

```
In [1]: # Import our dependencies
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler, OneHotEncoder, MinMaxScaler
import pandas as pd
import tensorflow as tf
import numpy as np

# Import our input dataset
df = pd.read_csv('../neural-network/pitcher_salaries_cleaned.csv')
df.head()
```

```
Out[1]:
```

	Year	Full Name	Age	Salary	ERA	Hits	Earned Runs	Strike Outs	Home Runs	Wins	Losses	Outs Pitched	Batters Faced by Pitcher	Games Finished	Weight	I
0	1990	AbbottJim	23	185000	4.51	246	106	105	16	10	14	635	925	0	200	
1	1990	AbbottPaul	23	100000	5.97	37	23	25	0	0	5	104	162	0	185	
2	1990	AldredScott	22	100000	3.77	13	6	7	0	1	2	43	63	0	195	
3	1990	AndersonAllan	26	300000	4.53	214	95	82	20	7	18	566	797	0	178	
4	1990	AppierKevin	23	100000	2.76	179	57	127	13	12	8	557	784	1	180	

```
In [2]: # create log transformed column for salary
df['sal-log'] = np.log10(df['Salary'])
df
```

```
Out[2]:
```

	Year	Full Name	Age	Salary	ERA	Hits	Earned Runs	Strike Outs	Home Runs	Wins	Losses	Outs Pitched	Batters Faced by Pitcher	Games Finished
0	1990	AbbottJim	23	185000	4.51	246	106	105	16	10	14	635	925	0
1	1990	AbbottPaul	23	100000	5.97	37	23	25	0	0	5	104	162	0
2	1990	AldredScott	22	100000	3.77	13	6	7	0	1	2	43	63	0
3	1990	AndersonAllan	26	300000	4.53	214	95	82	20	7	18	566	797	0
4	1990	AppierKevin	23	100000	2.76	179	57	127	13	12	8	557	784	1
...
4932	2016	WorleyVance	29	2600000	3.53	84	34	56	11	2	2	260	365	13
4933	2016	WrightMike	26	510500	5.79	81	48	50	12	3	4	224	328	5
4934	2016	WrightSteven	32	514500	3.33	138	58	127	12	13	6	470	656	0
4935	2016	YoungChris	37	4250000	6.19	104	61	94	28	3	9	266	406	7
4936	2016	ZimmermannJordan	30	18000000	4.87	118	57	66	14	9	7	316	450	1

4937 rows × 15 columns

Reduce down to top features

```
In [3]: df = df.drop(["Full Name", "Team", "League", "Age", "Earned Runs", "Home Runs", "Wins", "Losses", "Weight", "Height"])
df.head()
```

version of pandas all arguments of DataFrame.drop except for the argument 'labels' will be keyword-only
"""Entry point for launching an IPython kernel.

```
Out[3]:
```

	ERA	Hits	Strike Outs	Outs Pitched	Batters Faced by Pitcher	Games Finished	Games Started	sal-log
0	4.51	246	105	635	925	0	33	5.267172
1	5.97	37	25	104	162	0	7	5.000000
2	3.77	13	7	43	63	0	3	5.000000
3	4.53	214	82	566	797	0	31	5.477121
4	2.76	179	127	557	784	1	24	5.000000

Split Features/Target & Training/Testing Sets

Split into features and target

- **y variable:** Our target variable, Salary
- **X variable:** Our features; just drop Salary and Full Name

```
In [4]: # Split our preprocessed data into our features and target arrays
y = df["sal-log"].values
X = df.drop(["sal-log"],1).values

# Split the preprocessed data into a training and testing dataset
X_train, X_test, y_train, y_test = train_test_split(X, y, random_state=1)
```

C:\Users\alyss\anaconda3\envs\mlenv\lib\site-packages\ipykernel_launcher.py:3: FutureWarning: In a future version of pandas all arguments of DataFrame.drop except for the argument 'labels' will be keyword-only
This is separate from the ipykernel package so we can avoid doing imports until

Build and Instantiate StandardScaler object, then standardize numerical features

```
In [5]: # Create a StandardScaler instance
scaler = MinMaxScaler()

# Fit the StandardScaler
X_scaler = scaler.fit(X_train)

# Scale the data
X_train_scaled = X_scaler.transform(X_train)
X_test_scaled = X_scaler.transform(X_test)
```

```
In [ ]: # see if data scaled properly
scaled_data=pd.DataFrame(X_train_scaled)
scaled_data.head()
```

```
In [ ]: # see if data scaled properly
scaled_y=pd.DataFrame(y_train_scaled)
scaled_y.head()
```

Build Neural Net Framework

```
In [33]: # Define the model - deep neural net
number_input_features = len(X_train[0])
```

```

hidden_nodes_layer1 = 50
hidden_nodes_layer2 = 30
hidden_nodes_layer3 = 20

nn = tf.keras.models.Sequential()

# First hidden layer
nn.add(
    tf.keras.layers.Dense(units=hidden_nodes_layer1, input_dim=number_input_features, activation="elu")
)

# Second hidden layer
nn.add(tf.keras.layers.Dense(units=hidden_nodes_layer2, activation="relu"))

# Third hidden layer
nn.add(tf.keras.layers.Dense(units=hidden_nodes_layer2, activation="relu"))

# Fourth hidden layer
nn.add(tf.keras.layers.Dense(units=hidden_nodes_layer2, activation="relu"))

# Output Layer
nn.add(tf.keras.layers.Dense(units=10, activation="elu"))

# Check the structure of the model
nn.summary()

```

Model: "sequential_5"

Layer (type)	Output Shape	Param #
dense_25 (Dense)	(None, 50)	400
dense_26 (Dense)	(None, 30)	1530
dense_27 (Dense)	(None, 30)	930
dense_28 (Dense)	(None, 30)	930
dense_29 (Dense)	(None, 10)	310
Total params: 4,100		
Trainable params: 4,100		
Non-trainable params: 0		

Compile the Model

```

In [34]: # Compile the model
nn.compile(loss="mean_squared_error", optimizer="adam", metrics=["accuracy"])

```

Train the model

```

In [35]: # Train the model
fit_model = nn.fit(X_train,y_train,epochs=500)

Epoch 1/500
116/116 [=====] - 1s 2ms/step - loss: 30.3725 - accuracy: 0.0049
Epoch 2/500
116/116 [=====] - 0s 2ms/step - loss: 20.4539 - accuracy: 0.0062
Epoch 3/500
116/116 [=====] - 0s 1ms/step - loss: 7.2146 - accuracy: 0.0035
Epoch 4/500
116/116 [=====] - 0s 2ms/step - loss: 1.1347 - accuracy: 0.0022
Epoch 5/500

