3/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5591 -
accuracy: 0.8707 - val_loss: 0.5531 - val_accuracy: 0.8768
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5574 -
accuracy: 0.8741 - val_loss: 0.5509 - val_accuracy: 0.8773
Epoch 5/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5554 -
accuracy: 0.8756 - val_loss: 0.5496 - val_accuracy: 0.8783
Epoch 6/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5528 -
accuracy: 0.8774 - val_loss: 0.5478 - val_accuracy: 0.8790
Epoch 7/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5509 -
accuracy: 0.8787 - val_loss: 0.5466 - val_accuracy: 0.8804
Epoch 8/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5503 -
accuracy: 0.8791 - val_loss: 0.5456 - val_accuracy: 0.8809
Epoch 9/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5489 -
accuracy: 0.8812 - val_loss: 0.5453 - val_accuracy: 0.8788
Epoch 10/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5478 -
accuracy: 0.8816 - val_loss: 0.5444 - val_accuracy: 0.8794
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5477 -
accuracy: 0.8814 - val_loss: 0.5436 - val_accuracy: 0.8826
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5468 -
accuracy: 0.8817 - val_loss: 0.5429 - val_accuracy: 0.8841
Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5467 -
accuracy: 0.8820 - val_loss: 0.5429 - val_accuracy: 0.8800
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5457 -
accuracy: 0.8824 - val_loss: 0.5429 - val_accuracy: 0.8820
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5458 -
accuracy: 0.8823 - val_loss: 0.5420 - val_accuracy: 0.8837
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5452 -
accuracy: 0.8839 - val_loss: 0.5415 - val_accuracy: 0.8836
```

```
Epoch 17/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5450 -
accuracy: 0.8830 - val_loss: 0.5412 - val_accuracy: 0.8832
Epoch 18/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5451 -
accuracy: 0.8828 - val_loss: 0.5412 - val_accuracy: 0.8847
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5446 -
accuracy: 0.8824 - val_loss: 0.5419 - val_accuracy: 0.8806
Epoch 20/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5448 -
accuracy: 0.8819 - val_loss: 0.5407 - val_accuracy: 0.8854
Epoch 21/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5441 -
accuracy: 0.8834 - val_loss: 0.5406 - val_accuracy: 0.8823
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5435 -
accuracy: 0.8833 - val_loss: 0.5409 - val_accuracy: 0.8805
Epoch 23/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5435 -
accuracy: 0.8834 - val_loss: 0.5413 - val_accuracy: 0.8811
Epoch 24/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5432 -
accuracy: 0.8835 - val_loss: 0.5402 - val_accuracy: 0.8867
Epoch 25/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5437 -
accuracy: 0.8824 - val_loss: 0.5400 - val_accuracy: 0.8822
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5436 -
accuracy: 0.8824 - val_loss: 0.5394 - val_accuracy: 0.8856
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5433 -
accuracy: 0.8843 - val_loss: 0.5398 - val_accuracy: 0.8829
Epoch 28/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5431 -
accuracy: 0.8835 - val_loss: 0.5396 - val_accuracy: 0.8842
Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5430 -
accuracy: 0.8844 - val_loss: 0.5392 - val_accuracy: 0.8842
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5424 -
accuracy: 0.8842 - val_loss: 0.5386 - val_accuracy: 0.8859
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5432 -
accuracy: 0.8833 - val_loss: 0.5392 - val_accuracy: 0.8832
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5423 -
accuracy: 0.8838 - val_loss: 0.5394 - val_accuracy: 0.8878
```

```
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5431 -
accuracy: 0.8834 - val_loss: 0.5389 - val_accuracy: 0.8841
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5432 -
accuracy: 0.8825 - val_loss: 0.5391 - val_accuracy: 0.8855
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5423 -
accuracy: 0.8840 - val_loss: 0.5388 - val_accuracy: 0.8840
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5428 -
accuracy: 0.8822 - val_loss: 0.5390 - val_accuracy: 0.8835
Epoch 37/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5430 -
accuracy: 0.8838 - val_loss: 0.5380 - val_accuracy: 0.8852
Epoch 38/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5420 -
accuracy: 0.8836 - val_loss: 0.5388 - val_accuracy: 0.8831
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5423 -
accuracy: 0.8842 - val_loss: 0.5392 - val_accuracy: 0.8875
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5431 -
accuracy: 0.8835 - val_loss: 0.5387 - val_accuracy: 0.8837
Epoch 41/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5422 -
accuracy: 0.8841 - val_loss: 0.5380 - val_accuracy: 0.8842
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5422 -
accuracy: 0.8841 - val_loss: 0.5387 - val_accuracy: 0.8860
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5424 -
accuracy: 0.8834 - val_loss: 0.5386 - val_accuracy: 0.8852
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5421 -
accuracy: 0.8838 - val_loss: 0.5379 - val_accuracy: 0.8852
Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5421 -
accuracy: 0.8848 - val_loss: 0.5381 - val_accuracy: 0.8849
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5417 -
accuracy: 0.8834 - val_loss: 0.5379 - val_accuracy: 0.8848
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5415 -
accuracy: 0.8842 - val_loss: 0.5385 - val_accuracy: 0.8821
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5419 -
accuracy: 0.8838 - val_loss: 0.5380 - val_accuracy: 0.8827
```

```
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5421 -
accuracy: 0.8825 - val_loss: 0.5381 - val_accuracy: 0.8841
Epoch 50/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5417 -
accuracy: 0.8853 - val_loss: 0.5400 - val_accuracy: 0.8812
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5414 -
accuracy: 0.8850 - val_loss: 0.5376 - val_accuracy: 0.8870
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5415 -
accuracy: 0.8845 - val_loss: 0.5371 - val_accuracy: 0.8868
Epoch 53/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5415 -
accuracy: 0.8845 - val_loss: 0.5391 - val_accuracy: 0.8842
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5416 -
accuracy: 0.8847 - val_loss: 0.5388 - val_accuracy: 0.8832
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5411 -
accuracy: 0.8851 - val_loss: 0.5368 - val_accuracy: 0.8862
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5416 -
accuracy: 0.8852 - val_loss: 0.5377 - val_accuracy: 0.8832
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5416 -
accuracy: 0.8839 - val_loss: 0.5382 - val_accuracy: 0.8829
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5419 -
accuracy: 0.8839 - val_loss: 0.5385 - val_accuracy: 0.8859
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5407 -
accuracy: 0.8853 - val_loss: 0.5376 - val_accuracy: 0.8842
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5410 -
accuracy: 0.8842 - val_loss: 0.5385 - val_accuracy: 0.8863
Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5409 -
accuracy: 0.8850 - val_loss: 0.5371 - val_accuracy: 0.8857
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5407 -
accuracy: 0.8858 - val_loss: 0.5371 - val_accuracy: 0.8860
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5412 -
accuracy: 0.8850 - val_loss: 0.5382 - val_accuracy: 0.8859
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5413 -
accuracy: 0.8844 - val_loss: 0.5379 - val_accuracy: 0.8848
```

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Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5413 -
accuracy: 0.8839 - val_loss: 0.5381 - val_accuracy: 0.8852
Epoch 66/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5413 -
accuracy: 0.8835 - val_loss: 0.5364 - val_accuracy: 0.8866
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5415 -
accuracy: 0.8837 - val_loss: 0.5382 - val_accuracy: 0.8838
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5413 -
accuracy: 0.8851 - val_loss: 0.5397 - val_accuracy: 0.8804
Epoch 69/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.5410 -
accuracy: 0.8848 - val_loss: 0.5372 - val_accuracy: 0.8863
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5406 -
accuracy: 0.8854 - val_loss: 0.5369 - val_accuracy: 0.8860
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5407 -
accuracy: 0.8853 - val_loss: 0.5368 - val_accuracy: 0.8874
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5412 -
accuracy: 0.8840 - val_loss: 0.5371 - val_accuracy: 0.8852
Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5408 -
accuracy: 0.8852 - val_loss: 0.5372 - val_accuracy: 0.8856
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5413 -
accuracy: 0.8838 - val_loss: 0.5364 - val_accuracy: 0.8864
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5414 -
accuracy: 0.8834 - val_loss: 0.5368 - val_accuracy: 0.8859
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5411 -
accuracy: 0.8851 - val_loss: 0.5364 - val_accuracy: 0.8871
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5404 -
accuracy: 0.8847 - val_loss: 0.5386 - val_accuracy: 0.8827
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5412 -
accuracy: 0.8847 - val_loss: 0.5368 - val_accuracy: 0.8856
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5418 -
accuracy: 0.8841 - val_loss: 0.5384 - val_accuracy: 0.8817
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5400 -
accuracy: 0.8855 - val_loss: 0.5365 - val_accuracy: 0.8863
```

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Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5404 -
accuracy: 0.8848 - val_loss: 0.5382 - val_accuracy: 0.8840
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5405 -
accuracy: 0.8856 - val_loss: 0.5366 - val_accuracy: 0.8858
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5411 -
accuracy: 0.8844 - val_loss: 0.5369 - val_accuracy: 0.8864
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5405 -
accuracy: 0.8848 - val_loss: 0.5370 - val_accuracy: 0.8859
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5410 -
accuracy: 0.8836 - val_loss: 0.5364 - val_accuracy: 0.8858
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5411 -
accuracy: 0.8844 - val_loss: 0.5368 - val_accuracy: 0.8868
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5414 -
accuracy: 0.8839 - val_loss: 0.5367 - val_accuracy: 0.8864
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5412 -
accuracy: 0.8836 - val_loss: 0.5372 - val_accuracy: 0.8867
Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5408 -
accuracy: 0.8852 - val_loss: 0.5368 - val_accuracy: 0.8870
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5409 -
accuracy: 0.8835 - val_loss: 0.5378 - val_accuracy: 0.8873
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5406 -
accuracy: 0.8853 - val_loss: 0.5371 - val_accuracy: 0.8851
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5407 -
accuracy: 0.8864 - val_loss: 0.5386 - val_accuracy: 0.8866
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5406 -
accuracy: 0.8855 - val_loss: 0.5367 - val_accuracy: 0.8870
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5404 -
accuracy: 0.8855 - val_loss: 0.5367 - val_accuracy: 0.8858
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5406 -
accuracy: 0.8849 - val_loss: 0.5370 - val_accuracy: 0.8867
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5410 -
accuracy: 0.8847 - val_loss: 0.5366 - val_accuracy: 0.8875
```

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Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5410 -
accuracy: 0.8852 - val_loss: 0.5380 - val_accuracy: 0.8836
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5406 -
accuracy: 0.8846 - val_loss: 0.5373 - val_accuracy: 0.8863
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5405 -
accuracy: 0.8850 - val_loss: 0.5361 - val_accuracy: 0.8878
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5404 -
accuracy: 0.8856 - val_loss: 0.5387 - val_accuracy: 0.8842
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5406 -
accuracy: 0.8845 - val_loss: 0.5363 - val_accuracy: 0.8868
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5406 -
accuracy: 0.8851 - val_loss: 0.5375 - val_accuracy: 0.8874
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5400 -
accuracy: 0.8859 - val_loss: 0.5364 - val_accuracy: 0.8867
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5404 -
accuracy: 0.8847 - val_loss: 0.5370 - val_accuracy: 0.8866
Epoch 5/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5404 -
accuracy: 0.8838 - val_loss: 0.5371 - val_accuracy: 0.8846
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5404 -
accuracy: 0.8859 - val_loss: 0.5381 - val_accuracy: 0.8837
Epoch 7/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5407 -
accuracy: 0.8845 - val_loss: 0.5368 - val_accuracy: 0.8869
Epoch 8/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5411 -
accuracy: 0.8848 - val_loss: 0.5365 - val_accuracy: 0.8850
Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5403 -
accuracy: 0.8857 - val_loss: 0.5369 - val_accuracy: 0.8844
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5405 -
accuracy: 0.8849 - val_loss: 0.5367 - val_accuracy: 0.8860
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5413 -
accuracy: 0.8833 - val_loss: 0.5376 - val_accuracy: 0.8882
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5400 -
accuracy: 0.8862 - val_loss: 0.5367 - val_accuracy: 0.8868
```

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Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5403 -
accuracy: 0.8864 - val_loss: 0.5373 - val_accuracy: 0.8843
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5407 -
accuracy: 0.8857 - val_loss: 0.5384 - val_accuracy: 0.8844
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5404 -
accuracy: 0.8852 - val_loss: 0.5370 - val_accuracy: 0.8865
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8856 - val_loss: 0.5389 - val_accuracy: 0.8847
Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5411 -
accuracy: 0.8849 - val_loss: 0.5370 - val_accuracy: 0.8843
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5403 -
accuracy: 0.8845 - val_loss: 0.5371 - val_accuracy: 0.8869
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5404 -
accuracy: 0.8852 - val_loss: 0.5369 - val_accuracy: 0.8863
Epoch 20/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5401 -
accuracy: 0.8853 - val_loss: 0.5360 - val_accuracy: 0.8876
Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5400 -
accuracy: 0.8852 - val_loss: 0.5370 - val_accuracy: 0.8843
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5403 -
accuracy: 0.8852 - val_loss: 0.5372 - val_accuracy: 0.8837
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5404 -
accuracy: 0.8851 - val_loss: 0.5377 - val_accuracy: 0.8840
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5399 -
accuracy: 0.8859 - val_loss: 0.5363 - val_accuracy: 0.8860
Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5403 -
accuracy: 0.8858 - val_loss: 0.5368 - val_accuracy: 0.8866
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5403 -
accuracy: 0.8850 - val_loss: 0.5375 - val_accuracy: 0.8828
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5401 -
accuracy: 0.8857 - val_loss: 0.5363 - val_accuracy: 0.8876
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5401 -
accuracy: 0.8856 - val_loss: 0.5378 - val_accuracy: 0.8830
```

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Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5406 -
accuracy: 0.8845 - val_loss: 0.5371 - val_accuracy: 0.8856
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5408 -
accuracy: 0.8848 - val_loss: 0.5365 - val_accuracy: 0.8872
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5401 -
accuracy: 0.8858 - val_loss: 0.5363 - val_accuracy: 0.8858
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5402 -
accuracy: 0.8852 - val_loss: 0.5375 - val_accuracy: 0.8845
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5401 -
accuracy: 0.8851 - val_loss: 0.5372 - val_accuracy: 0.8835
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5399 -
accuracy: 0.8853 - val_loss: 0.5378 - val_accuracy: 0.8819
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5409 -
accuracy: 0.8846 - val_loss: 0.5367 - val_accuracy: 0.8861
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5410 -
accuracy: 0.8844 - val_loss: 0.5368 - val_accuracy: 0.8859
Epoch 37/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5398 -
accuracy: 0.8853 - val_loss: 0.5362 - val_accuracy: 0.8854
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5403 -
accuracy: 0.8853 - val_loss: 0.5366 - val_accuracy: 0.8853
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5400 -
accuracy: 0.8848 - val_loss: 0.5367 - val_accuracy: 0.8853
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5401 -
accuracy: 0.8857 - val_loss: 0.5370 - val_accuracy: 0.8867
Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5410 -
accuracy: 0.8853 - val_loss: 0.5372 - val_accuracy: 0.8853
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5399 -
accuracy: 0.8865 - val_loss: 0.5371 - val_accuracy: 0.8857
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5411 -
accuracy: 0.8845 - val_loss: 0.5369 - val_accuracy: 0.8863
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5401 -
accuracy: 0.8848 - val_loss: 0.5361 - val_accuracy: 0.8881
```

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Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5412 -
accuracy: 0.8862 - val_loss: 0.5370 - val_accuracy: 0.8830
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5404 -
accuracy: 0.8856 - val_loss: 0.5361 - val_accuracy: 0.8856
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5399 -
accuracy: 0.8866 - val_loss: 0.5360 - val_accuracy: 0.8884
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5402 -
accuracy: 0.8865 - val_loss: 0.5360 - val_accuracy: 0.8873
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8859 - val_loss: 0.5360 - val_accuracy: 0.8872
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5402 -
accuracy: 0.8861 - val_loss: 0.5364 - val_accuracy: 0.8880
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5405 -
accuracy: 0.8868 - val_loss: 0.5366 - val_accuracy: 0.8855
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5398 -
accuracy: 0.8860 - val_loss: 0.5365 - val_accuracy: 0.8872
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5402 -
accuracy: 0.8859 - val_loss: 0.5362 - val_accuracy: 0.8868
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8864 - val_loss: 0.5372 - val_accuracy: 0.8838
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5402 -
accuracy: 0.8862 - val_loss: 0.5365 - val_accuracy: 0.8848
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5407 -
accuracy: 0.8857 - val_loss: 0.5359 - val_accuracy: 0.8875
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5398 -
accuracy: 0.8864 - val_loss: 0.5369 - val_accuracy: 0.8874
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5403 -
accuracy: 0.8861 - val_loss: 0.5367 - val_accuracy: 0.8863
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5402 -
accuracy: 0.8855 - val_loss: 0.5365 - val_accuracy: 0.8867
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5400 -
accuracy: 0.8860 - val_loss: 0.5372 - val_accuracy: 0.8854
```

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Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5407 -
accuracy: 0.8857 - val_loss: 0.5354 - val_accuracy: 0.8883
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5405 -
accuracy: 0.8867 - val_loss: 0.5384 - val_accuracy: 0.8843
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5398 -
accuracy: 0.8866 - val_loss: 0.5353 - val_accuracy: 0.8878
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8855 - val_loss: 0.5356 - val_accuracy: 0.8875
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5399 -
accuracy: 0.8864 - val_loss: 0.5358 - val_accuracy: 0.8885
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5402 -
accuracy: 0.8853 - val_loss: 0.5363 - val_accuracy: 0.8852
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8856 - val_loss: 0.5363 - val_accuracy: 0.8849
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5400 -
accuracy: 0.8861 - val_loss: 0.5368 - val_accuracy: 0.8867
Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8871 - val_loss: 0.5355 - val_accuracy: 0.8892
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8871 - val_loss: 0.5372 - val_accuracy: 0.8859
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5399 -
accuracy: 0.8857 - val_loss: 0.5364 - val_accuracy: 0.8848
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5396 -
accuracy: 0.8873 - val_loss: 0.5350 - val_accuracy: 0.8890
Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8865 - val_loss: 0.5347 - val_accuracy: 0.8895
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8872 - val_loss: 0.5351 - val_accuracy: 0.8890
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8872 - val_loss: 0.5355 - val_accuracy: 0.8886
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8880 - val_loss: 0.5359 - val_accuracy: 0.8856
```

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Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8871 - val_loss: 0.5359 - val_accuracy: 0.8872
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5404 -
accuracy: 0.8876 - val_loss: 0.5361 - val_accuracy: 0.8884
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8869 - val_loss: 0.5361 - val_accuracy: 0.8865
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8877 - val_loss: 0.5354 - val_accuracy: 0.8899
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8883 - val_loss: 0.5352 - val_accuracy: 0.8903
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8868 - val_loss: 0.5356 - val_accuracy: 0.8886
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8876 - val_loss: 0.5357 - val_accuracy: 0.8884
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5396 -
accuracy: 0.8877 - val_loss: 0.5353 - val_accuracy: 0.8893
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8871 - val_loss: 0.5367 - val_accuracy: 0.8845
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8871 - val_loss: 0.5361 - val_accuracy: 0.8888
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5400 -
accuracy: 0.8854 - val_loss: 0.5356 - val_accuracy: 0.8899
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8870 - val_loss: 0.5359 - val_accuracy: 0.8874
Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5398 -
accuracy: 0.8870 - val_loss: 0.5366 - val_accuracy: 0.8889
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8865 - val_loss: 0.5350 - val_accuracy: 0.8882
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8868 - val_loss: 0.5360 - val_accuracy: 0.8882
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8878 - val_loss: 0.5351 - val_accuracy: 0.8891
```

```
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8871 - val_loss: 0.5359 - val_accuracy: 0.8881
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5399 -
accuracy: 0.8871 - val_loss: 0.5359 - val_accuracy: 0.8877
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8889 - val_loss: 0.5360 - val_accuracy: 0.8862
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8878 - val_loss: 0.5347 - val_accuracy: 0.8896
Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8887 - val_loss: 0.5367 - val_accuracy: 0.8888
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8871 - val_loss: 0.5356 - val_accuracy: 0.8897
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8862 - val_loss: 0.5351 - val_accuracy: 0.8882
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8873 - val_loss: 0.5351 - val_accuracy: 0.8897
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8876 - val_loss: 0.5354 - val_accuracy: 0.8884
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8864 - val_loss: 0.5355 - val_accuracy: 0.8877
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8868 - val_loss: 0.5353 - val_accuracy: 0.8888
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5396 -
accuracy: 0.8860 - val_loss: 0.5355 - val_accuracy: 0.8899
Epoch 5/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5400 -
accuracy: 0.8864 - val_loss: 0.5347 - val_accuracy: 0.8889
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8867 - val_loss: 0.5344 - val_accuracy: 0.8896
Epoch 7/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8884 - val_loss: 0.5362 - val_accuracy: 0.8912
Epoch 8/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8882 - val_loss: 0.5344 - val_accuracy: 0.8911
```

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Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5400 -
accuracy: 0.8879 - val_loss: 0.5344 - val_accuracy: 0.8907
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8878 - val_loss: 0.5352 - val_accuracy: 0.8890
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8878 - val_loss: 0.5363 - val_accuracy: 0.8884
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8877 - val_loss: 0.5344 - val_accuracy: 0.8890
Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8887 - val_loss: 0.5348 - val_accuracy: 0.8912
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8874 - val_loss: 0.5347 - val_accuracy: 0.8904
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8886 - val_loss: 0.5362 - val_accuracy: 0.8869
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8881 - val_loss: 0.5344 - val_accuracy: 0.8911
Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8878 - val_loss: 0.5347 - val_accuracy: 0.8917
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8890 - val_loss: 0.5357 - val_accuracy: 0.8883
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8879 - val_loss: 0.5341 - val_accuracy: 0.8904
Epoch 20/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8885 - val_loss: 0.5348 - val_accuracy: 0.8894
Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8883 - val_loss: 0.5352 - val_accuracy: 0.8893
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8874 - val_loss: 0.5354 - val_accuracy: 0.8916
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8877 - val_loss: 0.5349 - val_accuracy: 0.8907
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8895 - val_loss: 0.5345 - val_accuracy: 0.8909
```

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Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8872 - val_loss: 0.5358 - val_accuracy: 0.8898
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5400 -
accuracy: 0.8868 - val_loss: 0.5348 - val_accuracy: 0.8887
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8867 - val_loss: 0.5357 - val_accuracy: 0.8904
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8879 - val_loss: 0.5346 - val_accuracy: 0.8907
Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8887 - val_loss: 0.5343 - val_accuracy: 0.8915
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8888 - val_loss: 0.5350 - val_accuracy: 0.8904
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8876 - val_loss: 0.5341 - val_accuracy: 0.8911
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8874 - val_loss: 0.5345 - val_accuracy: 0.8904
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8873 - val_loss: 0.5345 - val_accuracy: 0.8903
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8877 - val_loss: 0.5367 - val_accuracy: 0.8921
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8875 - val_loss: 0.5344 - val_accuracy: 0.8918
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5398 -
accuracy: 0.8888 - val_loss: 0.5355 - val_accuracy: 0.8909
Epoch 37/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5406 -
accuracy: 0.8876 - val_loss: 0.5358 - val_accuracy: 0.8906
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8891 - val_loss: 0.5350 - val_accuracy: 0.8917
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8871 - val_loss: 0.5354 - val_accuracy: 0.8913
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8876 - val_loss: 0.5355 - val_accuracy: 0.8910
```

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Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8876 - val_loss: 0.5341 - val_accuracy: 0.8911
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8880 - val_loss: 0.5343 - val_accuracy: 0.8896
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8891 - val_loss: 0.5346 - val_accuracy: 0.8919
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8885 - val_loss: 0.5349 - val_accuracy: 0.8922
Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8884 - val_loss: 0.5345 - val_accuracy: 0.8889
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8880 - val_loss: 0.5350 - val_accuracy: 0.8892
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8880 - val_loss: 0.5347 - val_accuracy: 0.8908
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8882 - val_loss: 0.5341 - val_accuracy: 0.8920
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8888 - val_loss: 0.5342 - val_accuracy: 0.8900
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8873 - val_loss: 0.5351 - val_accuracy: 0.8909
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8881 - val_loss: 0.5347 - val_accuracy: 0.8901
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8868 - val_loss: 0.5350 - val_accuracy: 0.8890
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8870 - val_loss: 0.5347 - val_accuracy: 0.8911
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8874 - val_loss: 0.5345 - val_accuracy: 0.8909
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8891 - val_loss: 0.5340 - val_accuracy: 0.8924
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5396 -
accuracy: 0.8871 - val_loss: 0.5345 - val_accuracy: 0.8910
```

