

# Assignment1

February 15, 2024

## ASSIGNMENT 1

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Import Libraries

```
[ ]: import pandas as pd
import numpy as np
from tensorflow import keras
from sklearn.preprocessing import StandardScaler, LabelEncoder
from tensorflow.keras import layers
from sklearn.model_selection import train_test_split
from matplotlib import pyplot as plt
```

Import Dataset

```
[ ]: data = pd.read_csv('spotify_data_12_20_2023.csv')
data.dropna(inplace=True)
print(data.columns)
```

C:\Users\d-kin\AppData\Local\Temp\ipykernel\_22448\1230069711.py:1: DtypeWarning: Columns (25,26,44) have mixed types. Specify dtype option on import or set low\_memory=False.

```
data = pd.read_csv('spotify_data_12_20_2023.csv')
```

```
Index(['album_id', 'album_name', 'album_popularity', 'album_type', 'artists',
      'artist_0', 'artist_1', 'artist_2', 'artist_3', 'artist_4', 'artist_id',
      'duration_sec', 'label', 'release_date', 'total_tracks', 'track_id',
      'track_name', 'track_number', 'artist_genres', 'artist_popularity',
      'followers', 'name', 'genre_0', 'genre_1', 'genre_2', 'genre_3',
      'genre_4', 'acousticness', 'analysis_url', 'danceability',
      'duration_ms', 'energy', 'instrumentalness', 'key', 'liveness',
      'loudness', 'mode', 'speechiness', 'tempo', 'time_signature',
      'track_href', 'type', 'uri', 'valence', 'explicit', 'track_popularity',
      'release_year', 'release_month', 'rn'],
      dtype='object')
```

Describe Dataset

```
[ ]: print(data.describe())
```

	album_popularity	duration_sec	total_tracks	track_number \
count	583.000000	583.000000	583.000000	583.000000
mean	26.209262	239.709455	21.559177	10.161235
std	20.350218	152.308955	15.760215	9.029052
min	0.000000	17.466000	1.000000	1.000000
25%	7.000000	149.520000	10.000000	3.000000
50%	26.000000	218.160000	19.000000	8.000000
75%	38.500000	292.119500	29.500000	14.000000
max	82.000000	1549.965000	101.000000	50.000000

	artist_popularity	followers	acousticness	danceability \
count	583.000000	5.830000e+02	583.000000	583.000000
mean	61.005146	5.775971e+06	0.603440	0.462878
std	17.661624	8.838207e+06	0.428430	0.231616
min	24.000000	3.167000e+03	0.000039	0.060500
25%	38.000000	1.921400e+04	0.069000	0.246000
50%	65.000000	8.837690e+05	0.912000	0.462000
75%	75.500000	7.698680e+06	0.968000	0.656500
max	88.000000	3.475764e+07	0.994000	0.960000

	duration_ms	energy	...	liveness	loudness	mode \
count	5.830000e+02	583.000000	...	583.000000	583.000000	583.000000
mean	2.402119e+05	0.397114	...	0.192786	-14.957942	0.600343
std	1.524700e+05	0.330772	...	0.154239	8.814677	0.490248
min	1.746700e+04	0.002300	...	0.020500	-35.177000	0.000000
25%	1.497600e+05	0.107000	...	0.095250	-22.148000	0.000000
50%	2.183840e+05	0.252000	...	0.130000	-16.067000	1.000000
75%	2.924130e+05	0.764500	...	0.245500	-5.790000	1.000000
max	1.549965e+06	0.991000	...	0.927000	-1.428000	1.000000

	speechiness	tempo	time_signature	valence	track_popularity \
count	583.000000	583.000000	583.000000	583.000000	583.000000
mean	0.105063	109.509482	3.819897	0.338206	16.053173
std	0.124807	30.256383	0.688753	0.237555	16.728854
min	0.025100	39.363000	1.000000	0.000000	0.000000
25%	0.041950	85.161000	4.000000	0.139000	1.000000
50%	0.051000	104.564000	4.000000	0.301000	11.000000
75%	0.096600	128.022000	4.000000	0.520500	26.000000
max	0.927000	241.527000	5.000000	0.960000	78.000000

	release_year	rn
count	583.000000	583.0
mean	2004.692967	1.0
std	15.589231	0.0
min	1959.000000	1.0
25%	1994.000000	1.0
50%	2011.000000	1.0
75%	2016.000000	1.0