```

116/116 [=====] - 0s 1ms/step - loss: 0.8008 - accuracy: 0.0019
Epoch 6/500
116/116 [=====] - 0s 1ms/step - loss: 0.7140 - accuracy: 0.0022
Epoch 7/500
116/116 [=====] - 0s 1ms/step - loss: 0.6531 - accuracy: 0.0032
Epoch 8/500
116/116 [=====] - 0s 930us/step - loss: 0.6181 - accuracy: 0.0014
Epoch 9/500
116/116 [=====] - 0s 1ms/step - loss: 0.6786 - accuracy: 0.0014
Epoch 10/500
116/116 [=====] - 0s 939us/step - loss: 0.5128 - accuracy: 0.0019
Epoch 11/500
116/116 [=====] - 0s 783us/step - loss: 0.4996 - accuracy: 8.1037e-04
Epoch 12/500
116/116 [=====] - 0s 861us/step - loss: 0.5633 - accuracy: 0.0016
Epoch 13/500
116/116 [=====] - 0s 956us/step - loss: 0.4837 - accuracy: 0.0011
Epoch 14/500
116/116 [=====] - 0s 843us/step - loss: 0.4846 - accuracy: 0.0019
Epoch 15/500
116/116 [=====] - 0s 817us/step - loss: 0.5357 - accuracy: 0.0016
Epoch 16/500
116/116 [=====] - 0s 948us/step - loss: 0.5646 - accuracy: 0.0022
Epoch 17/500
116/116 [=====] - 0s 922us/step - loss: 0.4663 - accuracy: 0.0022
Epoch 18/500
116/116 [=====] - 0s 852us/step - loss: 0.6230 - accuracy: 0.0030
Epoch 19/500
116/116 [=====] - 0s 765us/step - loss: 0.5403 - accuracy: 0.0024
Epoch 20/500
116/116 [=====] - 0s 843us/step - loss: 0.4500 - accuracy: 0.0038
Epoch 21/500
116/116 [=====] - 0s 843us/step - loss: 0.4799 - accuracy: 0.0022
Epoch 22/500
116/116 [=====] - 0s 852us/step - loss: 0.4798 - accuracy: 0.0022
Epoch 23/500
116/116 [=====] - 0s 1ms/step - loss: 0.4919 - accuracy: 0.0019
Epoch 24/500
116/116 [=====] - 0s 1ms/step - loss: 0.4414 - accuracy: 0.0016
Epoch 25/500
116/116 [=====] - 0s 1ms/step - loss: 0.4258 - accuracy: 0.0019
Epoch 26/500
116/116 [=====] - 0s 1ms/step - loss: 0.4461 - accuracy: 0.0024
Epoch 27/500
116/116 [=====] - 0s 852us/step - loss: 0.4654 - accuracy: 0.0035
Epoch 28/500
116/116 [=====] - 0s 1ms/step - loss: 0.4620 - accuracy: 0.0024
Epoch 29/500
116/116 [=====] - 0s 957us/step - loss: 0.4496 - accuracy: 0.0024
Epoch 30/500
116/116 [=====] - 0s 809us/step - loss: 0.4171 - accuracy: 0.0016
Epoch 31/500
116/116 [=====] - 0s 826us/step - loss: 0.4181 - accuracy: 0.0030
Epoch 32/500
116/116 [=====] - 0s 783us/step - loss: 0.5032 - accuracy: 0.0027
Epoch 33/500
116/116 [=====] - 0s 922us/step - loss: 0.4906 - accuracy: 0.0035
Epoch 34/500
116/116 [=====] - 0s 2ms/step - loss: 0.4396 - accuracy: 0.0019
Epoch 35/500
116/116 [=====] - 0s 2ms/step - loss: 0.4339 - accuracy: 0.0024
Epoch 36/500
116/116 [=====] - 0s 2ms/step - loss: 0.4570 - accuracy: 0.0022
Epoch 37/500
116/116 [=====] - 0s 1ms/step - loss: 0.4076 - accuracy: 0.0011
Epoch 38/500
116/116 [=====] - 0s 817us/step - loss: 0.4763 - accuracy: 0.0016
Epoch 39/500
116/116 [=====] - 0s 826us/step - loss: 0.4484 - accuracy: 0.0038
Epoch 40/500
116/116 [=====] - 0s 783us/step - loss: 0.4857 - accuracy: 0.0030
Epoch 41/500
116/116 [=====] - 0s 791us/step - loss: 0.4446 - accuracy: 0.0027
Epoch 42/500
116/116 [=====] - 0s 948us/step - loss: 0.3865 - accuracy: 0.0032
Epoch 43/500