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Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8884 - val_loss: 0.5343 - val_accuracy: 0.8917
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8876 - val_loss: 0.5364 - val_accuracy: 0.8875
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5399 -
accuracy: 0.8868 - val_loss: 0.5354 - val_accuracy: 0.8897
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8879 - val_loss: 0.5344 - val_accuracy: 0.8920
Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8886 - val_loss: 0.5345 - val_accuracy: 0.8894
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8881 - val_loss: 0.5342 - val_accuracy: 0.8928
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8893 - val_loss: 0.5341 - val_accuracy: 0.8931
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8886 - val_loss: 0.5344 - val_accuracy: 0.8905
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8885 - val_loss: 0.5360 - val_accuracy: 0.8898
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8891 - val_loss: 0.5356 - val_accuracy: 0.8925
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8899 - val_loss: 0.5365 - val_accuracy: 0.8887
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8896 - val_loss: 0.5357 - val_accuracy: 0.8932
Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5400 -
accuracy: 0.8889 - val_loss: 0.5347 - val_accuracy: 0.8927
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8884 - val_loss: 0.5350 - val_accuracy: 0.8892
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8877 - val_loss: 0.5350 - val_accuracy: 0.8892
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8883 - val_loss: 0.5342 - val_accuracy: 0.8907
```

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Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8885 - val_loss: 0.5342 - val_accuracy: 0.8909
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8892 - val_loss: 0.5344 - val_accuracy: 0.8921
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8884 - val_loss: 0.5346 - val_accuracy: 0.8921
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8884 - val_loss: 0.5345 - val_accuracy: 0.8913
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8883 - val_loss: 0.5341 - val_accuracy: 0.8927
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8875 - val_loss: 0.5346 - val_accuracy: 0.8898
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5401 -
accuracy: 0.8875 - val_loss: 0.5354 - val_accuracy: 0.8897
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8882 - val_loss: 0.5365 - val_accuracy: 0.8873
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5401 -
accuracy: 0.8870 - val_loss: 0.5344 - val_accuracy: 0.8903
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8882 - val_loss: 0.5358 - val_accuracy: 0.8910
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8875 - val_loss: 0.5346 - val_accuracy: 0.8914
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8872 - val_loss: 0.5344 - val_accuracy: 0.8898
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8874 - val_loss: 0.5346 - val_accuracy: 0.8910
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8890 - val_loss: 0.5346 - val_accuracy: 0.8886
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8886 - val_loss: 0.5344 - val_accuracy: 0.8905
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5406 -
accuracy: 0.8872 - val_loss: 0.5361 - val_accuracy: 0.8882
```

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Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5412 -
accuracy: 0.8876 - val_loss: 0.5356 - val_accuracy: 0.8876
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8887 - val_loss: 0.5358 - val_accuracy: 0.8879
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5398 -
accuracy: 0.8882 - val_loss: 0.5355 - val_accuracy: 0.8896
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8873 - val_loss: 0.5345 - val_accuracy: 0.8906
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8890 - val_loss: 0.5352 - val_accuracy: 0.8884
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8887 - val_loss: 0.5343 - val_accuracy: 0.8902
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8884 - val_loss: 0.5345 - val_accuracy: 0.8916
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8892 - val_loss: 0.5349 - val_accuracy: 0.8912
Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8888 - val_loss: 0.5349 - val_accuracy: 0.8895
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8896 - val_loss: 0.5357 - val_accuracy: 0.8900
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8886 - val_loss: 0.5344 - val_accuracy: 0.8893
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8891 - val_loss: 0.5343 - val_accuracy: 0.8922
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8888 - val_loss: 0.5377 - val_accuracy: 0.8893
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5399 -
accuracy: 0.8875 - val_loss: 0.5350 - val_accuracy: 0.8914
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8881 - val_loss: 0.5343 - val_accuracy: 0.8903
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8881 - val_loss: 0.5353 - val_accuracy: 0.8895
```

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Epoch 5/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8885 - val_loss: 0.5342 - val_accuracy: 0.8917
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8894 - val_loss: 0.5351 - val_accuracy: 0.8915
Epoch 7/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5396 -
accuracy: 0.8882 - val_loss: 0.5342 - val_accuracy: 0.8902
Epoch 8/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8879 - val_loss: 0.5342 - val_accuracy: 0.8902
Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8884 - val_loss: 0.5350 - val_accuracy: 0.8889
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8881 - val_loss: 0.5349 - val_accuracy: 0.8901
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8884 - val_loss: 0.5367 - val_accuracy: 0.8879
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8867 - val_loss: 0.5360 - val_accuracy: 0.8878
Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8871 - val_loss: 0.5349 - val_accuracy: 0.8907
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8887 - val_loss: 0.5348 - val_accuracy: 0.8901
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8877 - val_loss: 0.5346 - val_accuracy: 0.8893
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8881 - val_loss: 0.5355 - val_accuracy: 0.8924
Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8899 - val_loss: 0.5349 - val_accuracy: 0.8906
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8898 - val_loss: 0.5358 - val_accuracy: 0.8916
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8902 - val_loss: 0.5358 - val_accuracy: 0.8938
Epoch 20/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8902 - val_loss: 0.5350 - val_accuracy: 0.8928
```

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Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5399 -
accuracy: 0.8891 - val_loss: 0.5357 - val_accuracy: 0.8929
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5396 -
accuracy: 0.8902 - val_loss: 0.5353 - val_accuracy: 0.8905
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8897 - val_loss: 0.5353 - val_accuracy: 0.8904
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8903 - val_loss: 0.5363 - val_accuracy: 0.8922
Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8893 - val_loss: 0.5366 - val_accuracy: 0.8909
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8886 - val_loss: 0.5345 - val_accuracy: 0.8912
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5401 -
accuracy: 0.8888 - val_loss: 0.5344 - val_accuracy: 0.8922
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8881 - val_loss: 0.5349 - val_accuracy: 0.8901
Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8869 - val_loss: 0.5356 - val_accuracy: 0.8889
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8881 - val_loss: 0.5348 - val_accuracy: 0.8900
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5398 -
accuracy: 0.8881 - val_loss: 0.5353 - val_accuracy: 0.8928
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8893 - val_loss: 0.5347 - val_accuracy: 0.8905
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8908 - val_loss: 0.5352 - val_accuracy: 0.8900
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8892 - val_loss: 0.5342 - val_accuracy: 0.8913
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8889 - val_loss: 0.5341 - val_accuracy: 0.8910
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8879 - val_loss: 0.5347 - val_accuracy: 0.8919
```

```
Epoch 37/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8885 - val_loss: 0.5352 - val_accuracy: 0.8939
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8899 - val_loss: 0.5360 - val_accuracy: 0.8902
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8892 - val_loss: 0.5349 - val_accuracy: 0.8922
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8894 - val_loss: 0.5343 - val_accuracy: 0.8916
Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8888 - val_loss: 0.5342 - val_accuracy: 0.8919
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8879 - val_loss: 0.5355 - val_accuracy: 0.8924
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8896 - val_loss: 0.5345 - val_accuracy: 0.8909
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8873 - val_loss: 0.5349 - val_accuracy: 0.8911
Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8875 - val_loss: 0.5350 - val_accuracy: 0.8901
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8894 - val_loss: 0.5344 - val_accuracy: 0.8917
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5401 -
accuracy: 0.8881 - val_loss: 0.5351 - val_accuracy: 0.8931
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8884 - val_loss: 0.5345 - val_accuracy: 0.8898
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8881 - val_loss: 0.5351 - val_accuracy: 0.8894
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8878 - val_loss: 0.5344 - val_accuracy: 0.8905
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8878 - val_loss: 0.5349 - val_accuracy: 0.8887
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8884 - val_loss: 0.5350 - val_accuracy: 0.8907
```

```
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8894 - val_loss: 0.5349 - val_accuracy: 0.8918
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8892 - val_loss: 0.5348 - val_accuracy: 0.8933
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8888 - val_loss: 0.5356 - val_accuracy: 0.8906
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8896 - val_loss: 0.5347 - val_accuracy: 0.8917
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8882 - val_loss: 0.5349 - val_accuracy: 0.8892
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8879 - val_loss: 0.5347 - val_accuracy: 0.8911
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8885 - val_loss: 0.5344 - val_accuracy: 0.8894
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8890 - val_loss: 0.5348 - val_accuracy: 0.8907
Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8883 - val_loss: 0.5340 - val_accuracy: 0.8909
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5396 -
accuracy: 0.8873 - val_loss: 0.5342 - val_accuracy: 0.8913
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8886 - val_loss: 0.5356 - val_accuracy: 0.8896
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8871 - val_loss: 0.5353 - val_accuracy: 0.8888
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8893 - val_loss: 0.5343 - val_accuracy: 0.8909
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8882 - val_loss: 0.5340 - val_accuracy: 0.8918
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8894 - val_loss: 0.5339 - val_accuracy: 0.8905
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5396 -
accuracy: 0.8873 - val_loss: 0.5345 - val_accuracy: 0.8904
```

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Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8881 - val_loss: 0.5337 - val_accuracy: 0.8910
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8880 - val_loss: 0.5340 - val_accuracy: 0.8908
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8890 - val_loss: 0.5340 - val_accuracy: 0.8920
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8887 - val_loss: 0.5343 - val_accuracy: 0.8899
Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8879 - val_loss: 0.5338 - val_accuracy: 0.8919
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8894 - val_loss: 0.5337 - val_accuracy: 0.8924
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8891 - val_loss: 0.5341 - val_accuracy: 0.8917
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8897 - val_loss: 0.5344 - val_accuracy: 0.8924
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8890 - val_loss: 0.5368 - val_accuracy: 0.8873
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8895 - val_loss: 0.5347 - val_accuracy: 0.8915
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8892 - val_loss: 0.5345 - val_accuracy: 0.8920
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8888 - val_loss: 0.5352 - val_accuracy: 0.8894
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8891 - val_loss: 0.5348 - val_accuracy: 0.8895
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8886 - val_loss: 0.5346 - val_accuracy: 0.8919
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8902 - val_loss: 0.5349 - val_accuracy: 0.8922
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8886 - val_loss: 0.5359 - val_accuracy: 0.8913
```

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Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5404 -
accuracy: 0.8890 - val_loss: 0.5348 - val_accuracy: 0.8931
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8894 - val_loss: 0.5346 - val_accuracy: 0.8917
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8890 - val_loss: 0.5347 - val_accuracy: 0.8909
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8886 - val_loss: 0.5349 - val_accuracy: 0.8902
Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8888 - val_loss: 0.5350 - val_accuracy: 0.8895
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8895 - val_loss: 0.5344 - val_accuracy: 0.8918
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8892 - val_loss: 0.5360 - val_accuracy: 0.8893
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5404 -
accuracy: 0.8886 - val_loss: 0.5347 - val_accuracy: 0.8905
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5401 -
accuracy: 0.8889 - val_loss: 0.5349 - val_accuracy: 0.8924
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8885 - val_loss: 0.5349 - val_accuracy: 0.8906
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8895 - val_loss: 0.5344 - val_accuracy: 0.8927
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8893 - val_loss: 0.5349 - val_accuracy: 0.8905
Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8878 - val_loss: 0.5351 - val_accuracy: 0.8892
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8876 - val_loss: 0.5354 - val_accuracy: 0.8899
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8868 - val_loss: 0.5350 - val_accuracy: 0.8870
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8871 - val_loss: 0.5341 - val_accuracy: 0.8910
```

```
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8877 - val_loss: 0.5339 - val_accuracy: 0.8905
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8883 - val_loss: 0.5339 - val_accuracy: 0.8896
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8883 - val_loss: 0.5347 - val_accuracy: 0.8922
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8888 - val_loss: 0.5345 - val_accuracy: 0.8907
Epoch 5/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8883 - val_loss: 0.5347 - val_accuracy: 0.8901
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8877 - val_loss: 0.5342 - val_accuracy: 0.8902
Epoch 7/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8890 - val_loss: 0.5344 - val_accuracy: 0.8904
Epoch 8/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8890 - val_loss: 0.5339 - val_accuracy: 0.8908
Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8879 - val_loss: 0.5343 - val_accuracy: 0.8900
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8893 - val_loss: 0.5342 - val_accuracy: 0.8909
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8884 - val_loss: 0.5337 - val_accuracy: 0.8913
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8881 - val_loss: 0.5345 - val_accuracy: 0.8907
Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8894 - val_loss: 0.5342 - val_accuracy: 0.8894
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8887 - val_loss: 0.5362 - val_accuracy: 0.8871
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8887 - val_loss: 0.5342 - val_accuracy: 0.8898
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8878 - val_loss: 0.5348 - val_accuracy: 0.8876
```

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Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8881 - val_loss: 0.5339 - val_accuracy: 0.8923
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8885 - val_loss: 0.5337 - val_accuracy: 0.8915
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8879 - val_loss: 0.5337 - val_accuracy: 0.8904
Epoch 20/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8891 - val_loss: 0.5356 - val_accuracy: 0.8901
Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8893 - val_loss: 0.5344 - val_accuracy: 0.8928
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8886 - val_loss: 0.5355 - val_accuracy: 0.8891
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8897 - val_loss: 0.5348 - val_accuracy: 0.8914
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8899 - val_loss: 0.5353 - val_accuracy: 0.8917
Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8889 - val_loss: 0.5344 - val_accuracy: 0.8913
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8893 - val_loss: 0.5345 - val_accuracy: 0.8922
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8903 - val_loss: 0.5349 - val_accuracy: 0.8896
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8876 - val_loss: 0.5339 - val_accuracy: 0.8912
Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8896 - val_loss: 0.5345 - val_accuracy: 0.8903
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8891 - val_loss: 0.5348 - val_accuracy: 0.8940
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8900 - val_loss: 0.5342 - val_accuracy: 0.8914
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8887 - val_loss: 0.5348 - val_accuracy: 0.8913
```

```
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8896 - val_loss: 0.5348 - val_accuracy: 0.8913
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8892 - val_loss: 0.5355 - val_accuracy: 0.8884
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8888 - val_loss: 0.5344 - val_accuracy: 0.8917
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5396 -
accuracy: 0.8893 - val_loss: 0.5349 - val_accuracy: 0.8918
Epoch 37/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8895 - val_loss: 0.5345 - val_accuracy: 0.8917
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8903 - val_loss: 0.5340 - val_accuracy: 0.8929
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8893 - val_loss: 0.5344 - val_accuracy: 0.8919
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5402 -
accuracy: 0.8890 - val_loss: 0.5349 - val_accuracy: 0.8907
Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8896 - val_loss: 0.5354 - val_accuracy: 0.8889
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8877 - val_loss: 0.5343 - val_accuracy: 0.8916
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5399 -
accuracy: 0.8883 - val_loss: 0.5358 - val_accuracy: 0.8930
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8897 - val_loss: 0.5343 - val_accuracy: 0.8918
Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8896 - val_loss: 0.5343 - val_accuracy: 0.8930
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8901 - val_loss: 0.5341 - val_accuracy: 0.8923
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8895 - val_loss: 0.5346 - val_accuracy: 0.8918
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5405 -
accuracy: 0.8900 - val_loss: 0.5345 - val_accuracy: 0.8916
```

```
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8887 - val_loss: 0.5344 - val_accuracy: 0.8920
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8888 - val_loss: 0.5350 - val_accuracy: 0.8906
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8891 - val_loss: 0.5345 - val_accuracy: 0.8900
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8887 - val_loss: 0.5345 - val_accuracy: 0.8919
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8884 - val_loss: 0.5343 - val_accuracy: 0.8921
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5396 -
accuracy: 0.8895 - val_loss: 0.5351 - val_accuracy: 0.8898
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8898 - val_loss: 0.5370 - val_accuracy: 0.8868
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8899 - val_loss: 0.5364 - val_accuracy: 0.8894
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8897 - val_loss: 0.5342 - val_accuracy: 0.8931
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8892 - val_loss: 0.5345 - val_accuracy: 0.8925
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8893 - val_loss: 0.5343 - val_accuracy: 0.8911
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5396 -
accuracy: 0.8884 - val_loss: 0.5343 - val_accuracy: 0.8924
Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8879 - val_loss: 0.5340 - val_accuracy: 0.8902
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8884 - val_loss: 0.5346 - val_accuracy: 0.8890
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8876 - val_loss: 0.5344 - val_accuracy: 0.8907
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8877 - val_loss: 0.5340 - val_accuracy: 0.8909
```

```
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8885 - val_loss: 0.5337 - val_accuracy: 0.8905
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8881 - val_loss: 0.5342 - val_accuracy: 0.8916
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8886 - val_loss: 0.5347 - val_accuracy: 0.8923
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8897 - val_loss: 0.5349 - val_accuracy: 0.8918
Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8886 - val_loss: 0.5342 - val_accuracy: 0.8914
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5402 -
accuracy: 0.8889 - val_loss: 0.5342 - val_accuracy: 0.8920
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8886 - val_loss: 0.5347 - val_accuracy: 0.8924
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8897 - val_loss: 0.5349 - val_accuracy: 0.8911
Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8885 - val_loss: 0.5341 - val_accuracy: 0.8896
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8864 - val_loss: 0.5352 - val_accuracy: 0.8918
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8879 - val_loss: 0.5344 - val_accuracy: 0.8904
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8882 - val_loss: 0.5357 - val_accuracy: 0.8882
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8874 - val_loss: 0.5345 - val_accuracy: 0.8915
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8894 - val_loss: 0.5341 - val_accuracy: 0.8912
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8880 - val_loss: 0.5347 - val_accuracy: 0.8915
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8887 - val_loss: 0.5361 - val_accuracy: 0.8880
```

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Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8898 - val_loss: 0.5343 - val_accuracy: 0.8909
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8881 - val_loss: 0.5364 - val_accuracy: 0.8886
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8888 - val_loss: 0.5342 - val_accuracy: 0.8903
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8891 - val_loss: 0.5340 - val_accuracy: 0.8898
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8880 - val_loss: 0.5343 - val_accuracy: 0.8893
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8885 - val_loss: 0.5340 - val_accuracy: 0.8892
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8889 - val_loss: 0.5338 - val_accuracy: 0.8913
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8887 - val_loss: 0.5343 - val_accuracy: 0.8912
Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5405 -
accuracy: 0.8880 - val_loss: 0.5344 - val_accuracy: 0.8909
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8878 - val_loss: 0.5343 - val_accuracy: 0.8906
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8891 - val_loss: 0.5350 - val_accuracy: 0.8918
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8888 - val_loss: 0.5345 - val_accuracy: 0.8900
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8884 - val_loss: 0.5339 - val_accuracy: 0.8898
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8891 - val_loss: 0.5339 - val_accuracy: 0.8916
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8893 - val_loss: 0.5346 - val_accuracy: 0.8903
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8880 - val_loss: 0.5337 - val_accuracy: 0.8908
```

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Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8872 - val_loss: 0.5345 - val_accuracy: 0.8916
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8883 - val_loss: 0.5349 - val_accuracy: 0.8905
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8886 - val_loss: 0.5348 - val_accuracy: 0.8891
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8882 - val_loss: 0.5341 - val_accuracy: 0.8913
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8882 - val_loss: 0.5346 - val_accuracy: 0.8886
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8883 - val_loss: 0.5342 - val_accuracy: 0.8898
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8891 - val_loss: 0.5342 - val_accuracy: 0.8903
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8880 - val_loss: 0.5346 - val_accuracy: 0.8889
Epoch 5/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8879 - val_loss: 0.5348 - val_accuracy: 0.8892
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8887 - val_loss: 0.5338 - val_accuracy: 0.8914
Epoch 7/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8893 - val_loss: 0.5346 - val_accuracy: 0.8908
Epoch 8/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8888 - val_loss: 0.5342 - val_accuracy: 0.8900
Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8896 - val_loss: 0.5345 - val_accuracy: 0.8930
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8896 - val_loss: 0.5344 - val_accuracy: 0.8931
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8893 - val_loss: 0.5342 - val_accuracy: 0.8910
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8892 - val_loss: 0.5341 - val_accuracy: 0.8900
```

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Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8895 - val_loss: 0.5344 - val_accuracy: 0.8915
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8889 - val_loss: 0.5342 - val_accuracy: 0.8914
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8903 - val_loss: 0.5347 - val_accuracy: 0.8921
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8900 - val_loss: 0.5342 - val_accuracy: 0.8919
Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8902 - val_loss: 0.5345 - val_accuracy: 0.8916
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8895 - val_loss: 0.5342 - val_accuracy: 0.8914
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8894 - val_loss: 0.5350 - val_accuracy: 0.8895
Epoch 20/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8890 - val_loss: 0.5347 - val_accuracy: 0.8906
Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8898 - val_loss: 0.5339 - val_accuracy: 0.8925
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5398 -
accuracy: 0.8890 - val_loss: 0.5341 - val_accuracy: 0.8923
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8895 - val_loss: 0.5343 - val_accuracy: 0.8921
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8888 - val_loss: 0.5340 - val_accuracy: 0.8935
Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8900 - val_loss: 0.5343 - val_accuracy: 0.8915
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8899 - val_loss: 0.5344 - val_accuracy: 0.8929
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8896 - val_loss: 0.5352 - val_accuracy: 0.8903
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8909 - val_loss: 0.5345 - val_accuracy: 0.8914
```

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Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8900 - val_loss: 0.5340 - val_accuracy: 0.8935
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8907 - val_loss: 0.5342 - val_accuracy: 0.8930
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8879 - val_loss: 0.5341 - val_accuracy: 0.8933
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8887 - val_loss: 0.5345 - val_accuracy: 0.8907
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8895 - val_loss: 0.5341 - val_accuracy: 0.8911
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8901 - val_loss: 0.5354 - val_accuracy: 0.8897
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8890 - val_loss: 0.5343 - val_accuracy: 0.8901
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8895 - val_loss: 0.5340 - val_accuracy: 0.8910
Epoch 37/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8887 - val_loss: 0.5343 - val_accuracy: 0.8901
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8872 - val_loss: 0.5343 - val_accuracy: 0.8888
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8887 - val_loss: 0.5348 - val_accuracy: 0.8919
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8895 - val_loss: 0.5345 - val_accuracy: 0.8905
Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8880 - val_loss: 0.5368 - val_accuracy: 0.8878
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8885 - val_loss: 0.5343 - val_accuracy: 0.8916
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8881 - val_loss: 0.5342 - val_accuracy: 0.8912
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8889 - val_loss: 0.5337 - val_accuracy: 0.8913
```

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Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8891 - val_loss: 0.5363 - val_accuracy: 0.8886
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8894 - val_loss: 0.5342 - val_accuracy: 0.8917
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8890 - val_loss: 0.5338 - val_accuracy: 0.8922
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8887 - val_loss: 0.5346 - val_accuracy: 0.8933
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8902 - val_loss: 0.5343 - val_accuracy: 0.8920
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8893 - val_loss: 0.5347 - val_accuracy: 0.8906
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8891 - val_loss: 0.5342 - val_accuracy: 0.8926
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8899 - val_loss: 0.5351 - val_accuracy: 0.8915
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8898 - val_loss: 0.5332 - val_accuracy: 0.8940
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8904 - val_loss: 0.5343 - val_accuracy: 0.8928
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8885 - val_loss: 0.5344 - val_accuracy: 0.8901
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8882 - val_loss: 0.5346 - val_accuracy: 0.8913
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8895 - val_loss: 0.5339 - val_accuracy: 0.8928
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8910 - val_loss: 0.5349 - val_accuracy: 0.8916
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8898 - val_loss: 0.5363 - val_accuracy: 0.8882
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8903 - val_loss: 0.5355 - val_accuracy: 0.8913
```

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Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8899 - val_loss: 0.5346 - val_accuracy: 0.8932
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8898 - val_loss: 0.5354 - val_accuracy: 0.8905
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8905 - val_loss: 0.5344 - val_accuracy: 0.8918
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8899 - val_loss: 0.5337 - val_accuracy: 0.8932
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8893 - val_loss: 0.5342 - val_accuracy: 0.8914
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8903 - val_loss: 0.5340 - val_accuracy: 0.8926
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8895 - val_loss: 0.5345 - val_accuracy: 0.8925
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8895 - val_loss: 0.5349 - val_accuracy: 0.8904
Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8896 - val_loss: 0.5340 - val_accuracy: 0.8923
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8903 - val_loss: 0.5347 - val_accuracy: 0.8916
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8899 - val_loss: 0.5341 - val_accuracy: 0.8921
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8893 - val_loss: 0.5340 - val_accuracy: 0.8922
Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8890 - val_loss: 0.5344 - val_accuracy: 0.8914
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8882 - val_loss: 0.5340 - val_accuracy: 0.8918
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8899 - val_loss: 0.5340 - val_accuracy: 0.8925
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8896 - val_loss: 0.5347 - val_accuracy: 0.8933
```

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Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8885 - val_loss: 0.5349 - val_accuracy: 0.8905
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8876 - val_loss: 0.5362 - val_accuracy: 0.8879
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8879 - val_loss: 0.5340 - val_accuracy: 0.8906
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8876 - val_loss: 0.5347 - val_accuracy: 0.8904
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8893 - val_loss: 0.5333 - val_accuracy: 0.8917
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8881 - val_loss: 0.5353 - val_accuracy: 0.8884
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8879 - val_loss: 0.5339 - val_accuracy: 0.8921
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8881 - val_loss: 0.5364 - val_accuracy: 0.8892
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8890 - val_loss: 0.5348 - val_accuracy: 0.8924
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8904 - val_loss: 0.5342 - val_accuracy: 0.8939
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8894 - val_loss: 0.5342 - val_accuracy: 0.8916
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8902 - val_loss: 0.5338 - val_accuracy: 0.8929
Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8893 - val_loss: 0.5338 - val_accuracy: 0.8926
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8902 - val_loss: 0.5354 - val_accuracy: 0.8904
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8899 - val_loss: 0.5372 - val_accuracy: 0.8888
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8888 - val_loss: 0.5344 - val_accuracy: 0.8926
```

```
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8894 - val_loss: 0.5343 - val_accuracy: 0.8927
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8903 - val_loss: 0.5345 - val_accuracy: 0.8922
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8895 - val_loss: 0.5342 - val_accuracy: 0.8917
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8894 - val_loss: 0.5371 - val_accuracy: 0.8883
Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8882 - val_loss: 0.5344 - val_accuracy: 0.8917
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8883 - val_loss: 0.5338 - val_accuracy: 0.8926
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8874 - val_loss: 0.5343 - val_accuracy: 0.8886
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8885 - val_loss: 0.5352 - val_accuracy: 0.8904
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8874 - val_loss: 0.5338 - val_accuracy: 0.8915
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8885 - val_loss: 0.5344 - val_accuracy: 0.8921
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8892 - val_loss: 0.5337 - val_accuracy: 0.8923
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8883 - val_loss: 0.5343 - val_accuracy: 0.8929
Epoch 5/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5400 -
accuracy: 0.8878 - val_loss: 0.5340 - val_accuracy: 0.8912
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8891 - val_loss: 0.5345 - val_accuracy: 0.8914
Epoch 7/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8880 - val_loss: 0.5348 - val_accuracy: 0.8892
Epoch 8/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8882 - val_loss: 0.5338 - val_accuracy: 0.8913
```

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Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8896 - val_loss: 0.5355 - val_accuracy: 0.8886
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8876 - val_loss: 0.5343 - val_accuracy: 0.8886
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5396 -
accuracy: 0.8874 - val_loss: 0.5348 - val_accuracy: 0.8911
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8885 - val_loss: 0.5338 - val_accuracy: 0.8900
Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8874 - val_loss: 0.5346 - val_accuracy: 0.8900
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8871 - val_loss: 0.5351 - val_accuracy: 0.8885
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5394 -
accuracy: 0.8881 - val_loss: 0.5339 - val_accuracy: 0.8902
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8898 - val_loss: 0.5344 - val_accuracy: 0.8919
Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8879 - val_loss: 0.5367 - val_accuracy: 0.8875
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8893 - val_loss: 0.5353 - val_accuracy: 0.8888
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8886 - val_loss: 0.5334 - val_accuracy: 0.8918
Epoch 20/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8891 - val_loss: 0.5342 - val_accuracy: 0.8913
Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8884 - val_loss: 0.5342 - val_accuracy: 0.8909
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8879 - val_loss: 0.5351 - val_accuracy: 0.8912
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8888 - val_loss: 0.5352 - val_accuracy: 0.8871
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8864 - val_loss: 0.5344 - val_accuracy: 0.8888
```