max 2023.000000 1.0

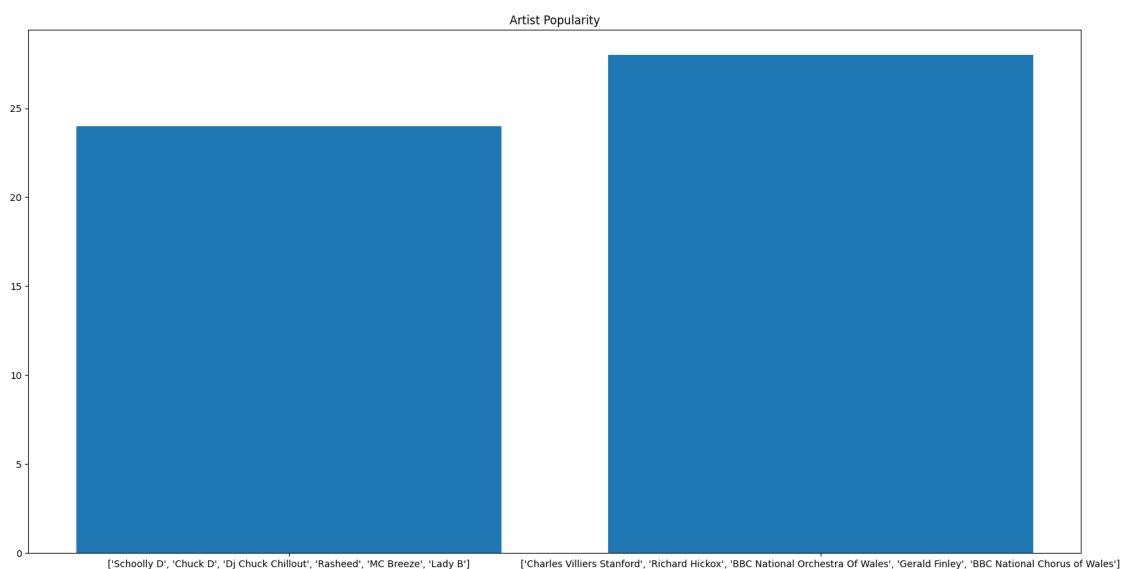
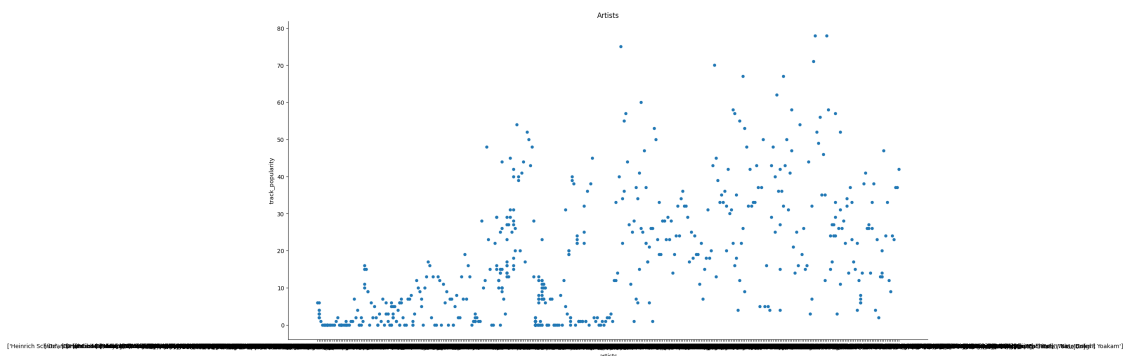
[8 rows x 22 columns]

Plot Graphs

```
[ ]: df = pd.DataFrame(data)

df.plot(kind='scatter', x='artists', y='track_popularity', figsize=(20, 10),
        title='Artists')
plt.gca().spines[['top', 'right']].set_visible(False)

x1 = df['artists']
y1 = df['artist_popularity']
plt.figure(figsize=(20, 10))
plt.bar(x1[0:10], y1[0:10])
plt.title('Artist Popularity')
plt.show()
```



Select Fields for data processing

```
[ ]: numeric_features = ['artist_popularity', 'acousticness', 'danceability',  
    ↪ 'energy', 'instrumentalness', 'liveness',  
        'loudness', 'speechiness', 'tempo', 'track_popularity',  
    ↪ 'followers', 'album_popularity',  
        'instrumentalness']  
categorical_features = ['artists', 'label', 'artist_genres']  
  
X_categorical = df[categorical_features]  
X_numeric = df[numeric_features]
```