116/116 [=====] - 0s 817us/step - loss: 0.4231 - accuracy: 0.0032
Epoch 44/500
116/116 [=====] - 0s 1ms/step - loss: 0.4132 - accuracy: 0.0024
Epoch 45/500
116/116 [=====] - 0s 1ms/step - loss: 0.4238 - accuracy: 0.0024
Epoch 46/500
116/116 [=====] - 0s 2ms/step - loss: 0.4536 - accuracy: 0.0022
Epoch 47/500
116/116 [=====] - 0s 1ms/step - loss: 0.4684 - accuracy: 0.0024
Epoch 48/500
116/116 [=====] - 0s 791us/step - loss: 0.4252 - accuracy: 0.0022
Epoch 49/500
116/116 [=====] - 0s 1ms/step - loss: 0.4124 - accuracy: 0.0011
Epoch 50/500
116/116 [=====] - 0s 826us/step - loss: 0.4232 - accuracy: 0.0024
Epoch 51/500
116/116 [=====] - 0s 878us/step - loss: 0.4121 - accuracy: 0.0024
Epoch 52/500
116/116 [=====] - 0s 1ms/step - loss: 0.4013 - accuracy: 0.0032
Epoch 53/500
116/116 [=====] - 0s 939us/step - loss: 0.4319 - accuracy: 0.0030
Epoch 54/500
116/116 [=====] - 0s 870us/step - loss: 0.4037 - accuracy: 0.0027
Epoch 55/500
116/116 [=====] - 0s 826us/step - loss: 0.4233 - accuracy: 0.0043
Epoch 56/500
116/116 [=====] - 0s 817us/step - loss: 0.4072 - accuracy: 0.0027
Epoch 57/500
116/116 [=====] - 0s 974us/step - loss: 0.4452 - accuracy: 0.0038
Epoch 58/500
116/116 [=====] - 0s 1ms/step - loss: 0.3949 - accuracy: 0.0027
Epoch 59/500
116/116 [=====] - 0s 2ms/step - loss: 0.4137 - accuracy: 0.0030
Epoch 60/500
116/116 [=====] - 0s 2ms/step - loss: 0.3934 - accuracy: 0.0041
Epoch 61/500
116/116 [=====] - 0s 1ms/step - loss: 0.4047 - accuracy: 0.0027
Epoch 62/500
116/116 [=====] - 0s 1ms/step - loss: 0.3928 - accuracy: 0.0030
Epoch 63/500
116/116 [=====] - 0s 2ms/step - loss: 0.4634 - accuracy: 0.0027
Epoch 64/500
116/116 [=====] - 0s 1ms/step - loss: 0.4020 - accuracy: 0.0014
Epoch 65/500
116/116 [=====] - 0s 2ms/step - loss: 0.3921 - accuracy: 0.0024
Epoch 66/500
116/116 [=====] - 0s 1ms/step - loss: 0.3829 - accuracy: 0.0030
Epoch 67/500
116/116 [=====] - 0s 1ms/step - loss: 0.4014 - accuracy: 0.0032
Epoch 68/500
116/116 [=====] - 0s 1ms/step - loss: 0.4039 - accuracy: 0.0030
Epoch 69/500
116/116 [=====] - 0s 1ms/step - loss: 0.3854 - accuracy: 0.0022
Epoch 70/500
116/116 [=====] - 0s 1ms/step - loss: 0.4175 - accuracy: 0.0027
Epoch 71/500
116/116 [=====] - 0s 3ms/step - loss: 0.4060 - accuracy: 0.0030
Epoch 72/500
116/116 [=====] - 0s 2ms/step - loss: 0.3912 - accuracy: 0.0032
Epoch 73/500
116/116 [=====] - 0s 2ms/step - loss: 0.3922 - accuracy: 0.0030
Epoch 74/500
116/116 [=====] - 0s 2ms/step - loss: 0.4121 - accuracy: 0.0024
Epoch 75/500
116/116 [=====] - 0s 2ms/step - loss: 0.3847 - accuracy: 0.0022
Epoch 76/500
116/116 [=====] - 0s 1ms/step - loss: 0.3846 - accuracy: 0.0024
Epoch 77/500
116/116 [=====] - 0s 2ms/step - loss: 0.4037 - accuracy: 0.0030
Epoch 78/500
116/116 [=====] - 0s 3ms/step - loss: 0.4216 - accuracy: 0.0043
Epoch 79/500
116/116 [=====] - 0s 2ms/step - loss: 0.4148 - accuracy: 0.0019
Epoch 80/500
116/116 [=====] - 0s 3ms/step - loss: 0.3934 - accuracy: 0.0024
Epoch 81/500

116/116 [=====] - 0s 2ms/step - loss: 0.4136 - accuracy: 0.0022
Epoch 82/500
116/116 [=====] - 0s 3ms/step - loss: 0.4180 - accuracy: 0.0024
Epoch 83/500
116/116 [=====] - 0s 3ms/step - loss: 0.4050 - accuracy: 0.0014
Epoch 84/500
116/116 [=====] - 0s 2ms/step - loss: 0.3819 - accuracy: 0.0043
Epoch 85/500
116/116 [=====] - 0s 2ms/step - loss: 0.3931 - accuracy: 0.0030
Epoch 86/500
116/116 [=====] - 0s 2ms/step - loss: 0.4226 - accuracy: 0.0016
Epoch 87/500
116/116 [=====] - 0s 2ms/step - loss: 0.3857 - accuracy: 0.0016
Epoch 88/500
116/116 [=====] - 0s 2ms/step - loss: 0.4231 - accuracy: 0.0024
Epoch 89/500
116/116 [=====] - 0s 2ms/step - loss: 0.3839 - accuracy: 0.0035
Epoch 90/500
116/116 [=====] - 0s 2ms/step - loss: 0.4167 - accuracy: 0.0041
Epoch 91/500
116/116 [=====] - 0s 2ms/step - loss: 0.3977 - accuracy: 0.0024
Epoch 92/500
116/116 [=====] - 0s 2ms/step - loss: 0.3851 - accuracy: 0.0038
Epoch 93/500
116/116 [=====] - 0s 2ms/step - loss: 0.3699 - accuracy: 0.0035
Epoch 94/500
116/116 [=====] - 0s 2ms/step - loss: 0.3925 - accuracy: 0.0043
Epoch 95/500
116/116 [=====] - 0s 2ms/step - loss: 0.4003 - accuracy: 0.0038
Epoch 96/500
116/116 [=====] - 0s 2ms/step - loss: 0.4089 - accuracy: 0.0041
Epoch 97/500
116/116 [=====] - 0s 2ms/step - loss: 0.3731 - accuracy: 0.0043
Epoch 98/500
116/116 [=====] - 0s 2ms/step - loss: 0.3845 - accuracy: 0.0049
Epoch 99/500
116/116 [=====] - 0s 2ms/step - loss: 0.3762 - accuracy: 0.0041
Epoch 100/500
116/116 [=====] - 0s 1ms/step - loss: 0.3883 - accuracy: 0.0035
Epoch 101/500
116/116 [=====] - 0s 2ms/step - loss: 0.3957 - accuracy: 0.0038
Epoch 102/500
116/116 [=====] - 0s 1ms/step - loss: 0.3719 - accuracy: 0.0030
Epoch 103/500
116/116 [=====] - 0s 1ms/step - loss: 0.3929 - accuracy: 0.0032
Epoch 104/500
116/116 [=====] - 0s 1ms/step - loss: 0.3844 - accuracy: 0.0043
Epoch 105/500
116/116 [=====] - 0s 1ms/step - loss: 0.3837 - accuracy: 0.0024
Epoch 106/500
116/116 [=====] - 0s 2ms/step - loss: 0.3831 - accuracy: 0.0041
Epoch 107/500
116/116 [=====] - 0s 1ms/step - loss: 0.4061 - accuracy: 0.0049
Epoch 108/500
116/116 [=====] - 0s 1ms/step - loss: 0.3930 - accuracy: 0.0030
Epoch 109/500
116/116 [=====] - 0s 1ms/step - loss: 0.3813 - accuracy: 0.0035
Epoch 110/500
116/116 [=====] - 0s 1ms/step - loss: 0.3816 - accuracy: 0.0038
Epoch 111/500
116/116 [=====] - 0s 1ms/step - loss: 0.3748 - accuracy: 0.0051
Epoch 112/500
116/116 [=====] - 0s 1ms/step - loss: 0.4300 - accuracy: 0.0030
Epoch 113/500
116/116 [=====] - 0s 1ms/step - loss: 0.3957 - accuracy: 0.0027
Epoch 114/500
116/116 [=====] - 0s 1ms/step - loss: 0.3954 - accuracy: 0.0035
Epoch 115/500
116/116 [=====] - 0s 2ms/step - loss: 0.3992 - accuracy: 0.0032
Epoch 116/500
116/116 [=====] - 0s 1ms/step - loss: 0.3877 - accuracy: 0.0043
Epoch 117/500
116/116 [=====] - 0s 1ms/step - loss: 0.3709 - accuracy: 0.0049
Epoch 118/500
116/116 [=====] - 0s 1ms/step - loss: 0.3903 - accuracy: 0.0032
Epoch 119/500