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Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8872 - val_loss: 0.5340 - val_accuracy: 0.8912
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8883 - val_loss: 0.5352 - val_accuracy: 0.8882
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8882 - val_loss: 0.5340 - val_accuracy: 0.8916
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8900 - val_loss: 0.5339 - val_accuracy: 0.8896
Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8880 - val_loss: 0.5343 - val_accuracy: 0.8906
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8881 - val_loss: 0.5343 - val_accuracy: 0.8884
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8882 - val_loss: 0.5346 - val_accuracy: 0.8909
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8894 - val_loss: 0.5338 - val_accuracy: 0.8912
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8889 - val_loss: 0.5344 - val_accuracy: 0.8907
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8885 - val_loss: 0.5338 - val_accuracy: 0.8908
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8882 - val_loss: 0.5339 - val_accuracy: 0.8912
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8894 - val_loss: 0.5347 - val_accuracy: 0.8911
Epoch 37/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8890 - val_loss: 0.5355 - val_accuracy: 0.8911
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8895 - val_loss: 0.5340 - val_accuracy: 0.8910
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8886 - val_loss: 0.5351 - val_accuracy: 0.8889
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8879 - val_loss: 0.5349 - val_accuracy: 0.8887
```

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Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8891 - val_loss: 0.5350 - val_accuracy: 0.8902
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8894 - val_loss: 0.5340 - val_accuracy: 0.8913
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8884 - val_loss: 0.5336 - val_accuracy: 0.8914
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8884 - val_loss: 0.5337 - val_accuracy: 0.8917
Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8899 - val_loss: 0.5338 - val_accuracy: 0.8915
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8888 - val_loss: 0.5342 - val_accuracy: 0.8919
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8892 - val_loss: 0.5348 - val_accuracy: 0.8905
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8888 - val_loss: 0.5338 - val_accuracy: 0.8910
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8892 - val_loss: 0.5335 - val_accuracy: 0.8919
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8895 - val_loss: 0.5339 - val_accuracy: 0.8921
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8893 - val_loss: 0.5343 - val_accuracy: 0.8921
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8896 - val_loss: 0.5344 - val_accuracy: 0.8903
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8890 - val_loss: 0.5345 - val_accuracy: 0.8895
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5395 -
accuracy: 0.8876 - val_loss: 0.5345 - val_accuracy: 0.8885
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8887 - val_loss: 0.5341 - val_accuracy: 0.8914
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8881 - val_loss: 0.5335 - val_accuracy: 0.8903
```

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Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8870 - val_loss: 0.5334 - val_accuracy: 0.8911
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8882 - val_loss: 0.5343 - val_accuracy: 0.8906
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8887 - val_loss: 0.5336 - val_accuracy: 0.8919
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8883 - val_loss: 0.5360 - val_accuracy: 0.8876
Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8894 - val_loss: 0.5335 - val_accuracy: 0.8905
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8887 - val_loss: 0.5338 - val_accuracy: 0.8915
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5399 -
accuracy: 0.8883 - val_loss: 0.5352 - val_accuracy: 0.8891
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5398 -
accuracy: 0.8873 - val_loss: 0.5334 - val_accuracy: 0.8916
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8878 - val_loss: 0.5337 - val_accuracy: 0.8924
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8891 - val_loss: 0.5335 - val_accuracy: 0.8915
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8889 - val_loss: 0.5336 - val_accuracy: 0.8906
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8893 - val_loss: 0.5352 - val_accuracy: 0.8906
Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8892 - val_loss: 0.5341 - val_accuracy: 0.8922
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8884 - val_loss: 0.5340 - val_accuracy: 0.8923
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8890 - val_loss: 0.5339 - val_accuracy: 0.8912
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8903 - val_loss: 0.5341 - val_accuracy: 0.8901
```

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Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8892 - val_loss: 0.5340 - val_accuracy: 0.8915
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8893 - val_loss: 0.5350 - val_accuracy: 0.8892
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8880 - val_loss: 0.5338 - val_accuracy: 0.8923
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8897 - val_loss: 0.5336 - val_accuracy: 0.8921
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5396 -
accuracy: 0.8885 - val_loss: 0.5336 - val_accuracy: 0.8917
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8900 - val_loss: 0.5341 - val_accuracy: 0.8915
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8884 - val_loss: 0.5338 - val_accuracy: 0.8909
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8867 - val_loss: 0.5335 - val_accuracy: 0.8913
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8897 - val_loss: 0.5348 - val_accuracy: 0.8876
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8877 - val_loss: 0.5333 - val_accuracy: 0.8911
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8874 - val_loss: 0.5340 - val_accuracy: 0.8892
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8876 - val_loss: 0.5335 - val_accuracy: 0.8909
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8886 - val_loss: 0.5336 - val_accuracy: 0.8906
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8877 - val_loss: 0.5341 - val_accuracy: 0.8915
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8891 - val_loss: 0.5337 - val_accuracy: 0.8906
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8894 - val_loss: 0.5358 - val_accuracy: 0.8911
```

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Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8888 - val_loss: 0.5339 - val_accuracy: 0.8905
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8877 - val_loss: 0.5345 - val_accuracy: 0.8911
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8892 - val_loss: 0.5336 - val_accuracy: 0.8913
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8892 - val_loss: 0.5338 - val_accuracy: 0.8907
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8895 - val_loss: 0.5342 - val_accuracy: 0.8917
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8892 - val_loss: 0.5335 - val_accuracy: 0.8924
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8889 - val_loss: 0.5337 - val_accuracy: 0.8910
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8882 - val_loss: 0.5348 - val_accuracy: 0.8900
Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8888 - val_loss: 0.5342 - val_accuracy: 0.8909
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5371 -
accuracy: 0.8899 - val_loss: 0.5338 - val_accuracy: 0.8921
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8889 - val_loss: 0.5341 - val_accuracy: 0.8914
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8899 - val_loss: 0.5338 - val_accuracy: 0.8916
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8898 - val_loss: 0.5339 - val_accuracy: 0.8916
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8891 - val_loss: 0.5339 - val_accuracy: 0.8921
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8887 - val_loss: 0.5339 - val_accuracy: 0.8902
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8896 - val_loss: 0.5342 - val_accuracy: 0.8919
```

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Epoch 5/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8892 - val_loss: 0.5339 - val_accuracy: 0.8896
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8884 - val_loss: 0.5351 - val_accuracy: 0.8894
Epoch 7/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8894 - val_loss: 0.5340 - val_accuracy: 0.8922
Epoch 8/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8901 - val_loss: 0.5356 - val_accuracy: 0.8884
Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8888 - val_loss: 0.5339 - val_accuracy: 0.8912
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8899 - val_loss: 0.5334 - val_accuracy: 0.8918
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8901 - val_loss: 0.5339 - val_accuracy: 0.8910
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8894 - val_loss: 0.5333 - val_accuracy: 0.8923
Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8898 - val_loss: 0.5339 - val_accuracy: 0.8922
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8900 - val_loss: 0.5338 - val_accuracy: 0.8923
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8894 - val_loss: 0.5354 - val_accuracy: 0.8921
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8890 - val_loss: 0.5339 - val_accuracy: 0.8907
Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8897 - val_loss: 0.5345 - val_accuracy: 0.8919
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8895 - val_loss: 0.5332 - val_accuracy: 0.8917
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8890 - val_loss: 0.5340 - val_accuracy: 0.8923
Epoch 20/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8895 - val_loss: 0.5339 - val_accuracy: 0.8900
```

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Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8892 - val_loss: 0.5341 - val_accuracy: 0.8893
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8895 - val_loss: 0.5345 - val_accuracy: 0.8891
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5371 -
accuracy: 0.8908 - val_loss: 0.5339 - val_accuracy: 0.8914
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8885 - val_loss: 0.5338 - val_accuracy: 0.8903
Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8879 - val_loss: 0.5344 - val_accuracy: 0.8913
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8888 - val_loss: 0.5338 - val_accuracy: 0.8913
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8885 - val_loss: 0.5340 - val_accuracy: 0.8916
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8888 - val_loss: 0.5340 - val_accuracy: 0.8902
Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8886 - val_loss: 0.5361 - val_accuracy: 0.8887
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8897 - val_loss: 0.5337 - val_accuracy: 0.8911
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8903 - val_loss: 0.5341 - val_accuracy: 0.8929
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8894 - val_loss: 0.5343 - val_accuracy: 0.8925
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8893 - val_loss: 0.5345 - val_accuracy: 0.8917
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8904 - val_loss: 0.5336 - val_accuracy: 0.8915
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8896 - val_loss: 0.5338 - val_accuracy: 0.8917
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8897 - val_loss: 0.5336 - val_accuracy: 0.8930
```

```
Epoch 37/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5369 -
accuracy: 0.8908 - val_loss: 0.5340 - val_accuracy: 0.8924
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8896 - val_loss: 0.5339 - val_accuracy: 0.8914
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8896 - val_loss: 0.5336 - val_accuracy: 0.8909
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8892 - val_loss: 0.5337 - val_accuracy: 0.8905
Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8888 - val_loss: 0.5332 - val_accuracy: 0.8924
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8895 - val_loss: 0.5338 - val_accuracy: 0.8921
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8910 - val_loss: 0.5343 - val_accuracy: 0.8918
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8898 - val_loss: 0.5340 - val_accuracy: 0.8921
Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8883 - val_loss: 0.5341 - val_accuracy: 0.8921
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8901 - val_loss: 0.5337 - val_accuracy: 0.8915
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8891 - val_loss: 0.5332 - val_accuracy: 0.8928
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8899 - val_loss: 0.5336 - val_accuracy: 0.8921
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8888 - val_loss: 0.5339 - val_accuracy: 0.8913
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8888 - val_loss: 0.5349 - val_accuracy: 0.8879
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8891 - val_loss: 0.5336 - val_accuracy: 0.8909
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8889 - val_loss: 0.5342 - val_accuracy: 0.8912
```

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Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8890 - val_loss: 0.5360 - val_accuracy: 0.8885
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8893 - val_loss: 0.5336 - val_accuracy: 0.8918
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8899 - val_loss: 0.5339 - val_accuracy: 0.8917
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8901 - val_loss: 0.5333 - val_accuracy: 0.8913
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8896 - val_loss: 0.5335 - val_accuracy: 0.8924
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8894 - val_loss: 0.5342 - val_accuracy: 0.8913
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8884 - val_loss: 0.5349 - val_accuracy: 0.8910
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8886 - val_loss: 0.5343 - val_accuracy: 0.8905
Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8876 - val_loss: 0.5339 - val_accuracy: 0.8902
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8896 - val_loss: 0.5333 - val_accuracy: 0.8916
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8898 - val_loss: 0.5337 - val_accuracy: 0.8912
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8896 - val_loss: 0.5337 - val_accuracy: 0.8897
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8888 - val_loss: 0.5336 - val_accuracy: 0.8906
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8899 - val_loss: 0.5337 - val_accuracy: 0.8921
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8893 - val_loss: 0.5336 - val_accuracy: 0.8917
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8892 - val_loss: 0.5339 - val_accuracy: 0.8912
```

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Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8903 - val_loss: 0.5335 - val_accuracy: 0.8922
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8904 - val_loss: 0.5341 - val_accuracy: 0.8919
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8886 - val_loss: 0.5342 - val_accuracy: 0.8911
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8883 - val_loss: 0.5334 - val_accuracy: 0.8919
Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8891 - val_loss: 0.5345 - val_accuracy: 0.8895
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8893 - val_loss: 0.5349 - val_accuracy: 0.8897
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8893 - val_loss: 0.5345 - val_accuracy: 0.8920
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8894 - val_loss: 0.5344 - val_accuracy: 0.8902
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5397 -
accuracy: 0.8883 - val_loss: 0.5344 - val_accuracy: 0.8905
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8885 - val_loss: 0.5335 - val_accuracy: 0.8911
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8890 - val_loss: 0.5331 - val_accuracy: 0.8927
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8886 - val_loss: 0.5340 - val_accuracy: 0.8921
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8899 - val_loss: 0.5342 - val_accuracy: 0.8923
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8897 - val_loss: 0.5340 - val_accuracy: 0.8927
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8896 - val_loss: 0.5343 - val_accuracy: 0.8905
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8896 - val_loss: 0.5338 - val_accuracy: 0.8921
```

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Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8888 - val_loss: 0.5356 - val_accuracy: 0.8882
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8902 - val_loss: 0.5336 - val_accuracy: 0.8917
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8888 - val_loss: 0.5340 - val_accuracy: 0.8919
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8890 - val_loss: 0.5336 - val_accuracy: 0.8924
Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8899 - val_loss: 0.5336 - val_accuracy: 0.8922
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8898 - val_loss: 0.5358 - val_accuracy: 0.8900
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8882 - val_loss: 0.5335 - val_accuracy: 0.8899
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8879 - val_loss: 0.5333 - val_accuracy: 0.8923
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8890 - val_loss: 0.5335 - val_accuracy: 0.8920
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8895 - val_loss: 0.5342 - val_accuracy: 0.8931
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8903 - val_loss: 0.5338 - val_accuracy: 0.8914
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8894 - val_loss: 0.5338 - val_accuracy: 0.8916
Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8889 - val_loss: 0.5334 - val_accuracy: 0.8936
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8899 - val_loss: 0.5337 - val_accuracy: 0.8920
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8899 - val_loss: 0.5345 - val_accuracy: 0.8925
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8893 - val_loss: 0.5340 - val_accuracy: 0.8914
```

```
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8885 - val_loss: 0.5335 - val_accuracy: 0.8905
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8882 - val_loss: 0.5344 - val_accuracy: 0.8922
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8902 - val_loss: 0.5349 - val_accuracy: 0.8917
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8886 - val_loss: 0.5339 - val_accuracy: 0.8915
Epoch 5/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8887 - val_loss: 0.5338 - val_accuracy: 0.8923
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8899 - val_loss: 0.5334 - val_accuracy: 0.8933
Epoch 7/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8897 - val_loss: 0.5340 - val_accuracy: 0.8925
Epoch 8/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8899 - val_loss: 0.5340 - val_accuracy: 0.8912
Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8895 - val_loss: 0.5349 - val_accuracy: 0.8877
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8903 - val_loss: 0.5365 - val_accuracy: 0.8926
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8907 - val_loss: 0.5341 - val_accuracy: 0.8930
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8902 - val_loss: 0.5335 - val_accuracy: 0.8918
Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8895 - val_loss: 0.5333 - val_accuracy: 0.8926
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8894 - val_loss: 0.5339 - val_accuracy: 0.8912
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8896 - val_loss: 0.5341 - val_accuracy: 0.8931
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8908 - val_loss: 0.5335 - val_accuracy: 0.8924
```

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Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8889 - val_loss: 0.5335 - val_accuracy: 0.8915
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8897 - val_loss: 0.5339 - val_accuracy: 0.8915
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8888 - val_loss: 0.5344 - val_accuracy: 0.8925
Epoch 20/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8892 - val_loss: 0.5346 - val_accuracy: 0.8901
Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8895 - val_loss: 0.5335 - val_accuracy: 0.8915
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8896 - val_loss: 0.5340 - val_accuracy: 0.8924
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8903 - val_loss: 0.5347 - val_accuracy: 0.8903
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8891 - val_loss: 0.5340 - val_accuracy: 0.8921
Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8902 - val_loss: 0.5345 - val_accuracy: 0.8912
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8900 - val_loss: 0.5346 - val_accuracy: 0.8922
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8905 - val_loss: 0.5333 - val_accuracy: 0.8925
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8899 - val_loss: 0.5335 - val_accuracy: 0.8921
Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8906 - val_loss: 0.5339 - val_accuracy: 0.8918
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8899 - val_loss: 0.5340 - val_accuracy: 0.8911
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8895 - val_loss: 0.5336 - val_accuracy: 0.8927
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8906 - val_loss: 0.5339 - val_accuracy: 0.8915
```

```
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5363 -
accuracy: 0.8906 - val_loss: 0.5341 - val_accuracy: 0.8904
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8893 - val_loss: 0.5338 - val_accuracy: 0.8925
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8903 - val_loss: 0.5336 - val_accuracy: 0.8919
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8890 - val_loss: 0.5337 - val_accuracy: 0.8909
Epoch 37/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8896 - val_loss: 0.5336 - val_accuracy: 0.8923
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8893 - val_loss: 0.5333 - val_accuracy: 0.8929
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5389 -
accuracy: 0.8906 - val_loss: 0.5342 - val_accuracy: 0.8923
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5370 -
accuracy: 0.8914 - val_loss: 0.5335 - val_accuracy: 0.8919
Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8899 - val_loss: 0.5337 - val_accuracy: 0.8928
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5371 -
accuracy: 0.8903 - val_loss: 0.5337 - val_accuracy: 0.8907
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8895 - val_loss: 0.5333 - val_accuracy: 0.8929
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8898 - val_loss: 0.5357 - val_accuracy: 0.8927
Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5370 -
accuracy: 0.8909 - val_loss: 0.5339 - val_accuracy: 0.8922
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8902 - val_loss: 0.5343 - val_accuracy: 0.8922
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8902 - val_loss: 0.5345 - val_accuracy: 0.8928
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8903 - val_loss: 0.5335 - val_accuracy: 0.8914
```

```
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8905 - val_loss: 0.5343 - val_accuracy: 0.8933
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8892 - val_loss: 0.5340 - val_accuracy: 0.8909
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8896 - val_loss: 0.5345 - val_accuracy: 0.8914
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8890 - val_loss: 0.5335 - val_accuracy: 0.8916
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8908 - val_loss: 0.5333 - val_accuracy: 0.8922
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8892 - val_loss: 0.5344 - val_accuracy: 0.8908
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8891 - val_loss: 0.5350 - val_accuracy: 0.8886
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8895 - val_loss: 0.5340 - val_accuracy: 0.8904
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8885 - val_loss: 0.5341 - val_accuracy: 0.8890
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8884 - val_loss: 0.5336 - val_accuracy: 0.8905
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8893 - val_loss: 0.5346 - val_accuracy: 0.8899
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8895 - val_loss: 0.5334 - val_accuracy: 0.8911
Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8904 - val_loss: 0.5336 - val_accuracy: 0.8922
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8899 - val_loss: 0.5344 - val_accuracy: 0.8903
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8888 - val_loss: 0.5333 - val_accuracy: 0.8919
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5371 -
accuracy: 0.8902 - val_loss: 0.5335 - val_accuracy: 0.8926
```

```
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5392 -
accuracy: 0.8892 - val_loss: 0.5340 - val_accuracy: 0.8919
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8899 - val_loss: 0.5335 - val_accuracy: 0.8929
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8899 - val_loss: 0.5337 - val_accuracy: 0.8920
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8898 - val_loss: 0.5334 - val_accuracy: 0.8923
Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8898 - val_loss: 0.5335 - val_accuracy: 0.8928
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8898 - val_loss: 0.5333 - val_accuracy: 0.8920
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8903 - val_loss: 0.5337 - val_accuracy: 0.8929
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8890 - val_loss: 0.5335 - val_accuracy: 0.8919
Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8890 - val_loss: 0.5334 - val_accuracy: 0.8921
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8899 - val_loss: 0.5341 - val_accuracy: 0.8919
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8903 - val_loss: 0.5352 - val_accuracy: 0.8890
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8900 - val_loss: 0.5335 - val_accuracy: 0.8927
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8903 - val_loss: 0.5335 - val_accuracy: 0.8923
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8889 - val_loss: 0.5338 - val_accuracy: 0.8920
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8909 - val_loss: 0.5333 - val_accuracy: 0.8915
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8894 - val_loss: 0.5337 - val_accuracy: 0.8918
```

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Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8899 - val_loss: 0.5339 - val_accuracy: 0.8923
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8897 - val_loss: 0.5337 - val_accuracy: 0.8924
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8903 - val_loss: 0.5335 - val_accuracy: 0.8925
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8906 - val_loss: 0.5331 - val_accuracy: 0.8916
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8894 - val_loss: 0.5338 - val_accuracy: 0.8913
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8897 - val_loss: 0.5338 - val_accuracy: 0.8931
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8903 - val_loss: 0.5333 - val_accuracy: 0.8918
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8899 - val_loss: 0.5335 - val_accuracy: 0.8929
Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8884 - val_loss: 0.5346 - val_accuracy: 0.8909
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8883 - val_loss: 0.5333 - val_accuracy: 0.8901
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8889 - val_loss: 0.5340 - val_accuracy: 0.8918
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8896 - val_loss: 0.5337 - val_accuracy: 0.8928
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8905 - val_loss: 0.5343 - val_accuracy: 0.8898
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8893 - val_loss: 0.5342 - val_accuracy: 0.8914
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8903 - val_loss: 0.5332 - val_accuracy: 0.8932
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8912 - val_loss: 0.5331 - val_accuracy: 0.8924
```

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Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5369 -
accuracy: 0.8910 - val_loss: 0.5333 - val_accuracy: 0.8928
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8892 - val_loss: 0.5342 - val_accuracy: 0.8911
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8903 - val_loss: 0.5343 - val_accuracy: 0.8911
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8890 - val_loss: 0.5338 - val_accuracy: 0.8913
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8902 - val_loss: 0.5344 - val_accuracy: 0.8907
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8899 - val_loss: 0.5338 - val_accuracy: 0.8915
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8894 - val_loss: 0.5336 - val_accuracy: 0.8911
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8887 - val_loss: 0.5342 - val_accuracy: 0.8912
Epoch 5/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8889 - val_loss: 0.5337 - val_accuracy: 0.8916
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5371 -
accuracy: 0.8895 - val_loss: 0.5335 - val_accuracy: 0.8911
Epoch 7/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8905 - val_loss: 0.5336 - val_accuracy: 0.8922
Epoch 8/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8899 - val_loss: 0.5341 - val_accuracy: 0.8895
Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8876 - val_loss: 0.5338 - val_accuracy: 0.8900
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8896 - val_loss: 0.5339 - val_accuracy: 0.8922
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5370 -
accuracy: 0.8909 - val_loss: 0.5333 - val_accuracy: 0.8929
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8905 - val_loss: 0.5333 - val_accuracy: 0.8924
```

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Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8887 - val_loss: 0.5346 - val_accuracy: 0.8889
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5393 -
accuracy: 0.8879 - val_loss: 0.5364 - val_accuracy: 0.8876
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5370 -
accuracy: 0.8903 - val_loss: 0.5340 - val_accuracy: 0.8921
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8896 - val_loss: 0.5343 - val_accuracy: 0.8913
Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8907 - val_loss: 0.5346 - val_accuracy: 0.8913
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5370 -
accuracy: 0.8905 - val_loss: 0.5342 - val_accuracy: 0.8918
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8906 - val_loss: 0.5338 - val_accuracy: 0.8927
Epoch 20/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8905 - val_loss: 0.5338 - val_accuracy: 0.8921
Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8891 - val_loss: 0.5355 - val_accuracy: 0.8870
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8892 - val_loss: 0.5336 - val_accuracy: 0.8920
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8905 - val_loss: 0.5337 - val_accuracy: 0.8922
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8898 - val_loss: 0.5335 - val_accuracy: 0.8916
Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8894 - val_loss: 0.5337 - val_accuracy: 0.8924
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8886 - val_loss: 0.5337 - val_accuracy: 0.8899
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8893 - val_loss: 0.5337 - val_accuracy: 0.8911
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8892 - val_loss: 0.5353 - val_accuracy: 0.8881
```

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Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8898 - val_loss: 0.5337 - val_accuracy: 0.8904
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8886 - val_loss: 0.5347 - val_accuracy: 0.8885
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8884 - val_loss: 0.5337 - val_accuracy: 0.8918
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8904 - val_loss: 0.5339 - val_accuracy: 0.8928
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8893 - val_loss: 0.5336 - val_accuracy: 0.8924
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8896 - val_loss: 0.5340 - val_accuracy: 0.8921
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8894 - val_loss: 0.5355 - val_accuracy: 0.8890
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5384 -
accuracy: 0.8888 - val_loss: 0.5348 - val_accuracy: 0.8913
Epoch 37/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8904 - val_loss: 0.5333 - val_accuracy: 0.8916
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8891 - val_loss: 0.5336 - val_accuracy: 0.8917
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8882 - val_loss: 0.5335 - val_accuracy: 0.8910
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8907 - val_loss: 0.5339 - val_accuracy: 0.8924
Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8900 - val_loss: 0.5337 - val_accuracy: 0.8926
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8901 - val_loss: 0.5340 - val_accuracy: 0.8913
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5386 -
accuracy: 0.8891 - val_loss: 0.5334 - val_accuracy: 0.8918
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8901 - val_loss: 0.5335 - val_accuracy: 0.8921
```

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Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5407 -
accuracy: 0.8896 - val_loss: 0.5336 - val_accuracy: 0.8925
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8903 - val_loss: 0.5333 - val_accuracy: 0.8925
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5388 -
accuracy: 0.8892 - val_loss: 0.5339 - val_accuracy: 0.8916
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8909 - val_loss: 0.5335 - val_accuracy: 0.8914
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8903 - val_loss: 0.5341 - val_accuracy: 0.8906
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5390 -
accuracy: 0.8896 - val_loss: 0.5344 - val_accuracy: 0.8913
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8899 - val_loss: 0.5339 - val_accuracy: 0.8929
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8899 - val_loss: 0.5341 - val_accuracy: 0.8912
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8890 - val_loss: 0.5339 - val_accuracy: 0.8915
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8884 - val_loss: 0.5337 - val_accuracy: 0.8907
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8896 - val_loss: 0.5339 - val_accuracy: 0.8919
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8905 - val_loss: 0.5338 - val_accuracy: 0.8921
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8903 - val_loss: 0.5336 - val_accuracy: 0.8925
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8904 - val_loss: 0.5334 - val_accuracy: 0.8914
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8902 - val_loss: 0.5335 - val_accuracy: 0.8923
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5370 -
accuracy: 0.8911 - val_loss: 0.5336 - val_accuracy: 0.8928
```