Prepare the Data for Processing

```
[ ]: scaler = StandardScaler()  
X_numeric_scaled = scaler.fit_transform(X_numeric)  
  
label_encoders = {}  
X_categorical_encoded = pd.DataFrame()  
  
for feature in categorical_features:  
    label_encoder = LabelEncoder()  
    X_categorical_encoded[feature] = label_encoder.fit_transform(df[feature])  
    label_encoders[feature] = label_encoder
```

Split the data

```
[ ]: X = pd.concat([pd.DataFrame(X_numeric_scaled, columns=numeric_features),  
    ↪ X_categorical_encoded], axis=1)  
y = df['artist_popularity']  
  
# Split the data into training and testing sets  
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,  
    ↪ random_state=42)
```

Construct the Input layer

```
[ ]: # Constructing the input  
x = np.column_stack((X_train.values, y_train.values))  
y = y_train.values
```

Build and execute the model.

```
[ ]: # Defining the model  
model = keras.Sequential([  
    keras.layers.Dense(units=X_train.shape[1], activation='sigmoid',  
    ↪ input_dim=X_train.shape[1]),
```

```

        keras.layers.Dense(10, activation='sigmoid'),
        keras.layers.Dense(5, activation='sigmoid'),
        keras.layers.Dense(1)
    ])

    # Compiling the model
    model.compile(optimizer='adam', loss=keras.losses.BinaryCrossentropy(),
        metrics=['accuracy'])
    # model.compile(optimizer='adam', loss='mse', metrics=['accuracy'])

    # fitting the model
    h = model.fit(X_train, y_train, epochs=300, verbose=1, validation_data=(X_test,
        y_test), batch_size=8)

```

```

Epoch 1/300
59/59 [=====] - 2s 7ms/step - loss: 5.8846 - accuracy:
0.0000e+00 - val_loss: -57.4236 - val_accuracy: 0.0000e+00
Epoch 2/300
59/59 [=====] - 0s 4ms/step - loss: -568.1992 -
accuracy: 0.0000e+00 - val_loss: -898.7927 - val_accuracy: 0.0000e+00
Epoch 3/300
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -
accuracy: 0.0000e+00 - val_loss: -898.7927 - val_accuracy: 0.0000e+00
Epoch 4/300
59/59 [=====] - 0s 5ms/step - loss: -919.1101 -
accuracy: 0.0000e+00 - val_loss: -898.7927 - val_accuracy: 0.0000e+00
Epoch 5/300
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -
accuracy: 0.0000e+00 - val_loss: -898.7927 - val_accuracy: 0.0000e+00
Epoch 6/300
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -
accuracy: 0.0000e+00 - val_loss: -898.7927 - val_accuracy: 0.0000e+00
Epoch 7/300
59/59 [=====] - 0s 5ms/step - loss: -919.1102 -
accuracy: 0.0000e+00 - val_loss: -898.7927 - val_accuracy: 0.0000e+00
Epoch 8/300
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -
accuracy: 0.0000e+00 - val_loss: -898.7927 - val_accuracy: 0.0000e+00
Epoch 9/300
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -
accuracy: 0.0000e+00 - val_loss: -898.7927 - val_accuracy: 0.0000e+00
Epoch 10/300
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -
accuracy: 0.0000e+00 - val_loss: -898.7927 - val_accuracy: 0.0000e+00
Epoch 11/300
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -
accuracy: 0.0000e+00 - val_loss: -898.7927 - val_accuracy: 0.0000e+00
Epoch 12/300

```

59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 13/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 14/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 15/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 16/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 17/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 18/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 19/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 20/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 21/300  
59/59 [=====] - 0s 5ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 22/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 23/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1105 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 24/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 25/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 26/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 27/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 28/300

59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 29/300

59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 30/300

59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 31/300

59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 32/300

59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 33/300

59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 34/300

59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 35/300

59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 36/300

59/59 [=====] - 0s 3ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 37/300

59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 38/300

59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 39/300

59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 40/300

59/59 [=====] - 0s 4ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 41/300

59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 42/300

59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 43/300

59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 44/300

59/59 [=====] - 0s 4ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 45/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 46/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 47/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 48/300  
59/59 [=====] - 0s 5ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 49/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 50/300  
59/59 [=====] - 0s 5ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 51/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 52/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 53/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 54/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 55/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 56/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 57/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 58/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 59/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 60/300