116/116 [=====] - 0s 1ms/step - loss: 0.3900 - accuracy: 0.0022
Epoch 120/500
116/116 [=====] - 0s 1ms/step - loss: 0.3677 - accuracy: 0.0022
Epoch 121/500
116/116 [=====] - 0s 1ms/step - loss: 0.3609 - accuracy: 0.0032
Epoch 122/500
116/116 [=====] - 0s 2ms/step - loss: 0.3734 - accuracy: 0.0030
Epoch 123/500
116/116 [=====] - 0s 2ms/step - loss: 0.3734 - accuracy: 0.0022
Epoch 124/500
116/116 [=====] - 0s 1ms/step - loss: 0.3726 - accuracy: 0.0022
Epoch 125/500
116/116 [=====] - 0s 2ms/step - loss: 0.3861 - accuracy: 0.0016
Epoch 126/500
116/116 [=====] - 0s 2ms/step - loss: 0.3798 - accuracy: 0.0027
Epoch 127/500
116/116 [=====] - 0s 2ms/step - loss: 0.3665 - accuracy: 0.0019
Epoch 128/500
116/116 [=====] - 0s 3ms/step - loss: 0.3785 - accuracy: 0.0038
Epoch 129/500
116/116 [=====] - 0s 2ms/step - loss: 0.3792 - accuracy: 0.0016
Epoch 130/500
116/116 [=====] - 0s 1ms/step - loss: 0.3922 - accuracy: 0.0019
Epoch 131/500
116/116 [=====] - 0s 1ms/step - loss: 0.3790 - accuracy: 0.0024
Epoch 132/500
116/116 [=====] - 0s 1ms/step - loss: 0.3674 - accuracy: 0.0030
Epoch 133/500
116/116 [=====] - 0s 1ms/step - loss: 0.3666 - accuracy: 0.0027
Epoch 134/500
116/116 [=====] - 0s 1ms/step - loss: 0.3671 - accuracy: 0.0032
Epoch 135/500
116/116 [=====] - 0s 1ms/step - loss: 0.3707 - accuracy: 0.0022
Epoch 136/500
116/116 [=====] - 0s 2ms/step - loss: 0.3625 - accuracy: 0.0032
Epoch 137/500
116/116 [=====] - 0s 2ms/step - loss: 0.3610 - accuracy: 0.0014
Epoch 138/500
116/116 [=====] - 0s 1ms/step - loss: 0.3847 - accuracy: 0.0030
Epoch 139/500
116/116 [=====] - 0s 974us/step - loss: 0.3666 - accuracy: 0.0030
Epoch 140/500
116/116 [=====] - 0s 1ms/step - loss: 0.3820 - accuracy: 0.0035
Epoch 141/500
116/116 [=====] - 0s 1ms/step - loss: 0.3601 - accuracy: 0.0024
Epoch 142/500
116/116 [=====] - 0s 2ms/step - loss: 0.3861 - accuracy: 0.0024
Epoch 143/500
116/116 [=====] - 0s 1ms/step - loss: 0.3755 - accuracy: 0.0024
Epoch 144/500
116/116 [=====] - 0s 1ms/step - loss: 0.3795 - accuracy: 0.0035
Epoch 145/500
116/116 [=====] - 0s 957us/step - loss: 0.3668 - accuracy: 0.0043
Epoch 146/500
116/116 [=====] - 0s 1ms/step - loss: 0.3800 - accuracy: 0.0024
Epoch 147/500
116/116 [=====] - 0s 1ms/step - loss: 0.3712 - accuracy: 0.0041
Epoch 148/500
116/116 [=====] - 0s 1ms/step - loss: 0.3614 - accuracy: 0.0022
Epoch 149/500
116/116 [=====] - 0s 1ms/step - loss: 0.3665 - accuracy: 0.0019
Epoch 150/500
116/116 [=====] - 0s 2ms/step - loss: 0.3652 - accuracy: 0.0030
Epoch 151/500
116/116 [=====] - 0s 2ms/step - loss: 0.3778 - accuracy: 0.0024
Epoch 152/500
116/116 [=====] - 0s 1ms/step - loss: 0.3617 - accuracy: 0.0041
Epoch 153/500
116/116 [=====] - 0s 1ms/step - loss: 0.3718 - accuracy: 0.0019
Epoch 154/500
116/116 [=====] - 0s 1ms/step - loss: 0.3735 - accuracy: 0.0027
Epoch 155/500
116/116 [=====] - 0s 1ms/step - loss: 0.3660 - accuracy: 0.0016
Epoch 156/500
116/116 [=====] - 0s 1ms/step - loss: 0.3629 - accuracy: 0.0024
Epoch 157/500