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Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8910 - val_loss: 0.5333 - val_accuracy: 0.8924
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8906 - val_loss: 0.5333 - val_accuracy: 0.8920
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8894 - val_loss: 0.5341 - val_accuracy: 0.8897
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8901 - val_loss: 0.5336 - val_accuracy: 0.8918
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8895 - val_loss: 0.5340 - val_accuracy: 0.8918
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8897 - val_loss: 0.5335 - val_accuracy: 0.8924
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8898 - val_loss: 0.5338 - val_accuracy: 0.8925
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5373 -
accuracy: 0.8894 - val_loss: 0.5337 - val_accuracy: 0.8918
Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8908 - val_loss: 0.5338 - val_accuracy: 0.8931
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8898 - val_loss: 0.5333 - val_accuracy: 0.8921
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8899 - val_loss: 0.5334 - val_accuracy: 0.8918
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8892 - val_loss: 0.5336 - val_accuracy: 0.8912
Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8890 - val_loss: 0.5337 - val_accuracy: 0.8931
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8892 - val_loss: 0.5346 - val_accuracy: 0.8899
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5387 -
accuracy: 0.8897 - val_loss: 0.5344 - val_accuracy: 0.8901
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8890 - val_loss: 0.5342 - val_accuracy: 0.8914
```

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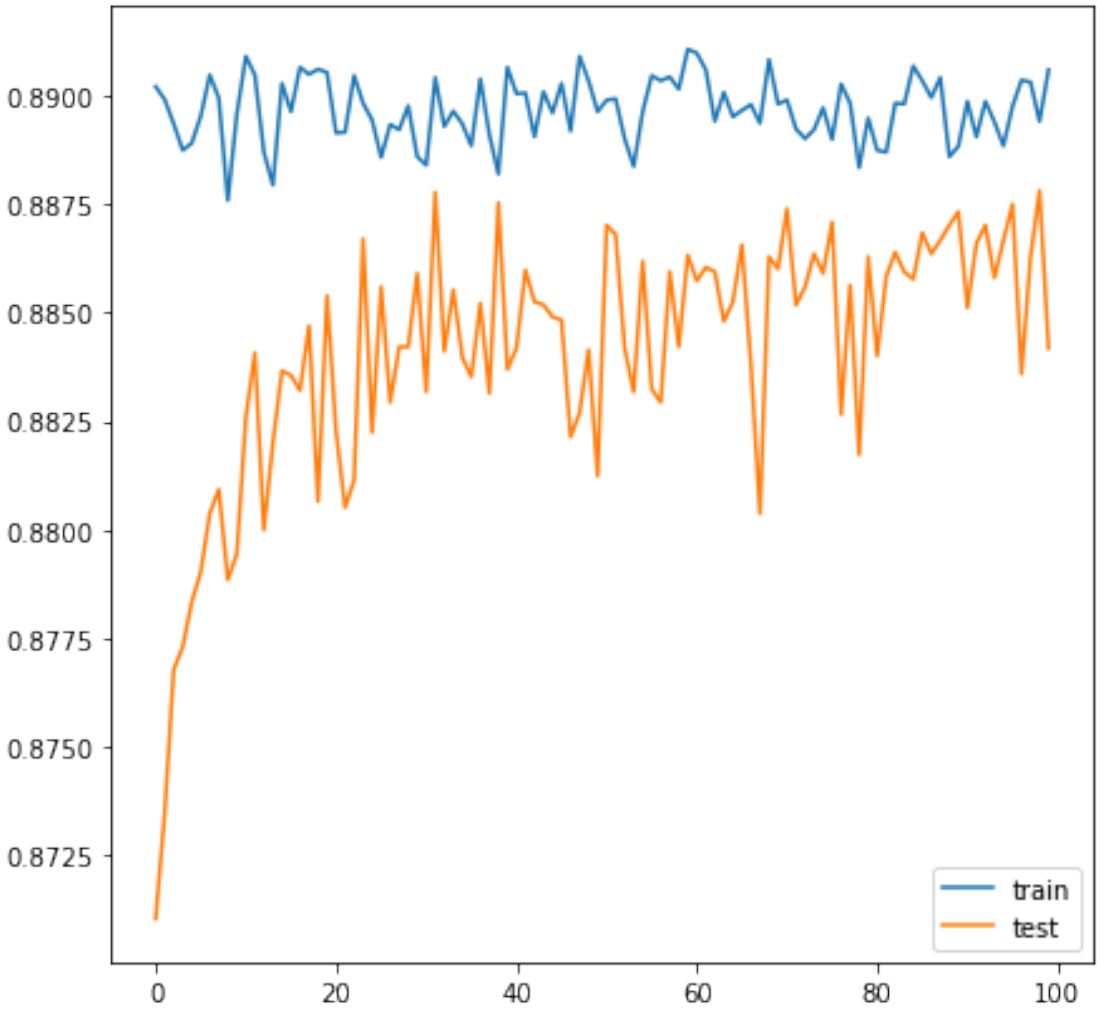
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5377 -
accuracy: 0.8903 - val_loss: 0.5338 - val_accuracy: 0.8920
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5380 -
accuracy: 0.8898 - val_loss: 0.5340 - val_accuracy: 0.8911
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5391 -
accuracy: 0.8883 - val_loss: 0.5335 - val_accuracy: 0.8921
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8895 - val_loss: 0.5334 - val_accuracy: 0.8911
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8887 - val_loss: 0.5343 - val_accuracy: 0.8895
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8887 - val_loss: 0.5337 - val_accuracy: 0.8922
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8898 - val_loss: 0.5344 - val_accuracy: 0.8919
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8898 - val_loss: 0.5340 - val_accuracy: 0.8919
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8907 - val_loss: 0.5334 - val_accuracy: 0.8915
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5370 -
accuracy: 0.8903 - val_loss: 0.5334 - val_accuracy: 0.8920
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5383 -
accuracy: 0.8900 - val_loss: 0.5335 - val_accuracy: 0.8922
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5376 -
accuracy: 0.8904 - val_loss: 0.5338 - val_accuracy: 0.8919
Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8886 - val_loss: 0.5333 - val_accuracy: 0.8910
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5385 -
accuracy: 0.8888 - val_loss: 0.5341 - val_accuracy: 0.8920
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5382 -
accuracy: 0.8899 - val_loss: 0.5338 - val_accuracy: 0.8924
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5379 -
accuracy: 0.8891 - val_loss: 0.5335 - val_accuracy: 0.8918
```

```
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8899 - val_loss: 0.5336 - val_accuracy: 0.8920
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5378 -
accuracy: 0.8894 - val_loss: 0.5335 - val_accuracy: 0.8922
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5374 -
accuracy: 0.8888 - val_loss: 0.5333 - val_accuracy: 0.8925
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8898 - val_loss: 0.5334 - val_accuracy: 0.8915
Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5372 -
accuracy: 0.8904 - val_loss: 0.5338 - val_accuracy: 0.8916
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5371 -
accuracy: 0.8903 - val_loss: 0.5337 - val_accuracy: 0.8925
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5381 -
accuracy: 0.8894 - val_loss: 0.5336 - val_accuracy: 0.8918
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.5375 -
accuracy: 0.8906 - val_loss: 0.5339 - val_accuracy: 0.8927
```

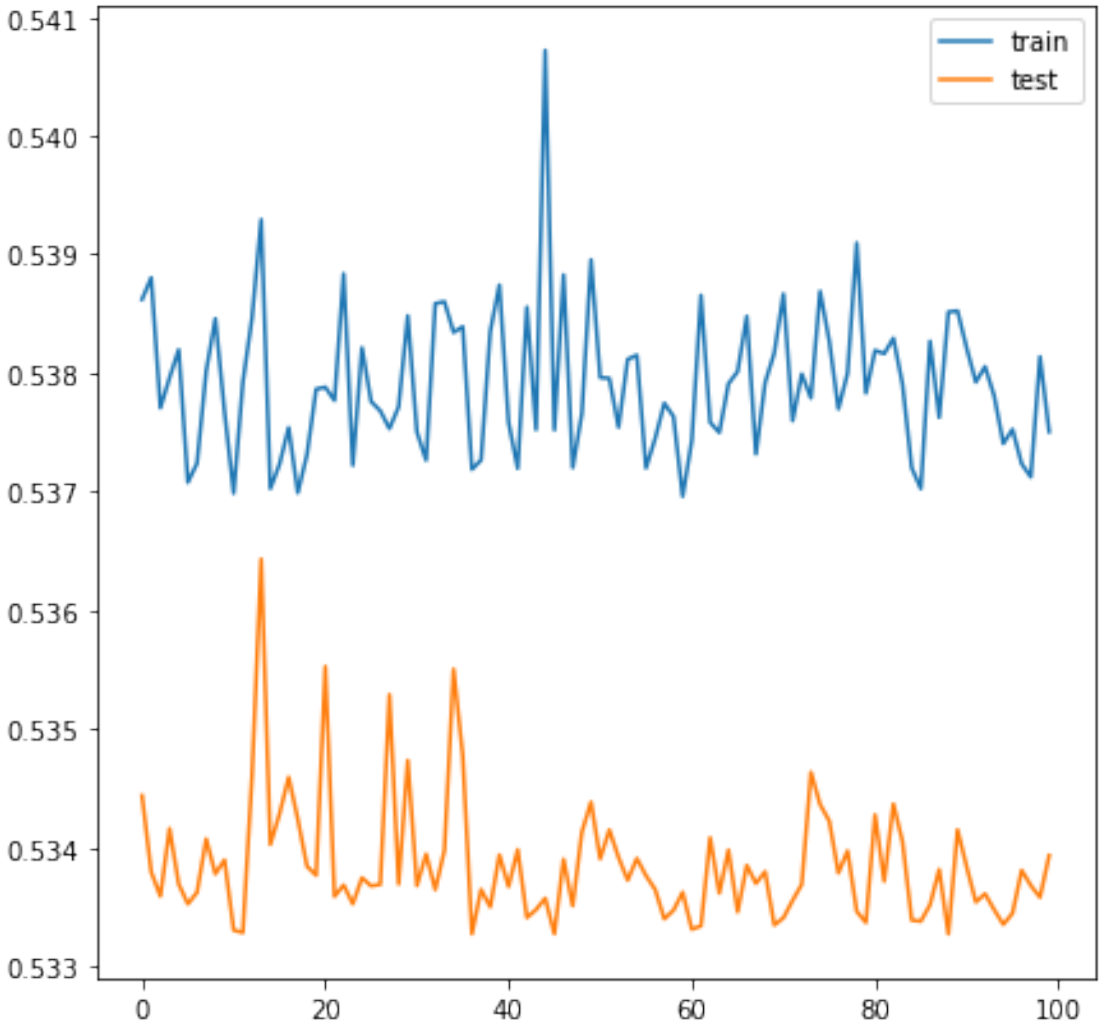
[89]:
```
len(val_accuracy_list)
```

[89]: 10

[90]:
```
plt.figure(figsize=(7, 7))
plt.plot(history.history['accuracy'], label='train')
plt.plot(history.history['val_accuracy'], label='test')
plt.legend()
plt.savefig('accuracy_entropy.jpg', dpi=200)
```



[91]:
```
plt.figure(figsize=(7, 7))
plt.plot(history.history['loss'], label='train')
plt.plot(history.history['val_loss'], label='test')
plt.legend()
plt.savefig('loss_entropy.jpg', dpi=200)
```