59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 61/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 62/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 63/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 64/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 65/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 66/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 67/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 68/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 69/300  
59/59 [=====] - 0s 5ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 70/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 71/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 72/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 73/300  
59/59 [=====] - 0s 5ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 74/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 75/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 76/300

59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 77/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 78/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 79/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 80/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 81/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 82/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1105 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 83/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 84/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 85/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 86/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 87/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 88/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 89/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 90/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 91/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 92/300

59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 93/300

59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 94/300

59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 95/300

59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 96/300

59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 97/300

59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 98/300

59/59 [=====] - 0s 4ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 99/300

59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 100/300

59/59 [=====] - 0s 4ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 101/300

59/59 [=====] - 0s 5ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 102/300

59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 103/300

59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 104/300

59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 105/300

59/59 [=====] - 0s 4ms/step - loss: -919.1105 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 106/300

59/59 [=====] - 0s 4ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 107/300

59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 108/300

59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 109/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 110/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 111/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 112/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 113/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 114/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 115/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 116/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 117/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 118/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 119/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 120/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 121/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 122/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 123/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 124/300

59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 125/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 126/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 127/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 128/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 129/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 130/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 131/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 132/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 133/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 134/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 135/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 136/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 137/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 138/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 139/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 140/300

59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 141/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 142/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 143/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 144/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1105 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 145/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 146/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 147/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 148/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 149/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 150/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 151/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 152/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 153/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 154/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 155/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 156/300

59/59 [=====] - 0s 4ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 157/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 158/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 159/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 160/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 161/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 162/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 163/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 164/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 165/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 166/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 167/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 168/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 169/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 170/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 171/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 172/300

59/59 [=====] - 0s 4ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 173/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 174/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 175/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 176/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 177/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 178/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 179/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1105 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 180/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 181/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 182/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 183/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 184/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1105 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 185/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 186/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 187/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 188/300



59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 189/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 190/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 191/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 192/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 193/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 194/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 195/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 196/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 197/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 198/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 199/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 200/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 201/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 202/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 203/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 204/300

59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 205/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 206/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 207/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 208/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 209/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 210/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1105 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 211/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 212/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 213/300  
59/59 [=====] - 0s 5ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 214/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 215/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 216/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 217/300  
59/59 [=====] - 0s 5ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 218/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 219/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 220/300

59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 221/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 222/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 223/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 224/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 225/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 226/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 227/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 228/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 229/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 230/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 231/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 232/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 233/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 234/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 235/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 236/300

59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 237/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 238/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 239/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 240/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 241/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 242/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 243/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 244/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 245/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 246/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 247/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 248/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 249/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 250/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 251/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 252/300

59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 253/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 254/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 255/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 256/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 257/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 258/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 259/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 260/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 261/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 262/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 263/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 264/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 265/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 266/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 267/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 268/300

59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 269/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 270/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 271/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 272/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 273/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 274/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 275/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 276/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 277/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 278/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 279/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 280/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 281/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 282/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 283/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 284/300

59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 285/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 286/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1104 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 287/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1101 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 288/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 289/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 290/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 291/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 292/300  
59/59 [=====] - 0s 4ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 293/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 294/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 295/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1103 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 296/300  
59/59 [=====] - 0s 3ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 297/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 298/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1102 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 299/300  
59/59 [=====] - 0s 2ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val\_loss: -898.7927 - val\_accuracy: 0.0000e+00  
Epoch 300/300

```
59/59 [=====] - 0s 3ms/step - loss: -919.1100 -  
accuracy: 0.0000e+00 - val_loss: -898.7927 - val_accuracy: 0.0000e+00
```

```
[ ]: model.summary()
```

Model: "sequential"

Layer (type)	Output Shape	Param #
dense (Dense)	(None, 16)	272
dense_1 (Dense)	(None, 10)	170
dense_2 (Dense)	(None, 5)	55
dense_3 (Dense)	(None, 1)	6

Total params: 503 (1.96 KB)  
Trainable params: 503 (1.96 KB)  
Non-trainable params: 0 (0.00 Byte)

Evaluate the model

```
[ ]: score=model.evaluate(X_test, y_test, verbose=0)  
print("Test loss:",score[0])  
print("Test accuracy",score[1])
```

Test loss: -898.792724609375

Test accuracy 0.0

Plot the model performance

```
[ ]: plt.plot(h.history['loss'])
```

```
[ ]: [ <matplotlib.lines.Line2D at 0x277fb487790> ]
```