116/116 [=====] - 0s 2ms/step - loss: 0.3580 - accuracy: 0.0019
Epoch 158/500
116/116 [=====] - 0s 2ms/step - loss: 0.3581 - accuracy: 0.0016
Epoch 159/500
116/116 [=====] - 0s 1ms/step - loss: 0.3649 - accuracy: 0.0032
Epoch 160/500
116/116 [=====] - 0s 1ms/step - loss: 0.3589 - accuracy: 0.0041
Epoch 161/500
116/116 [=====] - 0s 2ms/step - loss: 0.3524 - accuracy: 0.0032
Epoch 162/500
116/116 [=====] - 0s 1ms/step - loss: 0.3597 - accuracy: 0.0032
Epoch 163/500
116/116 [=====] - 0s 1ms/step - loss: 0.3593 - accuracy: 0.0016
Epoch 164/500
116/116 [=====] - 0s 1ms/step - loss: 0.3678 - accuracy: 0.0024
Epoch 165/500
116/116 [=====] - 0s 1ms/step - loss: 0.3773 - accuracy: 0.0024
Epoch 166/500
116/116 [=====] - 0s 2ms/step - loss: 0.3523 - accuracy: 0.0024
Epoch 167/500
116/116 [=====] - 0s 1ms/step - loss: 0.3564 - accuracy: 0.0041
Epoch 168/500
116/116 [=====] - 0s 1ms/step - loss: 0.3621 - accuracy: 0.0019
Epoch 169/500
116/116 [=====] - 0s 2ms/step - loss: 0.3523 - accuracy: 0.0024
Epoch 170/500
116/116 [=====] - 0s 2ms/step - loss: 0.3729 - accuracy: 0.0046
Epoch 171/500
116/116 [=====] - 0s 2ms/step - loss: 0.3819 - accuracy: 0.0027
Epoch 172/500
116/116 [=====] - 0s 2ms/step - loss: 0.3582 - accuracy: 0.0016
Epoch 173/500
116/116 [=====] - 0s 2ms/step - loss: 0.3702 - accuracy: 0.0035
Epoch 174/500
116/116 [=====] - 0s 1ms/step - loss: 0.3651 - accuracy: 0.0035
Epoch 175/500
116/116 [=====] - 0s 2ms/step - loss: 0.3711 - accuracy: 0.0035
Epoch 176/500
116/116 [=====] - 0s 1ms/step - loss: 0.3661 - accuracy: 0.0024
Epoch 177/500
116/116 [=====] - 0s 1ms/step - loss: 0.3585 - accuracy: 0.0032
Epoch 178/500
116/116 [=====] - 0s 2ms/step - loss: 0.3549 - accuracy: 0.0022
Epoch 179/500
116/116 [=====] - 0s 2ms/step - loss: 0.3671 - accuracy: 0.0030
Epoch 180/500
116/116 [=====] - 0s 1ms/step - loss: 0.3490 - accuracy: 0.0022
Epoch 181/500
116/116 [=====] - 0s 1ms/step - loss: 0.3628 - accuracy: 0.0027
Epoch 182/500
116/116 [=====] - 0s 1ms/step - loss: 0.3712 - accuracy: 0.0054
Epoch 183/500
116/116 [=====] - 0s 1ms/step - loss: 0.3535 - accuracy: 0.0019
Epoch 184/500
116/116 [=====] - 0s 1ms/step - loss: 0.3554 - accuracy: 0.0030
Epoch 185/500
116/116 [=====] - 0s 2ms/step - loss: 0.3502 - accuracy: 0.0022
Epoch 186/500
116/116 [=====] - 0s 1ms/step - loss: 0.3603 - accuracy: 0.0032
Epoch 187/500
116/116 [=====] - 0s 1ms/step - loss: 0.3565 - accuracy: 0.0035
Epoch 188/500
116/116 [=====] - 0s 1ms/step - loss: 0.3590 - accuracy: 0.0035
Epoch 189/500
116/116 [=====] - 0s 1ms/step - loss: 0.3600 - accuracy: 0.0027
Epoch 190/500
116/116 [=====] - 0s 1ms/step - loss: 0.3579 - accuracy: 0.0041
Epoch 191/500
116/116 [=====] - 0s 1ms/step - loss: 0.3600 - accuracy: 0.0030
Epoch 192/500
116/116 [=====] - 0s 1ms/step - loss: 0.3545 - accuracy: 0.0032
Epoch 193/500
116/116 [=====] - 0s 1ms/step - loss: 0.3524 - accuracy: 0.0038
Epoch 194/500
116/116 [=====] - 0s 1ms/step - loss: 0.3525 - accuracy: 0.0032
Epoch 195/500

116/116 [=====] - 0s 1ms/step - loss: 0.3524 - accuracy: 0.0024
Epoch 196/500
116/116 [=====] - 0s 1ms/step - loss: 0.3544 - accuracy: 0.0038
Epoch 197/500
116/116 [=====] - 0s 1ms/step - loss: 0.3475 - accuracy: 0.0027
Epoch 198/500
116/116 [=====] - 0s 1ms/step - loss: 0.3609 - accuracy: 0.0016
Epoch 199/500
116/116 [=====] - 0s 1ms/step - loss: 0.3510 - accuracy: 0.0027
Epoch 200/500
116/116 [=====] - 0s 1ms/step - loss: 0.3625 - accuracy: 0.0032
Epoch 201/500
116/116 [=====] - 0s 1ms/step - loss: 0.3491 - accuracy: 0.0046
Epoch 202/500
116/116 [=====] - 0s 1ms/step - loss: 0.3615 - accuracy: 0.0024
Epoch 203/500
116/116 [=====] - 0s 2ms/step - loss: 0.3453 - accuracy: 0.0022
Epoch 204/500
116/116 [=====] - 0s 1ms/step - loss: 0.3500 - accuracy: 0.0024
Epoch 205/500
116/116 [=====] - 0s 1ms/step - loss: 0.3563 - accuracy: 0.0032
Epoch 206/500
116/116 [=====] - 0s 1ms/step - loss: 0.3519 - accuracy: 0.0024
Epoch 207/500
116/116 [=====] - 0s 1ms/step - loss: 0.3568 - accuracy: 0.0032
Epoch 208/500
116/116 [=====] - 0s 1ms/step - loss: 0.3606 - accuracy: 0.0032
Epoch 209/500
116/116 [=====] - 0s 1ms/step - loss: 0.3515 - accuracy: 0.0032
Epoch 210/500
116/116 [=====] - 0s 1ms/step - loss: 0.3581 - accuracy: 0.0038
Epoch 211/500
116/116 [=====] - 0s 1ms/step - loss: 0.3530 - accuracy: 0.0027
Epoch 212/500
116/116 [=====] - 0s 1ms/step - loss: 0.3573 - accuracy: 0.0022
Epoch 213/500
116/116 [=====] - 0s 1ms/step - loss: 0.3507 - accuracy: 0.0030
Epoch 214/500
116/116 [=====] - 0s 1ms/step - loss: 0.3472 - accuracy: 0.0024
Epoch 215/500
116/116 [=====] - 0s 2ms/step - loss: 0.3494 - accuracy: 0.0019
Epoch 216/500
116/116 [=====] - 0s 1ms/step - loss: 0.3570 - accuracy: 0.0027
Epoch 217/500
116/116 [=====] - 0s 1ms/step - loss: 0.3433 - accuracy: 0.0027
Epoch 218/500
116/116 [=====] - 0s 1ms/step - loss: 0.3584 - accuracy: 0.0016
Epoch 219/500
116/116 [=====] - 0s 1ms/step - loss: 0.3422 - accuracy: 0.0032
Epoch 220/500
116/116 [=====] - 0s 1ms/step - loss: 0.3449 - accuracy: 0.0027
Epoch 221/500
116/116 [=====] - 0s 1ms/step - loss: 0.3594 - accuracy: 0.0027
Epoch 222/500
116/116 [=====] - 0s 1ms/step - loss: 0.3486 - accuracy: 0.0035
Epoch 223/500
116/116 [=====] - 0s 1ms/step - loss: 0.3513 - accuracy: 0.0043
Epoch 224/500
116/116 [=====] - 0s 1ms/step - loss: 0.3546 - accuracy: 0.0014
Epoch 225/500
116/116 [=====] - 0s 1ms/step - loss: 0.3516 - accuracy: 0.0041
Epoch 226/500
116/116 [=====] - 0s 1ms/step - loss: 0.3485 - accuracy: 0.0032
Epoch 227/500
116/116 [=====] - 0s 3ms/step - loss: 0.3472 - accuracy: 0.0030
Epoch 228/500
116/116 [=====] - 0s 3ms/step - loss: 0.3512 - accuracy: 0.0057
Epoch 229/500
116/116 [=====] - 0s 1ms/step - loss: 0.3431 - accuracy: 0.0038
Epoch 230/500
116/116 [=====] - 0s 2ms/step - loss: 0.3467 - accuracy: 0.0046
Epoch 231/500
116/116 [=====] - 0s 1ms/step - loss: 0.3407 - accuracy: 0.0032
Epoch 232/500
116/116 [=====] - 0s 1ms/step - loss: 0.3461 - accuracy: 0.0024
Epoch 233/500