[92]:
```
n = 50

model2 = tf.keras.Sequential([
    normalizer,
    tf.keras.layers.Dense(units=round((n+1)/2), activation='relu'),
    tf.keras.layers.Dropout(rate=0.2),
    tf.keras.layers.Dense(units=round((n+1)/4), activation='relu'),
    tf.keras.layers.Dropout(rate=0.2),
    tf.keras.layers.Dense(units=1, activation='relu')
])

model2.compile(loss='mean_squared_error',
               optimizer='adam',
               metrics=['accuracy'])
```

```
val_accuracy_list2 = []

while len(val_accuracy_list2) < 10:
    history2 = model2.fit(x_train,
                          y_train,
                          batch_size=50,
                          epochs=100,
                         validation_data=(x_test, y_test))
    val_accuracy_list2.append(history2.history['val_accuracy'])
```

```
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.1216 -
accuracy: 0.8344 - val_loss: 0.0935 - val_accuracy: 0.8719
Epoch 2/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0960 -
accuracy: 0.8712 - val_loss: 0.0882 - val_accuracy: 0.8749
Epoch 3/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0936 -
accuracy: 0.8749 - val_loss: 0.0870 - val_accuracy: 0.8761
Epoch 4/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0898 -
accuracy: 0.8781 - val_loss: 0.0848 - val_accuracy: 0.8838
Epoch 5/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0883 -
accuracy: 0.8806 - val_loss: 0.0842 - val_accuracy: 0.8874
Epoch 6/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0864 -
accuracy: 0.8838 - val_loss: 0.0830 - val_accuracy: 0.8870
Epoch 7/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0879 -
accuracy: 0.8854 - val_loss: 0.0814 - val_accuracy: 0.8884
Epoch 8/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0841 -
accuracy: 0.8873 - val_loss: 0.0800 - val_accuracy: 0.8904
Epoch 9/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0832 -
accuracy: 0.8874 - val_loss: 0.0801 - val_accuracy: 0.8895
Epoch 10/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0832 -
accuracy: 0.8895 - val_loss: 0.0797 - val_accuracy: 0.8891
Epoch 11/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0825 -
accuracy: 0.8882 - val_loss: 0.0794 - val_accuracy: 0.8897
Epoch 12/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0816 -
accuracy: 0.8894 - val_loss: 0.0790 - val_accuracy: 0.8903
Epoch 13/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0822 -
```

```
accuracy: 0.8895 - val_loss: 0.0790 - val_accuracy: 0.8898
Epoch 14/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0816 -
accuracy: 0.8895 - val_loss: 0.0784 - val_accuracy: 0.8903
Epoch 15/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0817 -
accuracy: 0.8889 - val_loss: 0.0796 - val_accuracy: 0.8904
Epoch 16/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0817 -
accuracy: 0.8894 - val_loss: 0.0786 - val_accuracy: 0.8899
Epoch 17/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0811 -
accuracy: 0.8902 - val_loss: 0.0785 - val_accuracy: 0.8906
Epoch 18/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0812 -
accuracy: 0.8902 - val_loss: 0.0780 - val_accuracy: 0.8907
Epoch 19/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0804 -
accuracy: 0.8900 - val_loss: 0.0791 - val_accuracy: 0.8891
Epoch 20/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0805 -
accuracy: 0.8901 - val_loss: 0.0774 - val_accuracy: 0.8901
Epoch 21/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0805 -
accuracy: 0.8892 - val_loss: 0.0769 - val_accuracy: 0.8906
Epoch 22/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0801 -
accuracy: 0.8908 - val_loss: 0.0769 - val_accuracy: 0.8900
Epoch 23/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0801 -
accuracy: 0.8905 - val_loss: 0.0773 - val_accuracy: 0.8902
Epoch 24/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0798 -
accuracy: 0.8905 - val_loss: 0.0773 - val_accuracy: 0.8894
Epoch 25/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0800 -
accuracy: 0.8902 - val_loss: 0.0765 - val_accuracy: 0.8916
Epoch 26/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0825 -
accuracy: 0.8900 - val_loss: 0.0770 - val_accuracy: 0.8901
Epoch 27/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0796 -
accuracy: 0.8895 - val_loss: 0.0765 - val_accuracy: 0.8906
Epoch 28/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0816 -
accuracy: 0.8910 - val_loss: 0.0766 - val_accuracy: 0.8912
Epoch 29/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0798 -
```

```
accuracy: 0.8905 - val_loss: 0.0772 - val_accuracy: 0.8893
Epoch 30/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0794 -
accuracy: 0.8912 - val_loss: 0.0761 - val_accuracy: 0.8912
Epoch 31/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0791 -
accuracy: 0.8910 - val_loss: 0.0765 - val_accuracy: 0.8921
Epoch 32/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0792 -
accuracy: 0.8915 - val_loss: 0.0767 - val_accuracy: 0.8910
Epoch 33/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0787 -
accuracy: 0.8920 - val_loss: 0.0764 - val_accuracy: 0.8902
Epoch 34/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0792 -
accuracy: 0.8908 - val_loss: 0.0758 - val_accuracy: 0.8915
Epoch 35/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0789 -
accuracy: 0.8913 - val_loss: 0.0761 - val_accuracy: 0.8918
Epoch 36/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0791 -
accuracy: 0.8918 - val_loss: 0.0765 - val_accuracy: 0.8918
Epoch 37/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0788 -
accuracy: 0.8919 - val_loss: 0.0756 - val_accuracy: 0.8913
Epoch 38/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0787 -
accuracy: 0.8918 - val_loss: 0.0755 - val_accuracy: 0.8915
Epoch 39/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0877 -
accuracy: 0.8918 - val_loss: 0.0754 - val_accuracy: 0.8912
Epoch 40/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0792 -
accuracy: 0.8907 - val_loss: 0.0754 - val_accuracy: 0.8914
Epoch 41/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0789 -
accuracy: 0.8910 - val_loss: 0.0756 - val_accuracy: 0.8907
Epoch 42/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0789 -
accuracy: 0.8911 - val_loss: 0.0759 - val_accuracy: 0.8909
Epoch 43/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0787 -
accuracy: 0.8918 - val_loss: 0.0756 - val_accuracy: 0.8911
Epoch 44/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0784 -
accuracy: 0.8915 - val_loss: 0.0757 - val_accuracy: 0.8905
Epoch 45/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0787 -
```

```
accuracy: 0.8914 - val_loss: 0.0751 - val_accuracy: 0.8923
Epoch 46/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0784 -
accuracy: 0.8922 - val_loss: 0.0754 - val_accuracy: 0.8917
Epoch 47/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0783 -
accuracy: 0.8927 - val_loss: 0.0782 - val_accuracy: 0.8917
Epoch 48/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0788 -
accuracy: 0.8911 - val_loss: 0.0748 - val_accuracy: 0.8916
Epoch 49/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0784 -
accuracy: 0.8921 - val_loss: 0.0751 - val_accuracy: 0.8913
Epoch 50/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0788 -
accuracy: 0.8906 - val_loss: 0.0752 - val_accuracy: 0.8910
Epoch 51/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0788 -
accuracy: 0.8914 - val_loss: 0.0756 - val_accuracy: 0.8912
Epoch 52/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0784 -
accuracy: 0.8921 - val_loss: 0.0752 - val_accuracy: 0.8914
Epoch 53/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0969 -
accuracy: 0.8907 - val_loss: 0.0759 - val_accuracy: 0.8909
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0790 -
accuracy: 0.8912 - val_loss: 0.0748 - val_accuracy: 0.8912
Epoch 55/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0807 -
accuracy: 0.8923 - val_loss: 0.0748 - val_accuracy: 0.8920
Epoch 56/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0786 -
accuracy: 0.8910 - val_loss: 0.0752 - val_accuracy: 0.8921
Epoch 57/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0783 -
accuracy: 0.8926 - val_loss: 0.0752 - val_accuracy: 0.8909
Epoch 58/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0785 -
accuracy: 0.8918 - val_loss: 0.0747 - val_accuracy: 0.8926
Epoch 59/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0782 -
accuracy: 0.8925 - val_loss: 0.0747 - val_accuracy: 0.8920
Epoch 60/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0779 -
accuracy: 0.8923 - val_loss: 0.0750 - val_accuracy: 0.8927
Epoch 61/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0790 -
```

```
accuracy: 0.8920 - val_loss: 0.0749 - val_accuracy: 0.8931
Epoch 62/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0784 -
accuracy: 0.8911 - val_loss: 0.0747 - val_accuracy: 0.8927
Epoch 63/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0785 -
accuracy: 0.8924 - val_loss: 0.0750 - val_accuracy: 0.8921
Epoch 64/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0782 -
accuracy: 0.8917 - val_loss: 0.0761 - val_accuracy: 0.8900
Epoch 65/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0783 -
accuracy: 0.8921 - val_loss: 0.0756 - val_accuracy: 0.8898
Epoch 66/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0782 -
accuracy: 0.8927 - val_loss: 0.0747 - val_accuracy: 0.8927
Epoch 67/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0788 -
accuracy: 0.8920 - val_loss: 0.0749 - val_accuracy: 0.8916
Epoch 68/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0787 -
accuracy: 0.8912 - val_loss: 0.0763 - val_accuracy: 0.8901
Epoch 69/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0783 -
accuracy: 0.8923 - val_loss: 0.0748 - val_accuracy: 0.8918
Epoch 70/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0781 -
accuracy: 0.8929 - val_loss: 0.0747 - val_accuracy: 0.8920
Epoch 71/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0787 -
accuracy: 0.8902 - val_loss: 0.0752 - val_accuracy: 0.8946
Epoch 72/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0777 -
accuracy: 0.8921 - val_loss: 0.0761 - val_accuracy: 0.8899
Epoch 73/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0784 -
accuracy: 0.8915 - val_loss: 0.0748 - val_accuracy: 0.8923
Epoch 74/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0793 -
accuracy: 0.8909 - val_loss: 0.0770 - val_accuracy: 0.8941
Epoch 75/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0792 -
accuracy: 0.8907 - val_loss: 0.0763 - val_accuracy: 0.8929
Epoch 76/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0799 -
accuracy: 0.8901 - val_loss: 0.0778 - val_accuracy: 0.8912
Epoch 77/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0790 -
```

```
accuracy: 0.8916 - val_loss: 0.0763 - val_accuracy: 0.8923
Epoch 78/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0789 -
accuracy: 0.8915 - val_loss: 0.0751 - val_accuracy: 0.8926
Epoch 79/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0800 -
accuracy: 0.8909 - val_loss: 0.0787 - val_accuracy: 0.8893
Epoch 80/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0791 -
accuracy: 0.8917 - val_loss: 0.0759 - val_accuracy: 0.8932
Epoch 81/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0790 -
accuracy: 0.8907 - val_loss: 0.0746 - val_accuracy: 0.8947
Epoch 82/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0786 -
accuracy: 0.8918 - val_loss: 0.0752 - val_accuracy: 0.8971
Epoch 83/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0788 -
accuracy: 0.8907 - val_loss: 0.0753 - val_accuracy: 0.8935
Epoch 84/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0786 -
accuracy: 0.8918 - val_loss: 0.0746 - val_accuracy: 0.8941
Epoch 85/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0790 -
accuracy: 0.8913 - val_loss: 0.0748 - val_accuracy: 0.8959
Epoch 86/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0784 -
accuracy: 0.8926 - val_loss: 0.0748 - val_accuracy: 0.8966
Epoch 87/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0785 -
accuracy: 0.8918 - val_loss: 0.0744 - val_accuracy: 0.8969
Epoch 88/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0781 -
accuracy: 0.8924 - val_loss: 0.0747 - val_accuracy: 0.8964
Epoch 89/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0784 -
accuracy: 0.8924 - val_loss: 0.0746 - val_accuracy: 0.8956
Epoch 90/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0787 -
accuracy: 0.8920 - val_loss: 0.0741 - val_accuracy: 0.8965
Epoch 91/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0783 -
accuracy: 0.8920 - val_loss: 0.0737 - val_accuracy: 0.8980
Epoch 92/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0781 -
accuracy: 0.8919 - val_loss: 0.0743 - val_accuracy: 0.8976
Epoch 93/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0782 -
```

```
accuracy: 0.8919 - val_loss: 0.0745 - val_accuracy: 0.8963
Epoch 94/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0777 -
accuracy: 0.8931 - val_loss: 0.0737 - val_accuracy: 0.8974
Epoch 95/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0779 -
accuracy: 0.8929 - val_loss: 0.0744 - val_accuracy: 0.8975
Epoch 96/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0783 -
accuracy: 0.8920 - val_loss: 0.0734 - val_accuracy: 0.8974
Epoch 97/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0782 -
accuracy: 0.8924 - val_loss: 0.0737 - val_accuracy: 0.8973
Epoch 98/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0778 -
accuracy: 0.8929 - val_loss: 0.0736 - val_accuracy: 0.8982
Epoch 99/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0776 -
accuracy: 0.8934 - val_loss: 0.0746 - val_accuracy: 0.8939
Epoch 100/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0779 -
accuracy: 0.8919 - val_loss: 0.0732 - val_accuracy: 0.8994
Epoch 1/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0785 -
accuracy: 0.8924 - val_loss: 0.0748 - val_accuracy: 0.8964
Epoch 2/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0778 -
accuracy: 0.8930 - val_loss: 0.0739 - val_accuracy: 0.8966
Epoch 3/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0776 -
accuracy: 0.8935 - val_loss: 0.0748 - val_accuracy: 0.8967
Epoch 4/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0780 -
accuracy: 0.8918 - val_loss: 0.0733 - val_accuracy: 0.8974
Epoch 5/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0777 -
accuracy: 0.8924 - val_loss: 0.0743 - val_accuracy: 0.8955
Epoch 6/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0779 -
accuracy: 0.8930 - val_loss: 0.0740 - val_accuracy: 0.8967
Epoch 7/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0779 -
accuracy: 0.8916 - val_loss: 0.0740 - val_accuracy: 0.8967
Epoch 8/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0777 -
accuracy: 0.8932 - val_loss: 0.0729 - val_accuracy: 0.8987
Epoch 9/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0778 -
```

```
accuracy: 0.8929 - val_loss: 0.0734 - val_accuracy: 0.8976
Epoch 10/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0778 -
accuracy: 0.8925 - val_loss: 0.0733 - val_accuracy: 0.8982
Epoch 11/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8941 - val_loss: 0.0739 - val_accuracy: 0.8967
Epoch 12/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0778 -
accuracy: 0.8930 - val_loss: 0.0735 - val_accuracy: 0.8970
Epoch 13/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0780 -
accuracy: 0.8924 - val_loss: 0.0730 - val_accuracy: 0.8996
Epoch 14/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0780 -
accuracy: 0.8923 - val_loss: 0.0739 - val_accuracy: 0.8948
Epoch 15/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8928 - val_loss: 0.0751 - val_accuracy: 0.8950
Epoch 16/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0781 -
accuracy: 0.8916 - val_loss: 0.0736 - val_accuracy: 0.8968
Epoch 17/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8935 - val_loss: 0.0749 - val_accuracy: 0.8949
Epoch 18/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0777 -
accuracy: 0.8928 - val_loss: 0.0741 - val_accuracy: 0.8962
Epoch 19/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8932 - val_loss: 0.0732 - val_accuracy: 0.8973
Epoch 20/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0776 -
accuracy: 0.8937 - val_loss: 0.0732 - val_accuracy: 0.8970
Epoch 21/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8933 - val_loss: 0.0734 - val_accuracy: 0.8981
Epoch 22/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0778 -
accuracy: 0.8921 - val_loss: 0.0733 - val_accuracy: 0.8972
Epoch 23/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0780 -
accuracy: 0.8916 - val_loss: 0.0731 - val_accuracy: 0.8983
Epoch 24/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0782 -
accuracy: 0.8919 - val_loss: 0.0739 - val_accuracy: 0.8971
Epoch 25/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
```

```
accuracy: 0.8936 - val_loss: 0.0731 - val_accuracy: 0.8978
Epoch 26/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0778 -
accuracy: 0.8936 - val_loss: 0.0736 - val_accuracy: 0.8965
Epoch 27/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0777 -
accuracy: 0.8931 - val_loss: 0.0737 - val_accuracy: 0.8982
Epoch 28/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0791 -
accuracy: 0.8920 - val_loss: 0.0740 - val_accuracy: 0.8987
Epoch 29/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0777 -
accuracy: 0.8933 - val_loss: 0.0737 - val_accuracy: 0.8955
Epoch 30/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0781 -
accuracy: 0.8931 - val_loss: 0.0736 - val_accuracy: 0.9002
Epoch 31/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8936 - val_loss: 0.0745 - val_accuracy: 0.8983
Epoch 32/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0776 -
accuracy: 0.8929 - val_loss: 0.0730 - val_accuracy: 0.8989
Epoch 33/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0780 -
accuracy: 0.8934 - val_loss: 0.0736 - val_accuracy: 0.8964
Epoch 34/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8935 - val_loss: 0.0747 - val_accuracy: 0.8980
Epoch 35/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0780 -
accuracy: 0.8914 - val_loss: 0.0738 - val_accuracy: 0.8960
Epoch 36/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0782 -
accuracy: 0.8929 - val_loss: 0.0736 - val_accuracy: 0.8994
Epoch 37/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8921 - val_loss: 0.0736 - val_accuracy: 0.8960
Epoch 38/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8927 - val_loss: 0.0728 - val_accuracy: 0.8976
Epoch 39/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0776 -
accuracy: 0.8922 - val_loss: 0.0733 - val_accuracy: 0.8985
Epoch 40/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0777 -
accuracy: 0.8926 - val_loss: 0.0737 - val_accuracy: 0.8957
Epoch 41/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0778 -
```

```
accuracy: 0.8930 - val_loss: 0.0733 - val_accuracy: 0.8960
Epoch 42/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0778 -
accuracy: 0.8923 - val_loss: 0.0735 - val_accuracy: 0.8969
Epoch 43/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0780 -
accuracy: 0.8922 - val_loss: 0.0738 - val_accuracy: 0.8979
Epoch 44/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0779 -
accuracy: 0.8919 - val_loss: 0.0730 - val_accuracy: 0.8994
Epoch 45/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8936 - val_loss: 0.0734 - val_accuracy: 0.8960
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0774 -
accuracy: 0.8933 - val_loss: 0.0740 - val_accuracy: 0.8954
Epoch 47/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8930 - val_loss: 0.0731 - val_accuracy: 0.8970
Epoch 48/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0776 -
accuracy: 0.8928 - val_loss: 0.0734 - val_accuracy: 0.8975
Epoch 49/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0777 -
accuracy: 0.8921 - val_loss: 0.0726 - val_accuracy: 0.9003
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0777 -
accuracy: 0.8918 - val_loss: 0.0742 - val_accuracy: 0.8980
Epoch 51/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0779 -
accuracy: 0.8920 - val_loss: 0.0743 - val_accuracy: 0.8969
Epoch 52/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8929 - val_loss: 0.0729 - val_accuracy: 0.8971
Epoch 53/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0778 -
accuracy: 0.8936 - val_loss: 0.0739 - val_accuracy: 0.8967
Epoch 54/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0776 -
accuracy: 0.8927 - val_loss: 0.0739 - val_accuracy: 0.8958
Epoch 55/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0777 -
accuracy: 0.8920 - val_loss: 0.0736 - val_accuracy: 0.8972
Epoch 56/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0779 -
accuracy: 0.8927 - val_loss: 0.0742 - val_accuracy: 0.8962
Epoch 57/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0776 -
```

```
accuracy: 0.8923 - val_loss: 0.0753 - val_accuracy: 0.8925
Epoch 58/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8930 - val_loss: 0.0735 - val_accuracy: 0.8957
Epoch 59/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8932 - val_loss: 0.0736 - val_accuracy: 0.8963
Epoch 60/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8931 - val_loss: 0.0738 - val_accuracy: 0.8963
Epoch 61/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8931 - val_loss: 0.0739 - val_accuracy: 0.8967
Epoch 62/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8921 - val_loss: 0.0733 - val_accuracy: 0.8993
Epoch 63/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8942 - val_loss: 0.0731 - val_accuracy: 0.8982
Epoch 64/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8943 - val_loss: 0.0731 - val_accuracy: 0.8972
Epoch 65/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8930 - val_loss: 0.0741 - val_accuracy: 0.8976
Epoch 66/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8937 - val_loss: 0.0734 - val_accuracy: 0.8976
Epoch 67/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0776 -
accuracy: 0.8930 - val_loss: 0.0733 - val_accuracy: 0.8957
Epoch 68/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8930 - val_loss: 0.0733 - val_accuracy: 0.8974
Epoch 69/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8932 - val_loss: 0.0732 - val_accuracy: 0.8965
Epoch 70/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0776 -
accuracy: 0.8924 - val_loss: 0.0732 - val_accuracy: 0.8969
Epoch 71/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8940 - val_loss: 0.0733 - val_accuracy: 0.8976
Epoch 72/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8933 - val_loss: 0.0736 - val_accuracy: 0.8978
Epoch 73/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
```

```
accuracy: 0.8921 - val_loss: 0.0738 - val_accuracy: 0.8952
Epoch 74/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8937 - val_loss: 0.0737 - val_accuracy: 0.8963
Epoch 75/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8934 - val_loss: 0.0730 - val_accuracy: 0.8969
Epoch 76/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8947 - val_loss: 0.0739 - val_accuracy: 0.8976
Epoch 77/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0780 -
accuracy: 0.8925 - val_loss: 0.0736 - val_accuracy: 0.8966
Epoch 78/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8932 - val_loss: 0.0732 - val_accuracy: 0.8982
Epoch 79/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0776 -
accuracy: 0.8940 - val_loss: 0.0732 - val_accuracy: 0.8978
Epoch 80/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8941 - val_loss: 0.0737 - val_accuracy: 0.8968
Epoch 81/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8935 - val_loss: 0.0730 - val_accuracy: 0.8981
Epoch 82/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8927 - val_loss: 0.0734 - val_accuracy: 0.8969
Epoch 83/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8931 - val_loss: 0.0727 - val_accuracy: 0.8981
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0775 -
accuracy: 0.8935 - val_loss: 0.0740 - val_accuracy: 0.8979
Epoch 85/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8928 - val_loss: 0.0734 - val_accuracy: 0.8979
Epoch 86/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0776 -
accuracy: 0.8929 - val_loss: 0.0732 - val_accuracy: 0.8974
Epoch 87/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0777 -
accuracy: 0.8925 - val_loss: 0.0731 - val_accuracy: 0.8973
Epoch 88/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8942 - val_loss: 0.0736 - val_accuracy: 0.8960
Epoch 89/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0776 -
```

```
accuracy: 0.8916 - val_loss: 0.0736 - val_accuracy: 0.8966
Epoch 90/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
accuracy: 0.8947 - val_loss: 0.0731 - val_accuracy: 0.8971
Epoch 91/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8944 - val_loss: 0.0733 - val_accuracy: 0.8952
Epoch 92/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8936 - val_loss: 0.0744 - val_accuracy: 0.8947
Epoch 93/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0776 -
accuracy: 0.8928 - val_loss: 0.0736 - val_accuracy: 0.8980
Epoch 94/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8941 - val_loss: 0.0736 - val_accuracy: 0.8956
Epoch 95/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8941 - val_loss: 0.0738 - val_accuracy: 0.8961
Epoch 96/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0778 -
accuracy: 0.8933 - val_loss: 0.0745 - val_accuracy: 0.8954
Epoch 97/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8938 - val_loss: 0.0738 - val_accuracy: 0.8956
Epoch 98/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8945 - val_loss: 0.0725 - val_accuracy: 0.8987
Epoch 99/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0790 -
accuracy: 0.8929 - val_loss: 0.0735 - val_accuracy: 0.8983
Epoch 100/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8933 - val_loss: 0.0731 - val_accuracy: 0.8981
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0777 -
accuracy: 0.8941 - val_loss: 0.0733 - val_accuracy: 0.8972
Epoch 2/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8943 - val_loss: 0.0744 - val_accuracy: 0.8940
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0775 -
accuracy: 0.8931 - val_loss: 0.0740 - val_accuracy: 0.8970
Epoch 4/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8939 - val_loss: 0.0733 - val_accuracy: 0.8984
Epoch 5/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
```

```
accuracy: 0.8952 - val_loss: 0.0738 - val_accuracy: 0.8972
Epoch 6/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8939 - val_loss: 0.0737 - val_accuracy: 0.8972
Epoch 7/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8934 - val_loss: 0.0734 - val_accuracy: 0.8961
Epoch 8/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0777 -
accuracy: 0.8933 - val_loss: 0.0732 - val_accuracy: 0.8981
Epoch 9/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8943 - val_loss: 0.0730 - val_accuracy: 0.8986
Epoch 10/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8926 - val_loss: 0.0738 - val_accuracy: 0.8970
Epoch 11/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8946 - val_loss: 0.0731 - val_accuracy: 0.8983
Epoch 12/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8944 - val_loss: 0.0731 - val_accuracy: 0.8995
Epoch 13/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8941 - val_loss: 0.0727 - val_accuracy: 0.8996
Epoch 14/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8931 - val_loss: 0.0728 - val_accuracy: 0.8979
Epoch 15/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8931 - val_loss: 0.0730 - val_accuracy: 0.8978
Epoch 16/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8928 - val_loss: 0.0737 - val_accuracy: 0.8969
Epoch 17/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8934 - val_loss: 0.0734 - val_accuracy: 0.8986
Epoch 18/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8935 - val_loss: 0.0735 - val_accuracy: 0.8961
Epoch 19/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8939 - val_loss: 0.0732 - val_accuracy: 0.8979
Epoch 20/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8927 - val_loss: 0.0731 - val_accuracy: 0.8978
Epoch 21/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
```

```
accuracy: 0.8941 - val_loss: 0.0731 - val_accuracy: 0.8970
Epoch 22/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8924 - val_loss: 0.0746 - val_accuracy: 0.8954
Epoch 23/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8942 - val_loss: 0.0733 - val_accuracy: 0.8966
Epoch 24/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8940 - val_loss: 0.0736 - val_accuracy: 0.8981
Epoch 25/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8930 - val_loss: 0.0738 - val_accuracy: 0.8975
Epoch 26/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8929 - val_loss: 0.0728 - val_accuracy: 0.8994
Epoch 27/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8937 - val_loss: 0.0731 - val_accuracy: 0.8990
Epoch 28/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8940 - val_loss: 0.0739 - val_accuracy: 0.8980
Epoch 29/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8938 - val_loss: 0.0735 - val_accuracy: 0.8968
Epoch 30/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8939 - val_loss: 0.0729 - val_accuracy: 0.8993
Epoch 31/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8934 - val_loss: 0.0733 - val_accuracy: 0.8969
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8937 - val_loss: 0.0737 - val_accuracy: 0.8975
Epoch 33/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8936 - val_loss: 0.0740 - val_accuracy: 0.8942
Epoch 34/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8943 - val_loss: 0.0732 - val_accuracy: 0.8985
Epoch 35/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8934 - val_loss: 0.0736 - val_accuracy: 0.8981
Epoch 36/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8934 - val_loss: 0.0730 - val_accuracy: 0.8978
Epoch 37/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
```

```
accuracy: 0.8934 - val_loss: 0.0729 - val_accuracy: 0.8987
Epoch 38/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8941 - val_loss: 0.0732 - val_accuracy: 0.8982
Epoch 39/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8940 - val_loss: 0.0734 - val_accuracy: 0.8955
Epoch 40/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8937 - val_loss: 0.0731 - val_accuracy: 0.8975
Epoch 41/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8931 - val_loss: 0.0730 - val_accuracy: 0.8981
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0778 -
accuracy: 0.8940 - val_loss: 0.0739 - val_accuracy: 0.8966
Epoch 43/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8933 - val_loss: 0.0734 - val_accuracy: 0.8968
Epoch 44/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8930 - val_loss: 0.0733 - val_accuracy: 0.8971
Epoch 45/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8927 - val_loss: 0.0732 - val_accuracy: 0.8973
Epoch 46/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8941 - val_loss: 0.0739 - val_accuracy: 0.8982
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8943 - val_loss: 0.0726 - val_accuracy: 0.8970
Epoch 48/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8935 - val_loss: 0.0730 - val_accuracy: 0.8971
Epoch 49/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8937 - val_loss: 0.0732 - val_accuracy: 0.8967
Epoch 50/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8939 - val_loss: 0.0725 - val_accuracy: 0.8980
Epoch 51/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0766 -
accuracy: 0.8940 - val_loss: 0.0737 - val_accuracy: 0.8962
Epoch 52/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8937 - val_loss: 0.0735 - val_accuracy: 0.8971
Epoch 53/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0766 -
```

```
accuracy: 0.8941 - val_loss: 0.0741 - val_accuracy: 0.8978
Epoch 54/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8944 - val_loss: 0.0734 - val_accuracy: 0.8955
Epoch 55/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8933 - val_loss: 0.0730 - val_accuracy: 0.8977
Epoch 56/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8940 - val_loss: 0.0732 - val_accuracy: 0.8966
Epoch 57/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8936 - val_loss: 0.0727 - val_accuracy: 0.8976
Epoch 58/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8953 - val_loss: 0.0734 - val_accuracy: 0.8948
Epoch 59/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8926 - val_loss: 0.0726 - val_accuracy: 0.8988
Epoch 60/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8931 - val_loss: 0.0736 - val_accuracy: 0.8978
Epoch 61/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8926 - val_loss: 0.0727 - val_accuracy: 0.8974
Epoch 62/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8941 - val_loss: 0.0731 - val_accuracy: 0.8978
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8935 - val_loss: 0.0729 - val_accuracy: 0.8991
Epoch 64/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8944 - val_loss: 0.0731 - val_accuracy: 0.8959
Epoch 65/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8936 - val_loss: 0.0733 - val_accuracy: 0.8955
Epoch 66/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0794 -
accuracy: 0.8941 - val_loss: 0.0732 - val_accuracy: 0.8975
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0772 -
accuracy: 0.8930 - val_loss: 0.0734 - val_accuracy: 0.8991
Epoch 68/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8939 - val_loss: 0.0726 - val_accuracy: 0.8981
Epoch 69/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
```

```
accuracy: 0.8940 - val_loss: 0.0728 - val_accuracy: 0.8986
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0787 -
accuracy: 0.8924 - val_loss: 0.0728 - val_accuracy: 0.8977
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
accuracy: 0.8929 - val_loss: 0.0729 - val_accuracy: 0.8986
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0774 -
accuracy: 0.8930 - val_loss: 0.0732 - val_accuracy: 0.8957
Epoch 73/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8936 - val_loss: 0.0731 - val_accuracy: 0.8974
Epoch 74/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8947 - val_loss: 0.0727 - val_accuracy: 0.8993
Epoch 75/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8932 - val_loss: 0.0735 - val_accuracy: 0.8988
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8944 - val_loss: 0.0732 - val_accuracy: 0.8970
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8935 - val_loss: 0.0731 - val_accuracy: 0.8958
Epoch 78/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
accuracy: 0.8932 - val_loss: 0.0725 - val_accuracy: 0.8984
Epoch 79/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0765 -
accuracy: 0.8949 - val_loss: 0.0730 - val_accuracy: 0.8999
Epoch 80/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8941 - val_loss: 0.0730 - val_accuracy: 0.8975
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0772 -
accuracy: 0.8927 - val_loss: 0.0735 - val_accuracy: 0.8966
Epoch 82/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8954 - val_loss: 0.0732 - val_accuracy: 0.8976
Epoch 83/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8930 - val_loss: 0.0728 - val_accuracy: 0.8986
Epoch 84/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8933 - val_loss: 0.0728 - val_accuracy: 0.8986
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
```

```
accuracy: 0.8935 - val_loss: 0.0730 - val_accuracy: 0.8968
Epoch 86/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8942 - val_loss: 0.0747 - val_accuracy: 0.8959
Epoch 87/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8927 - val_loss: 0.0725 - val_accuracy: 0.8985
Epoch 88/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8939 - val_loss: 0.0728 - val_accuracy: 0.8969
Epoch 89/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0763 -
accuracy: 0.8949 - val_loss: 0.0731 - val_accuracy: 0.8974
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8938 - val_loss: 0.0732 - val_accuracy: 0.8972
Epoch 91/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8939 - val_loss: 0.0735 - val_accuracy: 0.8972
Epoch 92/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0777 -
accuracy: 0.8931 - val_loss: 0.0733 - val_accuracy: 0.8967
Epoch 93/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8930 - val_loss: 0.0727 - val_accuracy: 0.8993
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
accuracy: 0.8937 - val_loss: 0.0731 - val_accuracy: 0.8976
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8941 - val_loss: 0.0732 - val_accuracy: 0.8970
Epoch 96/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8932 - val_loss: 0.0731 - val_accuracy: 0.8965
Epoch 97/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8928 - val_loss: 0.0734 - val_accuracy: 0.8976
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0774 -
accuracy: 0.8927 - val_loss: 0.0731 - val_accuracy: 0.8991
Epoch 99/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
accuracy: 0.8936 - val_loss: 0.0730 - val_accuracy: 0.9004
Epoch 100/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8939 - val_loss: 0.0729 - val_accuracy: 0.8963
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
```

```
accuracy: 0.8937 - val_loss: 0.0734 - val_accuracy: 0.8948
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
accuracy: 0.8944 - val_loss: 0.0742 - val_accuracy: 0.8971
Epoch 3/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8942 - val_loss: 0.0741 - val_accuracy: 0.8965
Epoch 4/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8941 - val_loss: 0.0736 - val_accuracy: 0.8977
Epoch 5/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8943 - val_loss: 0.0748 - val_accuracy: 0.8952
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8944 - val_loss: 0.0735 - val_accuracy: 0.8962
Epoch 7/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8937 - val_loss: 0.0735 - val_accuracy: 0.8968
Epoch 8/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8934 - val_loss: 0.0733 - val_accuracy: 0.8971
Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0772 -
accuracy: 0.8937 - val_loss: 0.0736 - val_accuracy: 0.8982
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8939 - val_loss: 0.0731 - val_accuracy: 0.8978
Epoch 11/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8937 - val_loss: 0.0751 - val_accuracy: 0.8954
Epoch 12/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8922 - val_loss: 0.0729 - val_accuracy: 0.8984
Epoch 13/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0766 -
accuracy: 0.8939 - val_loss: 0.0733 - val_accuracy: 0.8969
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0775 -
accuracy: 0.8934 - val_loss: 0.0735 - val_accuracy: 0.8962
Epoch 15/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8941 - val_loss: 0.0734 - val_accuracy: 0.8974
Epoch 16/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8931 - val_loss: 0.0734 - val_accuracy: 0.8966
Epoch 17/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
```

```
accuracy: 0.8933 - val_loss: 0.0744 - val_accuracy: 0.8962
Epoch 18/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8941 - val_loss: 0.0735 - val_accuracy: 0.8982
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8944 - val_loss: 0.0729 - val_accuracy: 0.8993
Epoch 20/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8937 - val_loss: 0.0733 - val_accuracy: 0.8957
Epoch 21/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0774 -
accuracy: 0.8936 - val_loss: 0.0731 - val_accuracy: 0.8978
Epoch 22/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
accuracy: 0.8947 - val_loss: 0.0727 - val_accuracy: 0.8982
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
accuracy: 0.8936 - val_loss: 0.0732 - val_accuracy: 0.8976
Epoch 24/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8940 - val_loss: 0.0733 - val_accuracy: 0.8981
Epoch 25/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
accuracy: 0.8940 - val_loss: 0.0734 - val_accuracy: 0.8974
Epoch 26/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8935 - val_loss: 0.0733 - val_accuracy: 0.8973
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8937 - val_loss: 0.0726 - val_accuracy: 0.8980
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8936 - val_loss: 0.0727 - val_accuracy: 0.8974
Epoch 29/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8945 - val_loss: 0.0731 - val_accuracy: 0.8984
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8940 - val_loss: 0.0733 - val_accuracy: 0.8960
Epoch 31/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8937 - val_loss: 0.0737 - val_accuracy: 0.8966
Epoch 32/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0808 -
accuracy: 0.8936 - val_loss: 0.0731 - val_accuracy: 0.8972
Epoch 33/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
```

```
accuracy: 0.8947 - val_loss: 0.0731 - val_accuracy: 0.8957
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8941 - val_loss: 0.0731 - val_accuracy: 0.8977
Epoch 35/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0802 -
accuracy: 0.8937 - val_loss: 0.0730 - val_accuracy: 0.8977
Epoch 36/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8929 - val_loss: 0.0732 - val_accuracy: 0.8966
Epoch 37/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8936 - val_loss: 0.0725 - val_accuracy: 0.8985
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8935 - val_loss: 0.0736 - val_accuracy: 0.8955
Epoch 39/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8937 - val_loss: 0.0725 - val_accuracy: 0.8977
Epoch 40/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
accuracy: 0.8944 - val_loss: 0.0730 - val_accuracy: 0.8988
Epoch 41/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0764 -
accuracy: 0.8939 - val_loss: 0.0733 - val_accuracy: 0.8977
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8940 - val_loss: 0.0730 - val_accuracy: 0.8972
Epoch 43/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8933 - val_loss: 0.0727 - val_accuracy: 0.8980
Epoch 44/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8939 - val_loss: 0.0735 - val_accuracy: 0.8977
Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8936 - val_loss: 0.0739 - val_accuracy: 0.8955
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8933 - val_loss: 0.0725 - val_accuracy: 0.8971
Epoch 47/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8932 - val_loss: 0.0735 - val_accuracy: 0.8966
Epoch 48/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8938 - val_loss: 0.0745 - val_accuracy: 0.8945
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
```

```
accuracy: 0.8937 - val_loss: 0.0743 - val_accuracy: 0.8936
Epoch 50/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8927 - val_loss: 0.0733 - val_accuracy: 0.8974
Epoch 51/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8938 - val_loss: 0.0721 - val_accuracy: 0.8987
Epoch 52/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0763 -
accuracy: 0.8939 - val_loss: 0.0732 - val_accuracy: 0.8962
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8938 - val_loss: 0.0730 - val_accuracy: 0.8965
Epoch 54/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8940 - val_loss: 0.0729 - val_accuracy: 0.8981
Epoch 55/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8942 - val_loss: 0.0743 - val_accuracy: 0.8995
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8944 - val_loss: 0.0726 - val_accuracy: 0.8976
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8943 - val_loss: 0.0730 - val_accuracy: 0.8974
Epoch 58/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
accuracy: 0.8933 - val_loss: 0.0724 - val_accuracy: 0.8997
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
accuracy: 0.8949 - val_loss: 0.0726 - val_accuracy: 0.8982
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8936 - val_loss: 0.0724 - val_accuracy: 0.8983
Epoch 61/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0770 -
accuracy: 0.8930 - val_loss: 0.0733 - val_accuracy: 0.8979
Epoch 62/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0766 -
accuracy: 0.8939 - val_loss: 0.0733 - val_accuracy: 0.8988
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8940 - val_loss: 0.0723 - val_accuracy: 0.8969
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8938 - val_loss: 0.0735 - val_accuracy: 0.8961
Epoch 65/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
```

```
accuracy: 0.8923 - val_loss: 0.0723 - val_accuracy: 0.8998
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
accuracy: 0.8944 - val_loss: 0.0727 - val_accuracy: 0.8995
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8942 - val_loss: 0.0732 - val_accuracy: 0.8955
Epoch 68/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8941 - val_loss: 0.0730 - val_accuracy: 0.8988
Epoch 69/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0764 -
accuracy: 0.8938 - val_loss: 0.0724 - val_accuracy: 0.9002
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8932 - val_loss: 0.0730 - val_accuracy: 0.8954
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8940 - val_loss: 0.0732 - val_accuracy: 0.8974
Epoch 72/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8931 - val_loss: 0.0727 - val_accuracy: 0.8995
Epoch 73/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8942 - val_loss: 0.0725 - val_accuracy: 0.8984
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8937 - val_loss: 0.0727 - val_accuracy: 0.8977
Epoch 75/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0765 -
accuracy: 0.8935 - val_loss: 0.0726 - val_accuracy: 0.8978
Epoch 76/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0765 -
accuracy: 0.8942 - val_loss: 0.0732 - val_accuracy: 0.8956
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8935 - val_loss: 0.0730 - val_accuracy: 0.8974
Epoch 78/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0775 -
accuracy: 0.8928 - val_loss: 0.0727 - val_accuracy: 0.8984
Epoch 79/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0765 -
accuracy: 0.8945 - val_loss: 0.0729 - val_accuracy: 0.8984
Epoch 80/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0766 -
accuracy: 0.8952 - val_loss: 0.0728 - val_accuracy: 0.8996
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
```

```
accuracy: 0.8942 - val_loss: 0.0736 - val_accuracy: 0.8966
Epoch 82/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
accuracy: 0.8953 - val_loss: 0.0730 - val_accuracy: 0.8977
Epoch 83/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8938 - val_loss: 0.0739 - val_accuracy: 0.8968
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8941 - val_loss: 0.0730 - val_accuracy: 0.8975
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8939 - val_loss: 0.0728 - val_accuracy: 0.8995
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8934 - val_loss: 0.0730 - val_accuracy: 0.8964
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8951 - val_loss: 0.0730 - val_accuracy: 0.8977
Epoch 88/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0764 -
accuracy: 0.8944 - val_loss: 0.0725 - val_accuracy: 0.8977
Epoch 89/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8939 - val_loss: 0.0733 - val_accuracy: 0.8998
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8942 - val_loss: 0.0728 - val_accuracy: 0.8990
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8932 - val_loss: 0.0727 - val_accuracy: 0.8997
Epoch 92/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0773 -
accuracy: 0.8954 - val_loss: 0.0732 - val_accuracy: 0.8968
Epoch 93/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8936 - val_loss: 0.0728 - val_accuracy: 0.8976
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
accuracy: 0.8941 - val_loss: 0.0734 - val_accuracy: 0.8996
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8942 - val_loss: 0.0726 - val_accuracy: 0.9000
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8945 - val_loss: 0.0726 - val_accuracy: 0.9005
Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
```

```
accuracy: 0.8939 - val_loss: 0.0731 - val_accuracy: 0.8994
Epoch 98/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
accuracy: 0.8951 - val_loss: 0.0732 - val_accuracy: 0.8983
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8954 - val_loss: 0.0723 - val_accuracy: 0.8985
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8939 - val_loss: 0.0731 - val_accuracy: 0.8967
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8940 - val_loss: 0.0727 - val_accuracy: 0.8995
Epoch 2/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0764 -
accuracy: 0.8948 - val_loss: 0.0725 - val_accuracy: 0.8975
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8943 - val_loss: 0.0737 - val_accuracy: 0.8954
Epoch 4/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8935 - val_loss: 0.0731 - val_accuracy: 0.8969
Epoch 5/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8942 - val_loss: 0.0729 - val_accuracy: 0.9000
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8946 - val_loss: 0.0744 - val_accuracy: 0.8946
Epoch 7/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
accuracy: 0.8942 - val_loss: 0.0728 - val_accuracy: 0.8989
Epoch 8/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0764 -
accuracy: 0.8952 - val_loss: 0.0727 - val_accuracy: 0.8983
Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
accuracy: 0.8932 - val_loss: 0.0738 - val_accuracy: 0.8969
Epoch 10/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0765 -
accuracy: 0.8954 - val_loss: 0.0733 - val_accuracy: 0.8983
Epoch 11/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
accuracy: 0.8947 - val_loss: 0.0732 - val_accuracy: 0.8986
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0791 -
accuracy: 0.8946 - val_loss: 0.0736 - val_accuracy: 0.8959
Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
```

```
accuracy: 0.8946 - val_loss: 0.0735 - val_accuracy: 0.8968
Epoch 14/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0766 -
accuracy: 0.8937 - val_loss: 0.0736 - val_accuracy: 0.8969
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8939 - val_loss: 0.0732 - val_accuracy: 0.8968
Epoch 16/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0765 -
accuracy: 0.8943 - val_loss: 0.0737 - val_accuracy: 0.8977
Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8952 - val_loss: 0.0730 - val_accuracy: 0.8979
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8951 - val_loss: 0.0731 - val_accuracy: 0.8968
Epoch 19/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8932 - val_loss: 0.0735 - val_accuracy: 0.8964
Epoch 20/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8933 - val_loss: 0.0731 - val_accuracy: 0.8983
Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8933 - val_loss: 0.0740 - val_accuracy: 0.8952
Epoch 22/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8923 - val_loss: 0.0735 - val_accuracy: 0.8971
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8936 - val_loss: 0.0726 - val_accuracy: 0.8998
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8935 - val_loss: 0.0732 - val_accuracy: 0.8985
Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8947 - val_loss: 0.0727 - val_accuracy: 0.8971
Epoch 26/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0765 -
accuracy: 0.8940 - val_loss: 0.0720 - val_accuracy: 0.9019
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0775 -
accuracy: 0.8932 - val_loss: 0.0731 - val_accuracy: 0.8992
Epoch 28/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8936 - val_loss: 0.0733 - val_accuracy: 0.8981
Epoch 29/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0766 -
```

```
accuracy: 0.8936 - val_loss: 0.0726 - val_accuracy: 0.8985
Epoch 30/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0761 -
accuracy: 0.8941 - val_loss: 0.0724 - val_accuracy: 0.8994
Epoch 31/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8941 - val_loss: 0.0727 - val_accuracy: 0.9004
Epoch 32/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0766 -
accuracy: 0.8951 - val_loss: 0.0732 - val_accuracy: 0.8986
Epoch 33/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0768 -
accuracy: 0.8942 - val_loss: 0.0730 - val_accuracy: 0.8985
Epoch 34/100
1349/1349 [==============================] - 896s 665ms/step - loss: 0.0768 -
accuracy: 0.8940 - val_loss: 0.0729 - val_accuracy: 0.8994
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8933 - val_loss: 0.0729 - val_accuracy: 0.8982
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8940 - val_loss: 0.0729 - val_accuracy: 0.8979
Epoch 37/100
1349/1349 [==============================] - 2842s 2s/step - loss: 0.0770 -
accuracy: 0.8940 - val_loss: 0.0735 - val_accuracy: 0.8977
Epoch 38/100
1349/1349 [==============================] - 3s 2ms/step - loss: 0.0762 -
accuracy: 0.8941 - val_loss: 0.0726 - val_accuracy: 0.8972
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8935 - val_loss: 0.0728 - val_accuracy: 0.8980
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8931 - val_loss: 0.0740 - val_accuracy: 0.8951
Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0849 -
accuracy: 0.8939 - val_loss: 0.0726 - val_accuracy: 0.8975
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8936 - val_loss: 0.0731 - val_accuracy: 0.8967
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0774 -
accuracy: 0.8926 - val_loss: 0.0731 - val_accuracy: 0.8987
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8939 - val_loss: 0.0727 - val_accuracy: 0.8998
Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
```

```
accuracy: 0.8945 - val_loss: 0.0730 - val_accuracy: 0.8989
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8938 - val_loss: 0.0732 - val_accuracy: 0.8981
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8939 - val_loss: 0.0729 - val_accuracy: 0.8972
Epoch 48/100
1349/1349 [==============================] - 2s 2ms/step - loss: 0.0769 -
accuracy: 0.8944 - val_loss: 0.0739 - val_accuracy: 0.8950
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8940 - val_loss: 0.0731 - val_accuracy: 0.8988
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8952 - val_loss: 0.0725 - val_accuracy: 0.8999
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8940 - val_loss: 0.0725 - val_accuracy: 0.8986
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8942 - val_loss: 0.0733 - val_accuracy: 0.8978
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8939 - val_loss: 0.0728 - val_accuracy: 0.8977
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8938 - val_loss: 0.0724 - val_accuracy: 0.9000
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8936 - val_loss: 0.0731 - val_accuracy: 0.8972
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8930 - val_loss: 0.0731 - val_accuracy: 0.8985
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8940 - val_loss: 0.0734 - val_accuracy: 0.8947
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8935 - val_loss: 0.0735 - val_accuracy: 0.8979
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8944 - val_loss: 0.0730 - val_accuracy: 0.8972
Epoch 60/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0766 -
accuracy: 0.8949 - val_loss: 0.0729 - val_accuracy: 0.8996
Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
```

```
accuracy: 0.8942 - val_loss: 0.0733 - val_accuracy: 0.8988
Epoch 62/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0772 -
accuracy: 0.8948 - val_loss: 0.0725 - val_accuracy: 0.9001
Epoch 63/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0767 -
accuracy: 0.8951 - val_loss: 0.0726 - val_accuracy: 0.8992
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8947 - val_loss: 0.0727 - val_accuracy: 0.8980
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8930 - val_loss: 0.0728 - val_accuracy: 0.8980
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8931 - val_loss: 0.0728 - val_accuracy: 0.8999
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8955 - val_loss: 0.0728 - val_accuracy: 0.8977
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8950 - val_loss: 0.0736 - val_accuracy: 0.8981
Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8948 - val_loss: 0.0733 - val_accuracy: 0.8987
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8945 - val_loss: 0.0729 - val_accuracy: 0.8997
Epoch 71/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0763 -
accuracy: 0.8939 - val_loss: 0.0727 - val_accuracy: 0.8982
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8939 - val_loss: 0.0734 - val_accuracy: 0.8994
Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8955 - val_loss: 0.0731 - val_accuracy: 0.8986
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8945 - val_loss: 0.0727 - val_accuracy: 0.9009
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8946 - val_loss: 0.0728 - val_accuracy: 0.8972
Epoch 76/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0785 -
accuracy: 0.8947 - val_loss: 0.0730 - val_accuracy: 0.8996
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
```

```
accuracy: 0.8945 - val_loss: 0.0732 - val_accuracy: 0.8989
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0773 -
accuracy: 0.8942 - val_loss: 0.0726 - val_accuracy: 0.8991
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8940 - val_loss: 0.0725 - val_accuracy: 0.8998
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8943 - val_loss: 0.0725 - val_accuracy: 0.9000
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8936 - val_loss: 0.0732 - val_accuracy: 0.8980
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8937 - val_loss: 0.0729 - val_accuracy: 0.8986
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8949 - val_loss: 0.0726 - val_accuracy: 0.8967
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8941 - val_loss: 0.0728 - val_accuracy: 0.8994
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8941 - val_loss: 0.0732 - val_accuracy: 0.8978
Epoch 86/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0771 -
accuracy: 0.8942 - val_loss: 0.0734 - val_accuracy: 0.8986
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8942 - val_loss: 0.0726 - val_accuracy: 0.8994
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8939 - val_loss: 0.0726 - val_accuracy: 0.8992
Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8942 - val_loss: 0.0725 - val_accuracy: 0.8995
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8927 - val_loss: 0.0730 - val_accuracy: 0.8980
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8942 - val_loss: 0.0729 - val_accuracy: 0.8985
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8954 - val_loss: 0.0734 - val_accuracy: 0.8980
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
```

```
accuracy: 0.8942 - val_loss: 0.0726 - val_accuracy: 0.8988
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8945 - val_loss: 0.0733 - val_accuracy: 0.8974
Epoch 95/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0764 -
accuracy: 0.8947 - val_loss: 0.0724 - val_accuracy: 0.9000
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8944 - val_loss: 0.0728 - val_accuracy: 0.8984
Epoch 97/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0763 -
accuracy: 0.8946 - val_loss: 0.0732 - val_accuracy: 0.8981
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8945 - val_loss: 0.0734 - val_accuracy: 0.8982
Epoch 99/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0769 -
accuracy: 0.8945 - val_loss: 0.0735 - val_accuracy: 0.8995
Epoch 100/100
1349/1349 [==============================] - 1s 1ms/step - loss: 0.0763 -
accuracy: 0.8945 - val_loss: 0.0724 - val_accuracy: 0.8998
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
accuracy: 0.8940 - val_loss: 0.0739 - val_accuracy: 0.8984
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8943 - val_loss: 0.0729 - val_accuracy: 0.8990
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8943 - val_loss: 0.0726 - val_accuracy: 0.8995
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8941 - val_loss: 0.0730 - val_accuracy: 0.8978
Epoch 5/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8943 - val_loss: 0.0723 - val_accuracy: 0.9007
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0885 -
accuracy: 0.8945 - val_loss: 0.0729 - val_accuracy: 0.8986
Epoch 7/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8939 - val_loss: 0.0726 - val_accuracy: 0.8996
Epoch 8/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8944 - val_loss: 0.0728 - val_accuracy: 0.8978
Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
```

```
accuracy: 0.8945 - val_loss: 0.0727 - val_accuracy: 0.8992
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8953 - val_loss: 0.0738 - val_accuracy: 0.8958
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8948 - val_loss: 0.0726 - val_accuracy: 0.8995
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8948 - val_loss: 0.0727 - val_accuracy: 0.8988
Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8951 - val_loss: 0.0733 - val_accuracy: 0.8995
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8929 - val_loss: 0.0726 - val_accuracy: 0.8987
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8950 - val_loss: 0.0726 - val_accuracy: 0.8986
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8943 - val_loss: 0.0730 - val_accuracy: 0.8986
Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8952 - val_loss: 0.0728 - val_accuracy: 0.8973
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8943 - val_loss: 0.0724 - val_accuracy: 0.8985
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8941 - val_loss: 0.0725 - val_accuracy: 0.8987
Epoch 20/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8938 - val_loss: 0.0732 - val_accuracy: 0.8967
Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8931 - val_loss: 0.0726 - val_accuracy: 0.8982
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8959 - val_loss: 0.0731 - val_accuracy: 0.8979
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8940 - val_loss: 0.0730 - val_accuracy: 0.8991
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8947 - val_loss: 0.0748 - val_accuracy: 0.8936
Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
```

```
accuracy: 0.8945 - val_loss: 0.0733 - val_accuracy: 0.8985
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8948 - val_loss: 0.0731 - val_accuracy: 0.8968
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8946 - val_loss: 0.0728 - val_accuracy: 0.8982
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8945 - val_loss: 0.0726 - val_accuracy: 0.8992
Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8947 - val_loss: 0.0723 - val_accuracy: 0.9000
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8946 - val_loss: 0.0731 - val_accuracy: 0.8985
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8945 - val_loss: 0.0732 - val_accuracy: 0.8976
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8957 - val_loss: 0.0734 - val_accuracy: 0.8975
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0808 -
accuracy: 0.8953 - val_loss: 0.0730 - val_accuracy: 0.8995
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8943 - val_loss: 0.0724 - val_accuracy: 0.8988
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8953 - val_loss: 0.0726 - val_accuracy: 0.8989
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8942 - val_loss: 0.0728 - val_accuracy: 0.8962
Epoch 37/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8939 - val_loss: 0.0725 - val_accuracy: 0.9007
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8954 - val_loss: 0.0727 - val_accuracy: 0.8983
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8952 - val_loss: 0.0722 - val_accuracy: 0.8988
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8949 - val_loss: 0.0723 - val_accuracy: 0.8987
Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
```

```
accuracy: 0.8949 - val_loss: 0.0732 - val_accuracy: 0.8995
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8953 - val_loss: 0.0724 - val_accuracy: 0.9001
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8954 - val_loss: 0.0728 - val_accuracy: 0.8994
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8950 - val_loss: 0.0727 - val_accuracy: 0.8967
Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8937 - val_loss: 0.0723 - val_accuracy: 0.8996
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8941 - val_loss: 0.0735 - val_accuracy: 0.8983
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8946 - val_loss: 0.0723 - val_accuracy: 0.9005
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8942 - val_loss: 0.0735 - val_accuracy: 0.8969
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8948 - val_loss: 0.0730 - val_accuracy: 0.8994
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8941 - val_loss: 0.0739 - val_accuracy: 0.8992
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0773 -
accuracy: 0.8951 - val_loss: 0.0733 - val_accuracy: 0.8967
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8953 - val_loss: 0.0729 - val_accuracy: 0.8990
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8951 - val_loss: 0.0730 - val_accuracy: 0.8990
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8943 - val_loss: 0.0728 - val_accuracy: 0.8994
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8945 - val_loss: 0.0732 - val_accuracy: 0.8982
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8941 - val_loss: 0.0728 - val_accuracy: 0.8986
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
```

```
accuracy: 0.8938 - val_loss: 0.0731 - val_accuracy: 0.8968
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8955 - val_loss: 0.0732 - val_accuracy: 0.8960
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8939 - val_loss: 0.0733 - val_accuracy: 0.8969
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8948 - val_loss: 0.0729 - val_accuracy: 0.8967
Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8934 - val_loss: 0.0725 - val_accuracy: 0.8991
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8936 - val_loss: 0.0725 - val_accuracy: 0.8993
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8932 - val_loss: 0.0727 - val_accuracy: 0.8993
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8941 - val_loss: 0.0723 - val_accuracy: 0.9006
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8953 - val_loss: 0.0726 - val_accuracy: 0.8989
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8946 - val_loss: 0.0726 - val_accuracy: 0.8997
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8940 - val_loss: 0.0733 - val_accuracy: 0.8992
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8951 - val_loss: 0.0749 - val_accuracy: 0.8938
Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8944 - val_loss: 0.0732 - val_accuracy: 0.8970
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8945 - val_loss: 0.0726 - val_accuracy: 0.8994
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8941 - val_loss: 0.0732 - val_accuracy: 0.9001
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0758 -
accuracy: 0.8953 - val_loss: 0.0728 - val_accuracy: 0.8987
Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
```

```
accuracy: 0.8952 - val_loss: 0.0725 - val_accuracy: 0.8971
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8943 - val_loss: 0.0729 - val_accuracy: 0.8979
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8948 - val_loss: 0.0730 - val_accuracy: 0.8990
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8945 - val_loss: 0.0728 - val_accuracy: 0.8985
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8936 - val_loss: 0.0723 - val_accuracy: 0.9000
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8936 - val_loss: 0.0732 - val_accuracy: 0.8973
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8955 - val_loss: 0.0724 - val_accuracy: 0.8986
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8949 - val_loss: 0.0727 - val_accuracy: 0.8991
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8947 - val_loss: 0.0725 - val_accuracy: 0.8991
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8945 - val_loss: 0.0727 - val_accuracy: 0.8990
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8948 - val_loss: 0.0728 - val_accuracy: 0.8996
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8959 - val_loss: 0.0732 - val_accuracy: 0.8971
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8946 - val_loss: 0.0726 - val_accuracy: 0.8991
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8955 - val_loss: 0.0728 - val_accuracy: 0.8982
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8941 - val_loss: 0.0733 - val_accuracy: 0.8975
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8949 - val_loss: 0.0732 - val_accuracy: 0.8989
Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
```

```
accuracy: 0.8945 - val_loss: 0.0727 - val_accuracy: 0.9004
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8956 - val_loss: 0.0727 - val_accuracy: 0.8979
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8943 - val_loss: 0.0738 - val_accuracy: 0.8989
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8940 - val_loss: 0.0741 - val_accuracy: 0.8996
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8945 - val_loss: 0.0735 - val_accuracy: 0.8964
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8938 - val_loss: 0.0731 - val_accuracy: 0.8995
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8952 - val_loss: 0.0731 - val_accuracy: 0.8973
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8943 - val_loss: 0.0728 - val_accuracy: 0.8994
Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8947 - val_loss: 0.0724 - val_accuracy: 0.8982
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8958 - val_loss: 0.0728 - val_accuracy: 0.8988
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8950 - val_loss: 0.0725 - val_accuracy: 0.8990
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8948 - val_loss: 0.0730 - val_accuracy: 0.8996
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8936 - val_loss: 0.0736 - val_accuracy: 0.8961
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8947 - val_loss: 0.0732 - val_accuracy: 0.8987
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8946 - val_loss: 0.0725 - val_accuracy: 0.9006
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8946 - val_loss: 0.0733 - val_accuracy: 0.8994
Epoch 5/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
```

```
accuracy: 0.8945 - val_loss: 0.0726 - val_accuracy: 0.8991
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8944 - val_loss: 0.0727 - val_accuracy: 0.8986
Epoch 7/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8953 - val_loss: 0.0728 - val_accuracy: 0.8984
Epoch 8/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8952 - val_loss: 0.0724 - val_accuracy: 0.8994
Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8962 - val_loss: 0.0735 - val_accuracy: 0.8983
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0772 -
accuracy: 0.8952 - val_loss: 0.0727 - val_accuracy: 0.8989
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8938 - val_loss: 0.0733 - val_accuracy: 0.8965
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8963 - val_loss: 0.0728 - val_accuracy: 0.8984
Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8949 - val_loss: 0.0729 - val_accuracy: 0.8982
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8946 - val_loss: 0.0729 - val_accuracy: 0.8985
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8939 - val_loss: 0.0739 - val_accuracy: 0.8950
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8948 - val_loss: 0.0726 - val_accuracy: 0.8991
Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8949 - val_loss: 0.0732 - val_accuracy: 0.8987
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8949 - val_loss: 0.0729 - val_accuracy: 0.8983
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8943 - val_loss: 0.0732 - val_accuracy: 0.8983
Epoch 20/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8953 - val_loss: 0.0725 - val_accuracy: 0.8992
Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
```

```
accuracy: 0.8947 - val_loss: 0.0731 - val_accuracy: 0.8977
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8935 - val_loss: 0.0729 - val_accuracy: 0.9000
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8961 - val_loss: 0.0730 - val_accuracy: 0.8979
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8954 - val_loss: 0.0728 - val_accuracy: 0.8990
Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8939 - val_loss: 0.0728 - val_accuracy: 0.8982
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8945 - val_loss: 0.0732 - val_accuracy: 0.8988
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8948 - val_loss: 0.0726 - val_accuracy: 0.8995
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8941 - val_loss: 0.0729 - val_accuracy: 0.8982
Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8943 - val_loss: 0.0728 - val_accuracy: 0.8979
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8949 - val_loss: 0.0727 - val_accuracy: 0.8985
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8945 - val_loss: 0.0731 - val_accuracy: 0.8987
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0773 -
accuracy: 0.8949 - val_loss: 0.0731 - val_accuracy: 0.8979
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8960 - val_loss: 0.0730 - val_accuracy: 0.8991
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8962 - val_loss: 0.0727 - val_accuracy: 0.9002
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8944 - val_loss: 0.0732 - val_accuracy: 0.8991
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8961 - val_loss: 0.0726 - val_accuracy: 0.8995
Epoch 37/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
```

```
accuracy: 0.8949 - val_loss: 0.0728 - val_accuracy: 0.8992
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0755 -
accuracy: 0.8960 - val_loss: 0.0725 - val_accuracy: 0.8987
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8953 - val_loss: 0.0733 - val_accuracy: 0.8970
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8941 - val_loss: 0.0729 - val_accuracy: 0.9010
Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8948 - val_loss: 0.0730 - val_accuracy: 0.9011
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0758 -
accuracy: 0.8956 - val_loss: 0.0737 - val_accuracy: 0.8950
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8943 - val_loss: 0.0727 - val_accuracy: 0.9004
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0832 -
accuracy: 0.8951 - val_loss: 0.0720 - val_accuracy: 0.9007
Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8948 - val_loss: 0.0727 - val_accuracy: 0.8980
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8951 - val_loss: 0.0728 - val_accuracy: 0.8991
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8949 - val_loss: 0.0727 - val_accuracy: 0.8992
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8944 - val_loss: 0.0728 - val_accuracy: 0.8987
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8951 - val_loss: 0.0730 - val_accuracy: 0.8988
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8943 - val_loss: 0.0725 - val_accuracy: 0.8989
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0826 -
accuracy: 0.8953 - val_loss: 0.0739 - val_accuracy: 0.8977
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8949 - val_loss: 0.0735 - val_accuracy: 0.8987
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
```

```
accuracy: 0.8953 - val_loss: 0.0732 - val_accuracy: 0.8988
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8946 - val_loss: 0.0730 - val_accuracy: 0.8989
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8958 - val_loss: 0.0724 - val_accuracy: 0.9003
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8953 - val_loss: 0.0720 - val_accuracy: 0.8995
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8948 - val_loss: 0.0726 - val_accuracy: 0.8992
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8956 - val_loss: 0.0727 - val_accuracy: 0.8987
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8945 - val_loss: 0.0726 - val_accuracy: 0.8993
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8948 - val_loss: 0.0723 - val_accuracy: 0.9001
Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8961 - val_loss: 0.0730 - val_accuracy: 0.8978
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8955 - val_loss: 0.0730 - val_accuracy: 0.8986
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8938 - val_loss: 0.0727 - val_accuracy: 0.8993
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8946 - val_loss: 0.0726 - val_accuracy: 0.8983
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8947 - val_loss: 0.0729 - val_accuracy: 0.8984
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8949 - val_loss: 0.0731 - val_accuracy: 0.8986
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8949 - val_loss: 0.0728 - val_accuracy: 0.8992
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0757 -
accuracy: 0.8963 - val_loss: 0.0731 - val_accuracy: 0.8975
Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
```

```
accuracy: 0.8951 - val_loss: 0.0725 - val_accuracy: 0.8990
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8948 - val_loss: 0.0725 - val_accuracy: 0.8998
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8961 - val_loss: 0.0729 - val_accuracy: 0.9009
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8951 - val_loss: 0.0733 - val_accuracy: 0.8975
Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8956 - val_loss: 0.0729 - val_accuracy: 0.8985
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8949 - val_loss: 0.0731 - val_accuracy: 0.8991
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8951 - val_loss: 0.0730 - val_accuracy: 0.8986
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8954 - val_loss: 0.0724 - val_accuracy: 0.8993
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8959 - val_loss: 0.0731 - val_accuracy: 0.8984
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8957 - val_loss: 0.0727 - val_accuracy: 0.8973
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8953 - val_loss: 0.0727 - val_accuracy: 0.8984
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8949 - val_loss: 0.0730 - val_accuracy: 0.8987
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8949 - val_loss: 0.0731 - val_accuracy: 0.8987
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8945 - val_loss: 0.0730 - val_accuracy: 0.8974
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8952 - val_loss: 0.0726 - val_accuracy: 0.8996
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8957 - val_loss: 0.0732 - val_accuracy: 0.8984
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
```

```
accuracy: 0.8951 - val_loss: 0.0724 - val_accuracy: 0.9003
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8951 - val_loss: 0.0723 - val_accuracy: 0.9003
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8958 - val_loss: 0.0735 - val_accuracy: 0.8964
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8939 - val_loss: 0.0731 - val_accuracy: 0.9000
Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8952 - val_loss: 0.0725 - val_accuracy: 0.9002
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8954 - val_loss: 0.0733 - val_accuracy: 0.8965
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8959 - val_loss: 0.0725 - val_accuracy: 0.9004
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8956 - val_loss: 0.0730 - val_accuracy: 0.8975
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8946 - val_loss: 0.0726 - val_accuracy: 0.9000
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8961 - val_loss: 0.0724 - val_accuracy: 0.8992
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8946 - val_loss: 0.0742 - val_accuracy: 0.8964
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0824 -
accuracy: 0.8957 - val_loss: 0.0726 - val_accuracy: 0.8991
Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8957 - val_loss: 0.0730 - val_accuracy: 0.8984
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0778 -
accuracy: 0.8951 - val_loss: 0.0730 - val_accuracy: 0.8976
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8950 - val_loss: 0.0728 - val_accuracy: 0.8992
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8941 - val_loss: 0.0731 - val_accuracy: 0.8998
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
```

```
accuracy: 0.8951 - val_loss: 0.0738 - val_accuracy: 0.8972
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8931 - val_loss: 0.0725 - val_accuracy: 0.9002
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8948 - val_loss: 0.0728 - val_accuracy: 0.8980
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8957 - val_loss: 0.0726 - val_accuracy: 0.8994
Epoch 5/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8944 - val_loss: 0.0728 - val_accuracy: 0.9003
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8958 - val_loss: 0.0729 - val_accuracy: 0.8989
Epoch 7/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8956 - val_loss: 0.0728 - val_accuracy: 0.8985
Epoch 8/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8956 - val_loss: 0.0736 - val_accuracy: 0.8975
Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8954 - val_loss: 0.0739 - val_accuracy: 0.8986
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8959 - val_loss: 0.0729 - val_accuracy: 0.8974
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8949 - val_loss: 0.0730 - val_accuracy: 0.8984
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0887 -
accuracy: 0.8936 - val_loss: 0.0734 - val_accuracy: 0.8997
Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
accuracy: 0.8938 - val_loss: 0.0737 - val_accuracy: 0.8962
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8954 - val_loss: 0.0727 - val_accuracy: 0.8982
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8954 - val_loss: 0.0725 - val_accuracy: 0.8989
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8951 - val_loss: 0.0727 - val_accuracy: 0.9000
Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
```

```
accuracy: 0.8965 - val_loss: 0.0731 - val_accuracy: 0.8986
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8956 - val_loss: 0.0723 - val_accuracy: 0.8994
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8953 - val_loss: 0.0731 - val_accuracy: 0.8962
Epoch 20/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8950 - val_loss: 0.0725 - val_accuracy: 0.9001
Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8943 - val_loss: 0.0730 - val_accuracy: 0.8985
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8964 - val_loss: 0.0723 - val_accuracy: 0.9002
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8950 - val_loss: 0.0725 - val_accuracy: 0.8992
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0780 -
accuracy: 0.8939 - val_loss: 0.0724 - val_accuracy: 0.8998
Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8956 - val_loss: 0.0725 - val_accuracy: 0.8996
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8947 - val_loss: 0.0724 - val_accuracy: 0.9003
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8945 - val_loss: 0.0732 - val_accuracy: 0.8997
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8965 - val_loss: 0.0726 - val_accuracy: 0.8994
Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8956 - val_loss: 0.0733 - val_accuracy: 0.8980
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8961 - val_loss: 0.0728 - val_accuracy: 0.9008
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8953 - val_loss: 0.0727 - val_accuracy: 0.8992
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8949 - val_loss: 0.0729 - val_accuracy: 0.8994
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
```

```
accuracy: 0.8948 - val_loss: 0.0724 - val_accuracy: 0.9001
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8951 - val_loss: 0.0729 - val_accuracy: 0.9005
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8951 - val_loss: 0.0728 - val_accuracy: 0.9001
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8961 - val_loss: 0.0726 - val_accuracy: 0.8994
Epoch 37/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8963 - val_loss: 0.0726 - val_accuracy: 0.8999
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8941 - val_loss: 0.0739 - val_accuracy: 0.8948
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8957 - val_loss: 0.0725 - val_accuracy: 0.8982
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8948 - val_loss: 0.0731 - val_accuracy: 0.8982
Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8944 - val_loss: 0.0726 - val_accuracy: 0.8992
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8947 - val_loss: 0.0724 - val_accuracy: 0.9001
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8958 - val_loss: 0.0725 - val_accuracy: 0.9009
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8963 - val_loss: 0.0731 - val_accuracy: 0.8991
Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8945 - val_loss: 0.0725 - val_accuracy: 0.9006
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8963 - val_loss: 0.0729 - val_accuracy: 0.8984
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8948 - val_loss: 0.0727 - val_accuracy: 0.8991
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8963 - val_loss: 0.0725 - val_accuracy: 0.8984
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
```

```
accuracy: 0.8948 - val_loss: 0.0730 - val_accuracy: 0.8983
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8949 - val_loss: 0.0734 - val_accuracy: 0.8978
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8946 - val_loss: 0.0728 - val_accuracy: 0.8995
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8945 - val_loss: 0.0733 - val_accuracy: 0.8975
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8960 - val_loss: 0.0729 - val_accuracy: 0.8988
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8950 - val_loss: 0.0729 - val_accuracy: 0.9002
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8959 - val_loss: 0.0729 - val_accuracy: 0.8988
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8953 - val_loss: 0.0726 - val_accuracy: 0.8994
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8964 - val_loss: 0.0732 - val_accuracy: 0.8987
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8954 - val_loss: 0.0731 - val_accuracy: 0.8992
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8954 - val_loss: 0.0734 - val_accuracy: 0.8989
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8946 - val_loss: 0.0742 - val_accuracy: 0.8961
Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8945 - val_loss: 0.0727 - val_accuracy: 0.9002
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8958 - val_loss: 0.0742 - val_accuracy: 0.8972
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8968 - val_loss: 0.0728 - val_accuracy: 0.8996
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8960 - val_loss: 0.0733 - val_accuracy: 0.8992
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0886 -
```

```
accuracy: 0.8945 - val_loss: 0.0738 - val_accuracy: 0.8968
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8951 - val_loss: 0.0728 - val_accuracy: 0.9004
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8954 - val_loss: 0.0737 - val_accuracy: 0.8984
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8946 - val_loss: 0.0725 - val_accuracy: 0.9009
Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0787 -
accuracy: 0.8946 - val_loss: 0.0738 - val_accuracy: 0.8972
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
accuracy: 0.8946 - val_loss: 0.0725 - val_accuracy: 0.9001
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8948 - val_loss: 0.0737 - val_accuracy: 0.8947
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8945 - val_loss: 0.0730 - val_accuracy: 0.9012
Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8965 - val_loss: 0.0727 - val_accuracy: 0.9003
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
accuracy: 0.8948 - val_loss: 0.0735 - val_accuracy: 0.8985
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8949 - val_loss: 0.0728 - val_accuracy: 0.8980
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8944 - val_loss: 0.0724 - val_accuracy: 0.9003
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8959 - val_loss: 0.0724 - val_accuracy: 0.9004
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8941 - val_loss: 0.0722 - val_accuracy: 0.8994
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8951 - val_loss: 0.0727 - val_accuracy: 0.8977
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8949 - val_loss: 0.0728 - val_accuracy: 0.8992
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
```

```
accuracy: 0.8947 - val_loss: 0.0722 - val_accuracy: 0.8982
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8955 - val_loss: 0.0720 - val_accuracy: 0.9010
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8958 - val_loss: 0.0726 - val_accuracy: 0.9001
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8951 - val_loss: 0.0729 - val_accuracy: 0.8975
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8949 - val_loss: 0.0730 - val_accuracy: 0.9003
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8951 - val_loss: 0.0724 - val_accuracy: 0.8992
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0772 -
accuracy: 0.8952 - val_loss: 0.0723 - val_accuracy: 0.8985
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8964 - val_loss: 0.0727 - val_accuracy: 0.8992
Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8959 - val_loss: 0.0725 - val_accuracy: 0.8996
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8944 - val_loss: 0.0723 - val_accuracy: 0.8983
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8960 - val_loss: 0.0726 - val_accuracy: 0.8987
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8954 - val_loss: 0.0731 - val_accuracy: 0.8983
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8952 - val_loss: 0.0723 - val_accuracy: 0.8991
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8958 - val_loss: 0.0721 - val_accuracy: 0.9001
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8945 - val_loss: 0.0727 - val_accuracy: 0.8984
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8948 - val_loss: 0.0728 - val_accuracy: 0.8993
Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
```

```
accuracy: 0.8962 - val_loss: 0.0725 - val_accuracy: 0.8989
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8943 - val_loss: 0.0745 - val_accuracy: 0.8936
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0758 -
accuracy: 0.8963 - val_loss: 0.0724 - val_accuracy: 0.8996
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8951 - val_loss: 0.0723 - val_accuracy: 0.9000
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8949 - val_loss: 0.0727 - val_accuracy: 0.8997
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8959 - val_loss: 0.0721 - val_accuracy: 0.9011
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8966 - val_loss: 0.0728 - val_accuracy: 0.9004
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8954 - val_loss: 0.0726 - val_accuracy: 0.8979
Epoch 5/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8960 - val_loss: 0.0723 - val_accuracy: 0.9005
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8951 - val_loss: 0.0719 - val_accuracy: 0.9006
Epoch 7/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8960 - val_loss: 0.0725 - val_accuracy: 0.9005
Epoch 8/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0758 -
accuracy: 0.8961 - val_loss: 0.0726 - val_accuracy: 0.9005
Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8951 - val_loss: 0.0720 - val_accuracy: 0.9011
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8953 - val_loss: 0.0724 - val_accuracy: 0.8993
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8963 - val_loss: 0.0725 - val_accuracy: 0.9003
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0772 -
accuracy: 0.8955 - val_loss: 0.0734 - val_accuracy: 0.9002
Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
```

```
accuracy: 0.8964 - val_loss: 0.0730 - val_accuracy: 0.8997
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8949 - val_loss: 0.0730 - val_accuracy: 0.8996
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8954 - val_loss: 0.0734 - val_accuracy: 0.8998
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8946 - val_loss: 0.0744 - val_accuracy: 0.8971
Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8959 - val_loss: 0.0724 - val_accuracy: 0.8999
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8951 - val_loss: 0.0730 - val_accuracy: 0.8980
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8954 - val_loss: 0.0731 - val_accuracy: 0.8989
Epoch 20/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8957 - val_loss: 0.0724 - val_accuracy: 0.8994
Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0779 -
accuracy: 0.8953 - val_loss: 0.0738 - val_accuracy: 0.8975
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8958 - val_loss: 0.0728 - val_accuracy: 0.8980
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8956 - val_loss: 0.0731 - val_accuracy: 0.9001
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8953 - val_loss: 0.0728 - val_accuracy: 0.8990
Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8943 - val_loss: 0.0734 - val_accuracy: 0.8973
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8954 - val_loss: 0.0730 - val_accuracy: 0.9004
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8958 - val_loss: 0.0730 - val_accuracy: 0.8997
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8951 - val_loss: 0.0725 - val_accuracy: 0.8986
Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
```

```
accuracy: 0.8952 - val_loss: 0.0725 - val_accuracy: 0.9004
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8965 - val_loss: 0.0735 - val_accuracy: 0.8974
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8959 - val_loss: 0.0731 - val_accuracy: 0.8980
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8955 - val_loss: 0.0728 - val_accuracy: 0.8993
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8948 - val_loss: 0.0735 - val_accuracy: 0.8964
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0758 -
accuracy: 0.8964 - val_loss: 0.0727 - val_accuracy: 0.9009
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8950 - val_loss: 0.0732 - val_accuracy: 0.8980
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8956 - val_loss: 0.0728 - val_accuracy: 0.8996
Epoch 37/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8959 - val_loss: 0.0734 - val_accuracy: 0.8963
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8949 - val_loss: 0.0723 - val_accuracy: 0.8996
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0758 -
accuracy: 0.8969 - val_loss: 0.0726 - val_accuracy: 0.9006
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8965 - val_loss: 0.0727 - val_accuracy: 0.8988
Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8966 - val_loss: 0.0733 - val_accuracy: 0.8980
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8947 - val_loss: 0.0726 - val_accuracy: 0.9001
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0755 -
accuracy: 0.8963 - val_loss: 0.0737 - val_accuracy: 0.8965
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8961 - val_loss: 0.0729 - val_accuracy: 0.8976
Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
```

```
accuracy: 0.8943 - val_loss: 0.0745 - val_accuracy: 0.8957
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8966 - val_loss: 0.0722 - val_accuracy: 0.9001
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8960 - val_loss: 0.0729 - val_accuracy: 0.9001
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8965 - val_loss: 0.0726 - val_accuracy: 0.8998
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0756 -
accuracy: 0.8963 - val_loss: 0.0721 - val_accuracy: 0.9004
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8962 - val_loss: 0.0724 - val_accuracy: 0.8987
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8970 - val_loss: 0.0724 - val_accuracy: 0.8992
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8953 - val_loss: 0.0731 - val_accuracy: 0.9006
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8958 - val_loss: 0.0733 - val_accuracy: 0.8981
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8967 - val_loss: 0.0729 - val_accuracy: 0.9003
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8965 - val_loss: 0.0727 - val_accuracy: 0.8997
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8956 - val_loss: 0.0729 - val_accuracy: 0.8996
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8961 - val_loss: 0.0728 - val_accuracy: 0.9008
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8947 - val_loss: 0.0725 - val_accuracy: 0.8997
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8949 - val_loss: 0.0722 - val_accuracy: 0.9000
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8955 - val_loss: 0.0726 - val_accuracy: 0.9007
Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
```

```
accuracy: 0.8952 - val_loss: 0.0731 - val_accuracy: 0.9016
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8958 - val_loss: 0.0736 - val_accuracy: 0.8996
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8955 - val_loss: 0.0729 - val_accuracy: 0.9003
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8952 - val_loss: 0.0734 - val_accuracy: 0.9002
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8962 - val_loss: 0.0724 - val_accuracy: 0.9004
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8956 - val_loss: 0.0733 - val_accuracy: 0.8988
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8960 - val_loss: 0.0733 - val_accuracy: 0.9000
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0758 -
accuracy: 0.8964 - val_loss: 0.0727 - val_accuracy: 0.8987
Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8959 - val_loss: 0.0727 - val_accuracy: 0.8996
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8953 - val_loss: 0.0728 - val_accuracy: 0.9005
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8961 - val_loss: 0.0731 - val_accuracy: 0.9003
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8950 - val_loss: 0.0723 - val_accuracy: 0.9001
Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8950 - val_loss: 0.0734 - val_accuracy: 0.8977
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8967 - val_loss: 0.0725 - val_accuracy: 0.9008
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0783 -
accuracy: 0.8957 - val_loss: 0.0729 - val_accuracy: 0.8984
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8960 - val_loss: 0.0732 - val_accuracy: 0.8991
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
```

```
accuracy: 0.8943 - val_loss: 0.0724 - val_accuracy: 0.9006
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8955 - val_loss: 0.0729 - val_accuracy: 0.9002
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8962 - val_loss: 0.0731 - val_accuracy: 0.8981
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8959 - val_loss: 0.0724 - val_accuracy: 0.9007
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8959 - val_loss: 0.0730 - val_accuracy: 0.8988
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8965 - val_loss: 0.0726 - val_accuracy: 0.8982
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8961 - val_loss: 0.0728 - val_accuracy: 0.8990
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8958 - val_loss: 0.0728 - val_accuracy: 0.8988
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8965 - val_loss: 0.0726 - val_accuracy: 0.8992
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8959 - val_loss: 0.0725 - val_accuracy: 0.9000
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8957 - val_loss: 0.0735 - val_accuracy: 0.9000
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8951 - val_loss: 0.0731 - val_accuracy: 0.8980
Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8952 - val_loss: 0.0727 - val_accuracy: 0.9002
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8955 - val_loss: 0.0738 - val_accuracy: 0.8986
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8952 - val_loss: 0.0728 - val_accuracy: 0.8994
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8953 - val_loss: 0.0729 - val_accuracy: 0.8999
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
```

```
accuracy: 0.8954 - val_loss: 0.0737 - val_accuracy: 0.8997
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8962 - val_loss: 0.0726 - val_accuracy: 0.9003
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8959 - val_loss: 0.0727 - val_accuracy: 0.9001
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8956 - val_loss: 0.0731 - val_accuracy: 0.8999
Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8963 - val_loss: 0.0733 - val_accuracy: 0.8977
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8948 - val_loss: 0.0722 - val_accuracy: 0.9008
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8959 - val_loss: 0.0727 - val_accuracy: 0.8995
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8966 - val_loss: 0.0726 - val_accuracy: 0.9004
Epoch 1/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8969 - val_loss: 0.0722 - val_accuracy: 0.9000
Epoch 2/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0758 -
accuracy: 0.8966 - val_loss: 0.0730 - val_accuracy: 0.8988
Epoch 3/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8958 - val_loss: 0.0731 - val_accuracy: 0.8986
Epoch 4/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8965 - val_loss: 0.0731 - val_accuracy: 0.8967
Epoch 5/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0757 -
accuracy: 0.8964 - val_loss: 0.0727 - val_accuracy: 0.9009
Epoch 6/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8954 - val_loss: 0.0726 - val_accuracy: 0.8982
Epoch 7/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0755 -
accuracy: 0.8966 - val_loss: 0.0727 - val_accuracy: 0.8991
Epoch 8/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8955 - val_loss: 0.0730 - val_accuracy: 0.8985
Epoch 9/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
```

```
accuracy: 0.8954 - val_loss: 0.0724 - val_accuracy: 0.9004
Epoch 10/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8956 - val_loss: 0.0725 - val_accuracy: 0.9002
Epoch 11/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8966 - val_loss: 0.0728 - val_accuracy: 0.8999
Epoch 12/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8969 - val_loss: 0.0723 - val_accuracy: 0.9003
Epoch 13/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8959 - val_loss: 0.0727 - val_accuracy: 0.8992
Epoch 14/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8957 - val_loss: 0.0725 - val_accuracy: 0.9009
Epoch 15/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8963 - val_loss: 0.0729 - val_accuracy: 0.8991
Epoch 16/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8963 - val_loss: 0.0725 - val_accuracy: 0.9004
Epoch 17/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8960 - val_loss: 0.0719 - val_accuracy: 0.9010
Epoch 18/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8953 - val_loss: 0.0729 - val_accuracy: 0.8981
Epoch 19/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8964 - val_loss: 0.0730 - val_accuracy: 0.8983
Epoch 20/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8959 - val_loss: 0.0727 - val_accuracy: 0.8992
Epoch 21/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8963 - val_loss: 0.0736 - val_accuracy: 0.8975
Epoch 22/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8946 - val_loss: 0.0732 - val_accuracy: 0.8996
Epoch 23/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8955 - val_loss: 0.0727 - val_accuracy: 0.8994
Epoch 24/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8960 - val_loss: 0.0728 - val_accuracy: 0.8993
Epoch 25/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
```

```
accuracy: 0.8964 - val_loss: 0.0731 - val_accuracy: 0.8984
Epoch 26/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8961 - val_loss: 0.0733 - val_accuracy: 0.8980
Epoch 27/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8950 - val_loss: 0.0729 - val_accuracy: 0.8987
Epoch 28/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8943 - val_loss: 0.0732 - val_accuracy: 0.8981
Epoch 29/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8948 - val_loss: 0.0725 - val_accuracy: 0.8987
Epoch 30/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8952 - val_loss: 0.0728 - val_accuracy: 0.8995
Epoch 31/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8949 - val_loss: 0.0725 - val_accuracy: 0.8980
Epoch 32/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8953 - val_loss: 0.0737 - val_accuracy: 0.8983
Epoch 33/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8958 - val_loss: 0.0736 - val_accuracy: 0.8965
Epoch 34/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8956 - val_loss: 0.0723 - val_accuracy: 0.9000
Epoch 35/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8944 - val_loss: 0.0725 - val_accuracy: 0.8985
Epoch 36/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8958 - val_loss: 0.0730 - val_accuracy: 0.8985
Epoch 37/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0771 -
accuracy: 0.8936 - val_loss: 0.0723 - val_accuracy: 0.8984
Epoch 38/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8941 - val_loss: 0.0727 - val_accuracy: 0.8979
Epoch 39/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8948 - val_loss: 0.0727 - val_accuracy: 0.8998
Epoch 40/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8953 - val_loss: 0.0732 - val_accuracy: 0.8975
Epoch 41/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
```

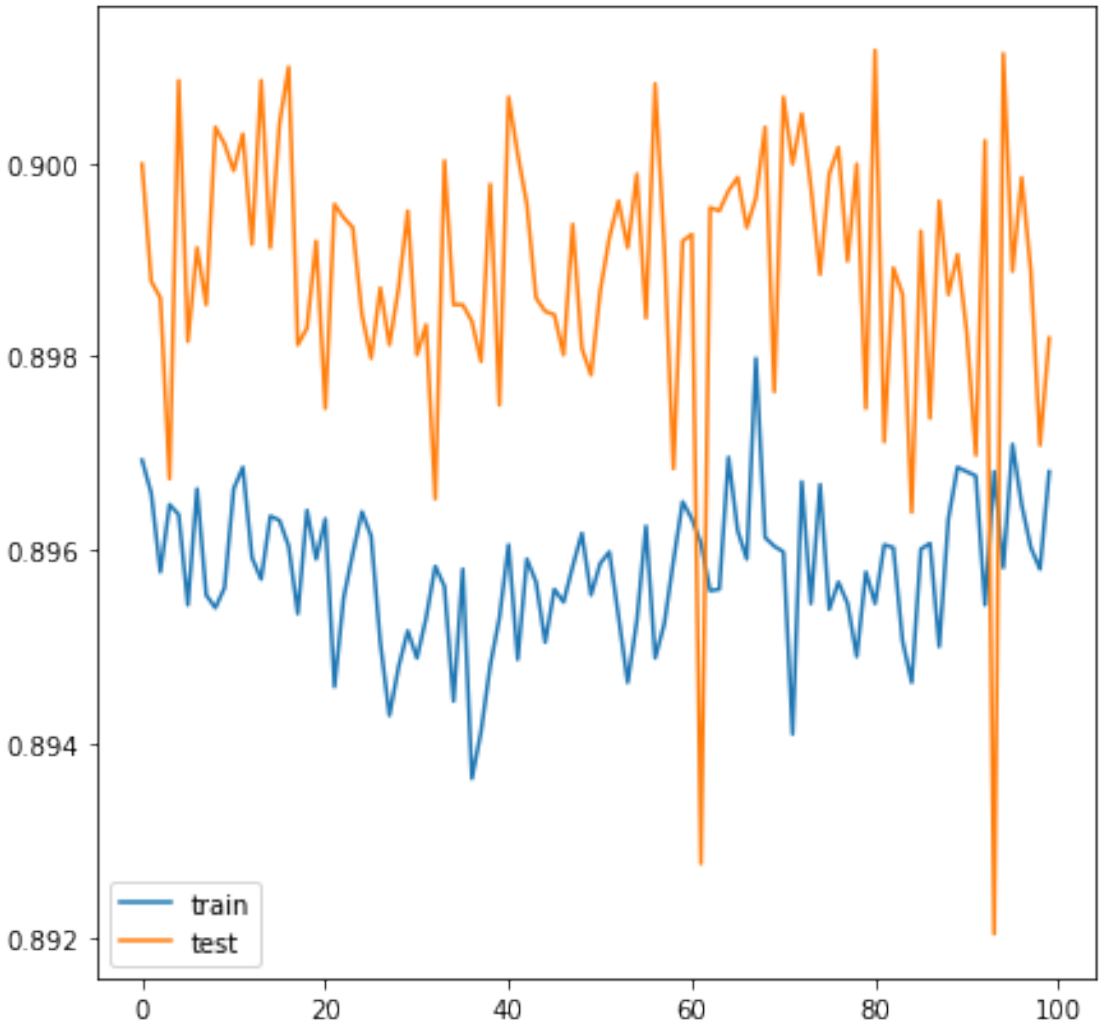
```
accuracy: 0.8961 - val_loss: 0.0721 - val_accuracy: 0.9007
Epoch 42/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8949 - val_loss: 0.0726 - val_accuracy: 0.9001
Epoch 43/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0784 -
accuracy: 0.8959 - val_loss: 0.0723 - val_accuracy: 0.8996
Epoch 44/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0770 -
accuracy: 0.8957 - val_loss: 0.0728 - val_accuracy: 0.8986
Epoch 45/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8950 - val_loss: 0.0729 - val_accuracy: 0.8985
Epoch 46/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8956 - val_loss: 0.0727 - val_accuracy: 0.8984
Epoch 47/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8955 - val_loss: 0.0733 - val_accuracy: 0.8980
Epoch 48/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8958 - val_loss: 0.0726 - val_accuracy: 0.8994
Epoch 49/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8962 - val_loss: 0.0731 - val_accuracy: 0.8981
Epoch 50/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8955 - val_loss: 0.0734 - val_accuracy: 0.8978
Epoch 51/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8959 - val_loss: 0.0729 - val_accuracy: 0.8987
Epoch 52/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8960 - val_loss: 0.0728 - val_accuracy: 0.8992
Epoch 53/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8953 - val_loss: 0.0723 - val_accuracy: 0.8996
Epoch 54/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8946 - val_loss: 0.0734 - val_accuracy: 0.8991
Epoch 55/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8953 - val_loss: 0.0726 - val_accuracy: 0.8999
Epoch 56/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8962 - val_loss: 0.0739 - val_accuracy: 0.8984
Epoch 57/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
```

```
accuracy: 0.8949 - val_loss: 0.0727 - val_accuracy: 0.9008
Epoch 58/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8952 - val_loss: 0.0732 - val_accuracy: 0.8991
Epoch 59/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8959 - val_loss: 0.0735 - val_accuracy: 0.8968
Epoch 60/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8965 - val_loss: 0.0730 - val_accuracy: 0.8992
Epoch 61/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8963 - val_loss: 0.0729 - val_accuracy: 0.8993
Epoch 62/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8961 - val_loss: 0.0756 - val_accuracy: 0.8928
Epoch 63/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0768 -
accuracy: 0.8956 - val_loss: 0.0738 - val_accuracy: 0.8995
Epoch 64/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8956 - val_loss: 0.0732 - val_accuracy: 0.8995
Epoch 65/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8970 - val_loss: 0.0734 - val_accuracy: 0.8997
Epoch 66/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8962 - val_loss: 0.0728 - val_accuracy: 0.8998
Epoch 67/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8959 - val_loss: 0.0734 - val_accuracy: 0.8993
Epoch 68/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0758 -
accuracy: 0.8980 - val_loss: 0.0729 - val_accuracy: 0.8996
Epoch 69/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8961 - val_loss: 0.0732 - val_accuracy: 0.9004
Epoch 70/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8960 - val_loss: 0.0732 - val_accuracy: 0.8976
Epoch 71/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8960 - val_loss: 0.0724 - val_accuracy: 0.9007
Epoch 72/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0769 -
accuracy: 0.8941 - val_loss: 0.0724 - val_accuracy: 0.9000
Epoch 73/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
```