116/116 [=====] - 0s 2ms/step - loss: 0.3476 - accuracy: 0.0024
Epoch 234/500
116/116 [=====] - 0s 1ms/step - loss: 0.3535 - accuracy: 0.0030
Epoch 235/500
116/116 [=====] - 0s 1ms/step - loss: 0.3514 - accuracy: 0.0016
Epoch 236/500
116/116 [=====] - 0s 1ms/step - loss: 0.3475 - accuracy: 0.0035
Epoch 237/500
116/116 [=====] - 0s 1ms/step - loss: 0.3451 - accuracy: 0.0019
Epoch 238/500
116/116 [=====] - 0s 1ms/step - loss: 0.3445 - accuracy: 0.0054
Epoch 239/500
116/116 [=====] - 0s 1ms/step - loss: 0.3527 - accuracy: 0.0019
Epoch 240/500
116/116 [=====] - 0s 1ms/step - loss: 0.3534 - accuracy: 0.0027
Epoch 241/500
116/116 [=====] - 0s 1ms/step - loss: 0.3488 - accuracy: 0.0041
Epoch 242/500
116/116 [=====] - 0s 1ms/step - loss: 0.3467 - accuracy: 0.0032
Epoch 243/500
116/116 [=====] - 0s 1ms/step - loss: 0.3506 - accuracy: 0.0019
Epoch 244/500
116/116 [=====] - 0s 1ms/step - loss: 0.3399 - accuracy: 0.0038
Epoch 245/500
116/116 [=====] - 0s 1ms/step - loss: 0.3473 - accuracy: 0.0038
Epoch 246/500
116/116 [=====] - 0s 2ms/step - loss: 0.3483 - accuracy: 0.0035
Epoch 247/500
116/116 [=====] - 0s 1ms/step - loss: 0.3482 - accuracy: 0.0027
Epoch 248/500
116/116 [=====] - 0s 2ms/step - loss: 0.3423 - accuracy: 0.0027
Epoch 249/500
116/116 [=====] - 0s 1ms/step - loss: 0.3467 - accuracy: 0.0027
Epoch 250/500
116/116 [=====] - 0s 1ms/step - loss: 0.3383 - accuracy: 0.0038
Epoch 251/500
116/116 [=====] - 0s 1ms/step - loss: 0.3453 - accuracy: 0.0051
Epoch 252/500
116/116 [=====] - 0s 2ms/step - loss: 0.3432 - accuracy: 0.0027
Epoch 253/500
116/116 [=====] - 0s 2ms/step - loss: 0.3433 - accuracy: 0.0022
Epoch 254/500
116/116 [=====] - 0s 2ms/step - loss: 0.3489 - accuracy: 0.0035
Epoch 255/500
116/116 [=====] - 0s 2ms/step - loss: 0.3435 - accuracy: 0.0022
Epoch 256/500
116/116 [=====] - 0s 2ms/step - loss: 0.3537 - accuracy: 0.0019
Epoch 257/500
116/116 [=====] - 0s 2ms/step - loss: 0.3438 - accuracy: 0.0032
Epoch 258/500
116/116 [=====] - 0s 1ms/step - loss: 0.3555 - accuracy: 0.0035
Epoch 259/500
116/116 [=====] - 0s 2ms/step - loss: 0.3413 - accuracy: 0.0022
Epoch 260/500
116/116 [=====] - 0s 2ms/step - loss: 0.3424 - accuracy: 0.0016
Epoch 261/500
116/116 [=====] - 0s 2ms/step - loss: 0.3454 - accuracy: 0.0027
Epoch 262/500
116/116 [=====] - 0s 2ms/step - loss: 0.3513 - accuracy: 0.0027
Epoch 263/500
116/116 [=====] - 0s 2ms/step - loss: 0.3417 - accuracy: 0.0030
Epoch 264/500
116/116 [=====] - 0s 2ms/step - loss: 0.3449 - accuracy: 0.0035
Epoch 265/500
116/116 [=====] - 0s 2ms/step - loss: 0.3406 - accuracy: 0.0032
Epoch 266/500
116/116 [=====] - 0s 2ms/step - loss: 0.3400 - accuracy: 0.0016
Epoch 267/500
116/116 [=====] - 0s 2ms/step - loss: 0.3424 - accuracy: 0.0027
Epoch 268/500
116/116 [=====] - 0s 2ms/step - loss: 0.3387 - accuracy: 0.0054
Epoch 269/500
116/116 [=====] - 0s 2ms/step - loss: 0.3493 - accuracy: 0.0038
Epoch 270/500
116/116 [=====] - 0s 2ms/step - loss: 0.3450 - accuracy: 0.0043
Epoch 271/500

116/116 [=====] - 0s 2ms/step - loss: 0.3444 - accuracy: 0.0030
Epoch 272/500
116/116 [=====] - 0s 2ms/step - loss: 0.3395 - accuracy: 0.0035
Epoch 273/500
116/116 [=====] - 0s 3ms/step - loss: 0.3541 - accuracy: 0.0030
Epoch 274/500
116/116 [=====] - 0s 2ms/step - loss: 0.3474 - accuracy: 0.0030
Epoch 275/500
116/116 [=====] - 0s 2ms/step - loss: 0.3433 - accuracy: 0.0043
Epoch 276/500
116/116 [=====] - 0s 1ms/step - loss: 0.3395 - accuracy: 0.0035
Epoch 277/500
116/116 [=====] - 0s 2ms/step - loss: 0.3470 - accuracy: 0.0022
Epoch 278/500
116/116 [=====] - 0s 2ms/step - loss: 0.3404 - accuracy: 0.0041
Epoch 279/500
116/116 [=====] - 0s 1ms/step - loss: 0.3376 - accuracy: 0.0027
Epoch 280/500
116/116 [=====] - 0s 1ms/step - loss: 0.3406 - accuracy: 0.0038
Epoch 281/500
116/116 [=====] - 0s 1ms/step - loss: 0.3470 - accuracy: 0.0019
Epoch 282/500
116/116 [=====] - 0s 2ms/step - loss: 0.3367 - accuracy: 0.0022
Epoch 283/500
116/116 [=====] - 0s 2ms/step - loss: 0.3451 - accuracy: 0.0027
Epoch 284/500
116/116 [=====] - 0s 2ms/step - loss: 0.3441 - accuracy: 0.0024
Epoch 285/500
116/116 [=====] - 0s 2ms/step - loss: 0.3425 - accuracy: 0.0030
Epoch 286/500
116/116 [=====] - 0s 2ms/step - loss: 0.3437 - accuracy: 0.0046
Epoch 287/500
116/116 [=====] - 0s 1ms/step - loss: 0.3376 - accuracy: 0.0027
Epoch 288/500
116/116 [=====] - 0s 1ms/step - loss: 0.3409 - accuracy: 0.0022
Epoch 289/500
116/116 [=====] - 0s 2ms/step - loss: 0.3363 - accuracy: 0.0022
Epoch 290/500
116/116 [=====] - 0s 1ms/step - loss: 0.3450 - accuracy: 0.0054
Epoch 291/500
116/116 [=====] - 0s 1ms/step - loss: 0.3458 - accuracy: 0.0035
Epoch 292/500
116/116 [=====] - 0s 1ms/step - loss: 0.3401 - accuracy: 0.0035
Epoch 293/500
116/116 [=====] - 0s 1ms/step - loss: 0.3439 - accuracy: 0.0041
Epoch 294/500
116/116 [=====] - 0s 1ms/step - loss: 0.3404 - accuracy: 0.0032
Epoch 295/500
116/116 [=====] - 0s 1ms/step - loss: 0.3383 - accuracy: 0.0019
Epoch 296/500
116/116 [=====] - 0s 2ms/step - loss: 0.3406 - accuracy: 0.0035
Epoch 297/500
116/116 [=====] - 0s 2ms/step - loss: 0.3409 - accuracy: 0.0024
Epoch 298/500
116/116 [=====] - 0s 2ms/step - loss: 0.3379 - accuracy: 0.0027
Epoch 299/500
116/116 [=====] - 0s 2ms/step - loss: 0.3441 - accuracy: 0.0041
Epoch 300/500
116/116 [=====] - 0s 2ms/step - loss: 0.3400 - accuracy: 0.0032
Epoch 301/500
116/116 [=====] - 0s 1ms/step - loss: 0.3415 - accuracy: 0.0030
Epoch 302/500
116/116 [=====] - 0s 2ms/step - loss: 0.3385 - accuracy: 0.0022
Epoch 303/500
116/116 [=====] - 0s 2ms/step - loss: 0.3371 - accuracy: 0.0014
Epoch 304/500
116/116 [=====] - 0s 2ms/step - loss: 0.3391 - accuracy: 0.0019
Epoch 305/500
116/116 [=====] - 0s 2ms/step - loss: 0.3390 - accuracy: 0.0019
Epoch 306/500
116/116 [=====] - 0s 1ms/step - loss: 0.3390 - accuracy: 8.1037e-04
Epoch 307/500
116/116 [=====] - 0s 2ms/step - loss: 0.3475 - accuracy: 0.0035
Epoch 308/500
116/116 [=====] - 0s 2ms/step - loss: 0.3354 - accuracy: 0.0030
Epoch 309/500