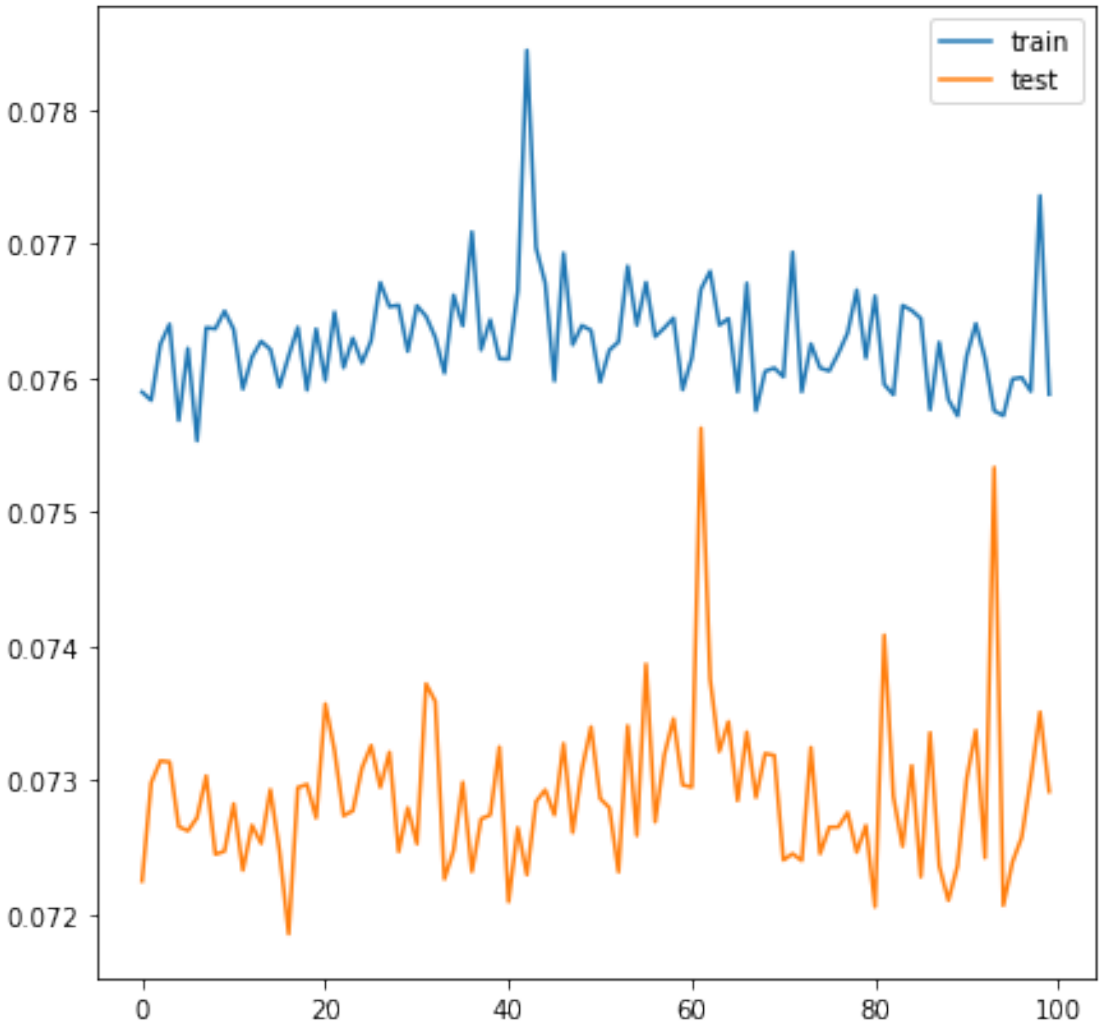
```
accuracy: 0.8967 - val_loss: 0.0724 - val_accuracy: 0.9005
Epoch 74/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8954 - val_loss: 0.0732 - val_accuracy: 0.8997
Epoch 75/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8967 - val_loss: 0.0724 - val_accuracy: 0.8988
Epoch 76/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8954 - val_loss: 0.0726 - val_accuracy: 0.8999
Epoch 77/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8957 - val_loss: 0.0726 - val_accuracy: 0.9002
Epoch 78/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8954 - val_loss: 0.0728 - val_accuracy: 0.8990
Epoch 79/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0767 -
accuracy: 0.8949 - val_loss: 0.0725 - val_accuracy: 0.9000
Epoch 80/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8958 - val_loss: 0.0727 - val_accuracy: 0.8975
Epoch 81/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0766 -
accuracy: 0.8954 - val_loss: 0.0721 - val_accuracy: 0.9012
Epoch 82/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8961 - val_loss: 0.0741 - val_accuracy: 0.8971
Epoch 83/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8960 - val_loss: 0.0729 - val_accuracy: 0.8989
Epoch 84/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8951 - val_loss: 0.0725 - val_accuracy: 0.8986
Epoch 85/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0765 -
accuracy: 0.8946 - val_loss: 0.0731 - val_accuracy: 0.8964
Epoch 86/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8960 - val_loss: 0.0723 - val_accuracy: 0.8993
Epoch 87/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0758 -
accuracy: 0.8961 - val_loss: 0.0734 - val_accuracy: 0.8974
Epoch 88/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0763 -
accuracy: 0.8950 - val_loss: 0.0724 - val_accuracy: 0.8996
Epoch 89/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0758 -
```

```
accuracy: 0.8963 - val_loss: 0.0721 - val_accuracy: 0.8986
Epoch 90/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0757 -
accuracy: 0.8969 - val_loss: 0.0724 - val_accuracy: 0.8991
Epoch 91/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0762 -
accuracy: 0.8968 - val_loss: 0.0730 - val_accuracy: 0.8983
Epoch 92/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0764 -
accuracy: 0.8968 - val_loss: 0.0734 - val_accuracy: 0.8970
Epoch 93/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0761 -
accuracy: 0.8954 - val_loss: 0.0724 - val_accuracy: 0.9002
Epoch 94/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0758 -
accuracy: 0.8968 - val_loss: 0.0753 - val_accuracy: 0.8920
Epoch 95/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0757 -
accuracy: 0.8958 - val_loss: 0.0721 - val_accuracy: 0.9011
Epoch 96/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8971 - val_loss: 0.0724 - val_accuracy: 0.8989
Epoch 97/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0760 -
accuracy: 0.8965 - val_loss: 0.0726 - val_accuracy: 0.8998
Epoch 98/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8960 - val_loss: 0.0730 - val_accuracy: 0.8989
Epoch 99/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0774 -
accuracy: 0.8958 - val_loss: 0.0735 - val_accuracy: 0.8971
Epoch 100/100
1349/1349 [==============================] - 2s 1ms/step - loss: 0.0759 -
accuracy: 0.8968 - val_loss: 0.0729 - val_accuracy: 0.8982
```

[93]:
```
plt.figure(figsize=(7, 7))
plt.plot(history2.history['accuracy'], label='train')
plt.plot(history2.history['val_accuracy'], label='test')
plt.legend()
plt.savefig('accuracy_mean_s_e.jpg', dpi=200)
```



[94]:
```
plt.figure(figsize=(7, 7))
plt.plot(history2.history['loss'], label='train')
plt.plot(history2.history['val_loss'], label='test')
plt.legend()
plt.savefig('loss_mean_s_e.jpg', dpi=200)
```



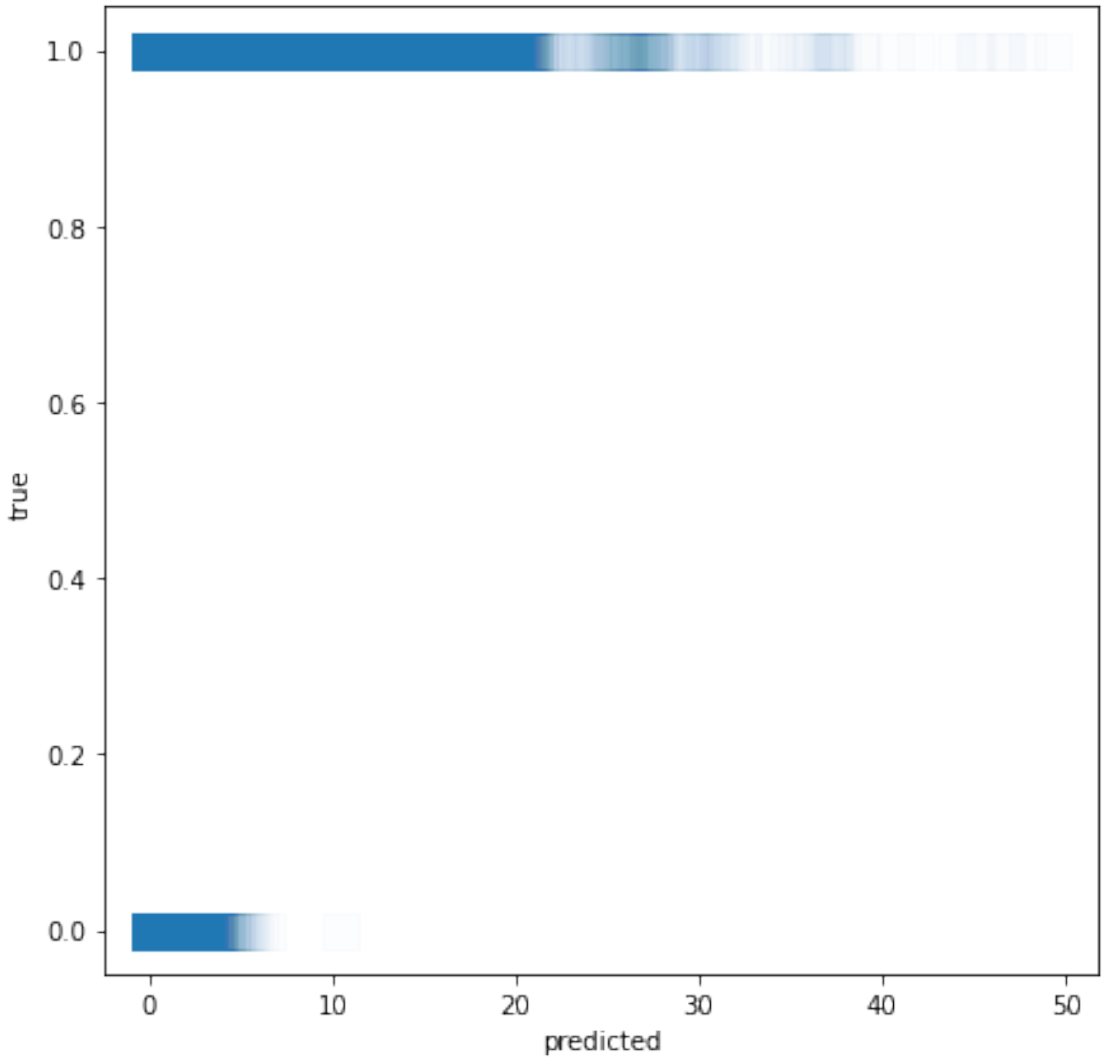
[95]:
```
y_predict = model(x_train)
y_predict
```

[95]:
```
<tf.Tensor: shape=(67447, 1), dtype=float32, numpy=
array([[0.       ],
       [1.1922374],
       [0.       ],
       …,
       [4.780798 ],
       [0.       ],
       [0.       ]], dtype=float32)>
```

[96]:
```
plt.figure(figsize=(7, 7))
plt.scatter(y_predict, y_train, s=200, marker='s', alpha=0.01)
plt.xlabel('predicted')
```

```
plt.ylabel('true')
```

[96]: Text(0, 0.5, 'true')



[112]:
```
for i in range(0, 10):
    val_accuracy_list[i] = sum(val_accuracy_list[i]) / 100
```

[114]:
```
for i in range(0, 10):
    val_accuracy_list2[i] = sum(val_accuracy_list2[i]) / 100
```

[113]:
```
val_accuracy_list
```

[113]:
```
[0.8840642064809799,
 0.8866186940670013,
```

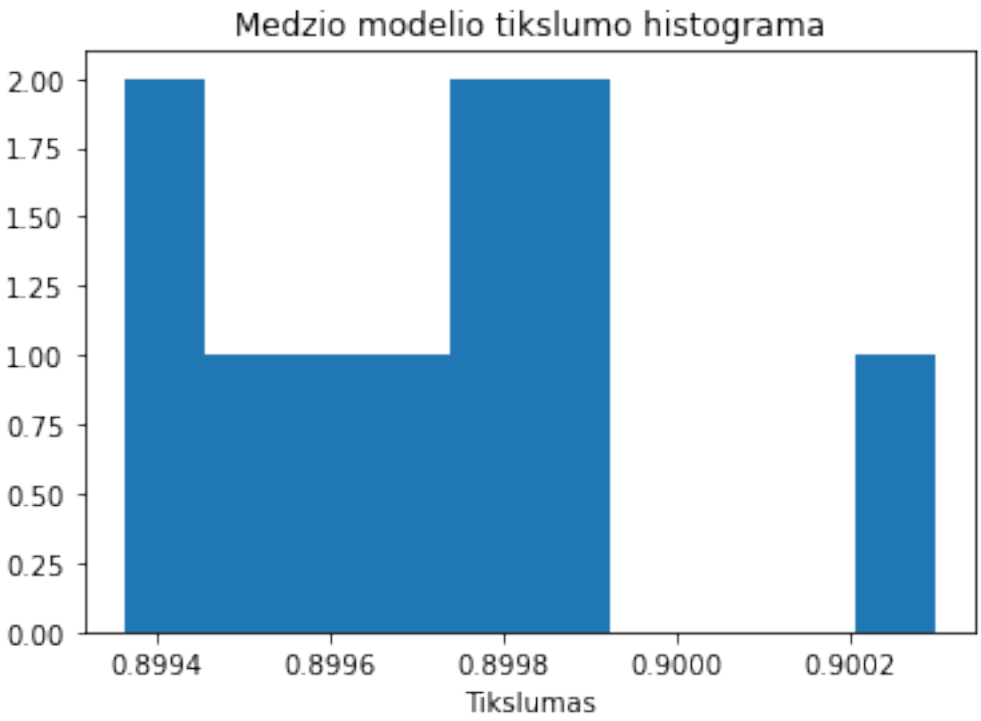
```
 0.8903604763746261,
 0.8908493053913117,
 0.890832349061966,
 0.891294886469841,
 0.8907174974679947,
 0.8913187605142593,
 0.8917460054159164,
 0.8915069508552551]
```

[115]:
```
val_accuracy_list2
```

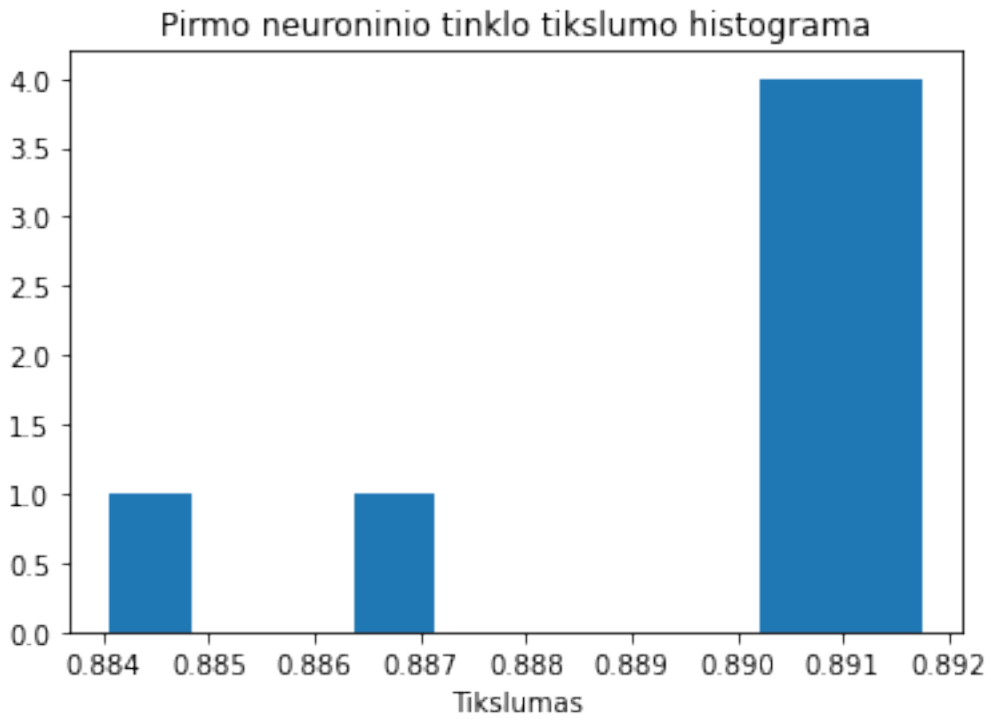
[115]:
```
[0.8915581548213959,
 0.8970635843276977,
 0.897506052851677,
 0.8975582921504974,
 0.8982560712099076,
 0.8984875082969666,
 0.8987352114915848,
 0.8989365547895432,
 0.8994035828113556,
 0.8988984972238541]
```

[119]:
```
score_list = []
while len(score_list) != 10:
    model = DecisionTreeClassifier()
    model.fit(x_train, y_train)
    predictions = model.predict(x_test)
    score = accuracy_score(y_test, predictions)
    score_list.append(score)
```

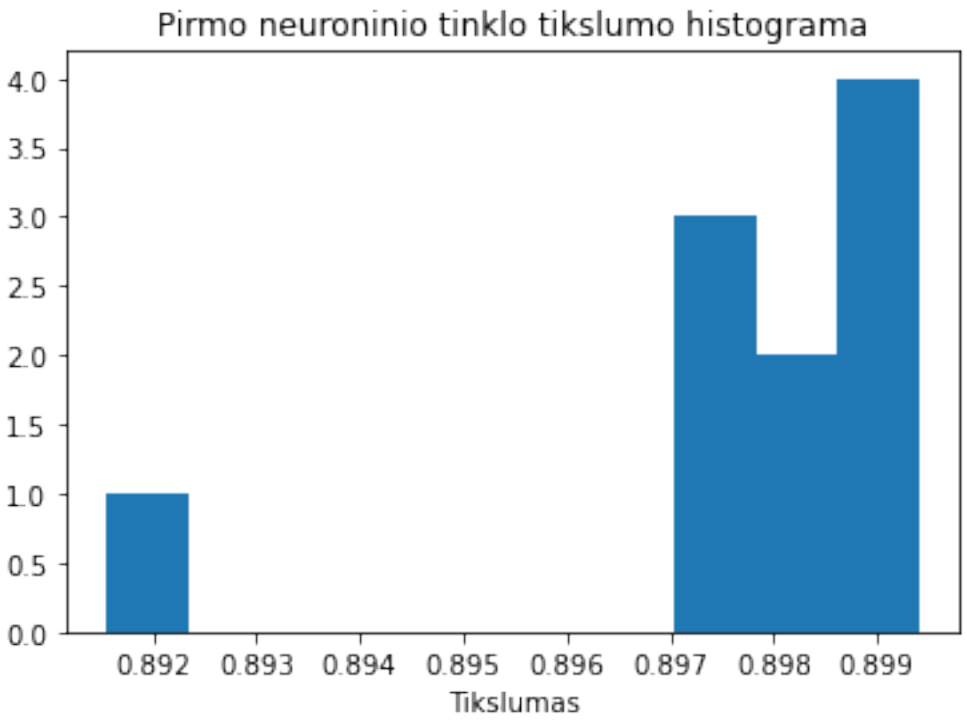
[137]:
```
plt.hist(score_list)
plt.xlabel('Tikslumas')
plt.title('Medzio modelio tikslumo histograma')
plt.savefig('tree_hist.png')
```



[138]:
```
plt.hist(val_accuracy_list)
plt.xlabel('Tikslumas')
plt.title('Pirmo neuroninio tinklo tikslumo histograma')
plt.savefig('model_hist.png')
```



[135]:
```
plt.hist(val_accuracy_list2)
plt.xlabel('Tikslumas')
plt.title('Antro neuroninio tinklo tikslumo histograma')
plt.savefig('model2_hist.png', dpi=200)
```



[125]:
```
score_mean = sum(score_list) / len(score_list)
score_mean = score_mean.round(3)
```

[126]:
```
model1_mean = sum(history.history['val_accuracy']) / len(history.
 ↪history['val_accuracy'])
model1_mean = round(model1_mean, 3)
```

[127]:
```
model2_mean = sum(history2.history['val_accuracy']) / len(history2.
 ↪history['val_accuracy'])
model2_mean = round(model2_mean, 3)
```

[128]:
```
print('Medzio klasifikavimo rezultatas yra', score_mean)
print('1 neuroninio tinklo klasifikavimo rezultatas yra', model1_mean)
print('2 neuroninio tinklo klasifikavimo rezultatas yra', model2_mean)
```

```
Medzio klasifikavimo rezultatas yra 0.9
1 neuroninio tinklo klasifikavimo rezultatas yra 0.892
2 neuroninio tinklo klasifikavimo rezultatas yra 0.899
```

[103]:
```
model = DecisionTreeClassifier()
model.fit(x_data, y_data)
predictions = model.predict(x_data)

y_data = y_data.astype(str)
```

```
tree.export_graphviz(model,
                     out_file='price_predicttion_tree_new.dot',
                     feature_names=['Year', 'Distance_km', 'Power',␣
 ↪'Engine_size'],
                     class_names=sorted(y_data.unique()),
                     label='all',
                     rounded=True,
                     filled=True
                    )
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Input In [103], in <cell line: 7>()
      3 predictions = model.predict(x_data)
      5 y_data = y_data.astype(str)
----> 7 tree.export_graphviz(model,
      8                      out_file='price_predicttion_tree_new.dot',
      9␣
 ↪                     feature_names=['Year', 'Distance_km', 'Power', 'Engine_s ze'],
     10                      class_names=sorted(y_data.unique()),
     11                      label='all',
     12                      rounded=True,
     13                      filled=True
     14                     )

File ~\anaconda3\lib\site-packages\sklearn\tree\_export.py:889, in␣
 ↪export_graphviz(decision_tree, out_file, max_depth, feature_names,␣
 ↪class_names, label, filled, leaves_parallel, impurity, node_ids, proportion,␣
 ↪rotate, rounded, special_characters, precision, fontname)
    870     out_file = StringIO()
    872 exporter = _DOTTreeExporter(
    873     out_file=out_file,
    874     max_depth=max_depth,
   (…)
    887     fontname=fontname,
    888 )
--> 889 exporter.export(decision_tree)
    891 if return_string:
    892     return exporter.out_file.getvalue()

File ~\anaconda3\lib\site-packages\sklearn\tree\_export.py:452, in␣
 ↪_DOTTreeExporter.export(self, decision_tree)
    450 if self.feature_names is not None:
    451     if len(self.feature_names) != decision_tree.n_features_in_:
--> 452         raise ValueError(
    453             "Length of feature_names, %d does not match number of␣
 ↪features, %d"
```

```
    454             % (len(self.feature_names), decision_tree.n_features_in_)
    455         )
    456 # each part writes to out_file
    457 self.head()

ValueError: Length of feature_names, 4 does not match number of features, 5
```

[ ]:
```
# X_input = predict_data.drop(columns=['Price'])␣
 ↪################################ padaro kodas medi tikimybini
# Y_output = predict_data['Price']

# model = DecisionTreeClassifier()
# model.fit(X_input.values, Y_output.values)

# # Y_output = Y_output.astype(str)

# tree.export_graphviz(model,
#                      out_file='price-predictor.dot',
#                      feature_names=['Power', 'Engine CC'],
#                      class_names=sorted(Y_output.unique()),
#                      label='all',
#                      rounded=True,
#                      filled=True
#                     )
```