116/116 [=====] - 0s 1ms/step - loss: 0.3377 - accuracy: 0.0016
Epoch 310/500
116/116 [=====] - 0s 1ms/step - loss: 0.3388 - accuracy: 0.0022
Epoch 311/500
116/116 [=====] - 0s 2ms/step - loss: 0.3395 - accuracy: 0.0027
Epoch 312/500
116/116 [=====] - 0s 1ms/step - loss: 0.3486 - accuracy: 0.0024
Epoch 313/500
116/116 [=====] - 0s 2ms/step - loss: 0.3414 - accuracy: 0.0027
Epoch 314/500
116/116 [=====] - 0s 2ms/step - loss: 0.3369 - accuracy: 0.0035
Epoch 315/500
116/116 [=====] - 0s 1ms/step - loss: 0.3390 - accuracy: 0.0016
Epoch 316/500
116/116 [=====] - 0s 1ms/step - loss: 0.3382 - accuracy: 0.0022
Epoch 317/500
116/116 [=====] - 0s 2ms/step - loss: 0.3367 - accuracy: 0.0022
Epoch 318/500
116/116 [=====] - 0s 1ms/step - loss: 0.3339 - accuracy: 0.0027
Epoch 319/500
116/116 [=====] - 0s 2ms/step - loss: 0.3394 - accuracy: 0.0035
Epoch 320/500
116/116 [=====] - 0s 2ms/step - loss: 0.3357 - accuracy: 0.0022
Epoch 321/500
116/116 [=====] - 0s 2ms/step - loss: 0.3401 - accuracy: 0.0016
Epoch 322/500
116/116 [=====] - 0s 2ms/step - loss: 0.3378 - accuracy: 0.0016
Epoch 323/500
116/116 [=====] - 0s 2ms/step - loss: 0.3390 - accuracy: 0.0035
Epoch 324/500
116/116 [=====] - 0s 2ms/step - loss: 0.3339 - accuracy: 0.0022
Epoch 325/500
116/116 [=====] - 0s 2ms/step - loss: 0.3385 - accuracy: 0.0024
Epoch 326/500
116/116 [=====] - 0s 2ms/step - loss: 0.3381 - accuracy: 0.0022
Epoch 327/500
116/116 [=====] - 0s 1ms/step - loss: 0.3361 - accuracy: 0.0035
Epoch 328/500
116/116 [=====] - 0s 1ms/step - loss: 0.3418 - accuracy: 0.0035
Epoch 329/500
116/116 [=====] - 0s 2ms/step - loss: 0.3339 - accuracy: 0.0022
Epoch 330/500
116/116 [=====] - 0s 2ms/step - loss: 0.3422 - accuracy: 0.0030
Epoch 331/500
116/116 [=====] - 0s 1ms/step - loss: 0.3379 - accuracy: 0.0027
Epoch 332/500
116/116 [=====] - 0s 1ms/step - loss: 0.3384 - accuracy: 0.0022
Epoch 333/500
116/116 [=====] - 0s 1ms/step - loss: 0.3410 - accuracy: 0.0024
Epoch 334/500
116/116 [=====] - 0s 1ms/step - loss: 0.3326 - accuracy: 0.0027
Epoch 335/500
116/116 [=====] - 0s 1ms/step - loss: 0.3406 - accuracy: 0.0027
Epoch 336/500
116/116 [=====] - 0s 1ms/step - loss: 0.3391 - accuracy: 0.0027
Epoch 337/500
116/116 [=====] - 0s 1ms/step - loss: 0.3444 - accuracy: 0.0030
Epoch 338/500
116/116 [=====] - 0s 1ms/step - loss: 0.3403 - accuracy: 0.0024
Epoch 339/500
116/116 [=====] - 0s 2ms/step - loss: 0.3368 - accuracy: 0.0019
Epoch 340/500
116/116 [=====] - 0s 1ms/step - loss: 0.3342 - accuracy: 0.0032
Epoch 341/500
116/116 [=====] - 0s 2ms/step - loss: 0.3435 - accuracy: 0.0038
Epoch 342/500
116/116 [=====] - 0s 2ms/step - loss: 0.3394 - accuracy: 0.0019
Epoch 343/500
116/116 [=====] - 0s 2ms/step - loss: 0.3361 - accuracy: 0.0014
Epoch 344/500
116/116 [=====] - 0s 1ms/step - loss: 0.3355 - accuracy: 0.0032
Epoch 345/500
116/116 [=====] - 0s 1ms/step - loss: 0.3408 - accuracy: 0.0024
Epoch 346/500
116/116 [=====] - 0s 1ms/step - loss: 0.3312 - accuracy: 0.0014
Epoch 347/500

116/116 [=====] - 0s 2ms/step - loss: 0.3375 - accuracy: 0.0038
Epoch 348/500
116/116 [=====] - 0s 1ms/step - loss: 0.3339 - accuracy: 0.0041
Epoch 349/500
116/116 [=====] - 0s 2ms/step - loss: 0.3314 - accuracy: 0.0024
Epoch 350/500
116/116 [=====] - 0s 2ms/step - loss: 0.3363 - accuracy: 0.0030
Epoch 351/500
116/116 [=====] - 0s 2ms/step - loss: 0.3347 - accuracy: 0.0032
Epoch 352/500
116/116 [=====] - 0s 3ms/step - loss: 0.3308 - accuracy: 0.0027
Epoch 353/500
116/116 [=====] - 0s 3ms/step - loss: 0.3365 - accuracy: 0.0027
Epoch 354/500
116/116 [=====] - 0s 1ms/step - loss: 0.3335 - accuracy: 0.0019
Epoch 355/500
116/116 [=====] - 0s 2ms/step - loss: 0.3387 - accuracy: 0.0011
Epoch 356/500
116/116 [=====] - 0s 1ms/step - loss: 0.3420 - accuracy: 0.0014
Epoch 357/500
116/116 [=====] - 0s 2ms/step - loss: 0.3383 - accuracy: 0.0019
Epoch 358/500
116/116 [=====] - 0s 1ms/step - loss: 0.3375 - accuracy: 0.0019
Epoch 359/500
116/116 [=====] - 0s 1ms/step - loss: 0.3397 - accuracy: 0.0027
Epoch 360/500
116/116 [=====] - 0s 1ms/step - loss: 0.3375 - accuracy: 0.0027
Epoch 361/500
116/116 [=====] - 0s 2ms/step - loss: 0.3345 - accuracy: 0.0024
Epoch 362/500
116/116 [=====] - 0s 2ms/step - loss: 0.3309 - accuracy: 2.7012e-04
Epoch 363/500
116/116 [=====] - 0s 2ms/step - loss: 0.3310 - accuracy: 0.0022
Epoch 364/500
116/116 [=====] - 0s 2ms/step - loss: 0.3397 - accuracy: 0.0022
Epoch 365/500
116/116 [=====] - 0s 3ms/step - loss: 0.3324 - accuracy: 0.0032
Epoch 366/500
116/116 [=====] - 0s 2ms/step - loss: 0.3384 - accuracy: 0.0027
Epoch 367/500
116/116 [=====] - 0s 2ms/step - loss: 0.3342 - accuracy: 0.0011
Epoch 368/500
116/116 [=====] - 0s 3ms/step - loss: 0.3312 - accuracy: 0.0011
Epoch 369/500
116/116 [=====] - 0s 2ms/step - loss: 0.3342 - accuracy: 0.0019
Epoch 370/500
116/116 [=====] - 0s 2ms/step - loss: 0.3336 - accuracy: 0.0019
Epoch 371/500
116/116 [=====] - 0s 2ms/step - loss: 0.3347 - accuracy: 0.0030
Epoch 372/500
116/116 [=====] - 0s 2ms/step - loss: 0.3328 - accuracy: 0.0014
Epoch 373/500
116/116 [=====] - 0s 2ms/step - loss: 0.3334 - accuracy: 0.0014
Epoch 374/500
116/116 [=====] - 0s 1ms/step - loss: 0.3349 - accuracy: 0.0011
Epoch 375/500
116/116 [=====] - 0s 2ms/step - loss: 0.3339 - accuracy: 0.0024
Epoch 376/500
116/116 [=====] - 0s 1ms/step - loss: 0.3306 - accuracy: 8.1037e-04
Epoch 377/500
116/116 [=====] - 0s 1ms/step - loss: 0.3319 - accuracy: 8.1037e-04
Epoch 378/500
116/116 [=====] - 0s 2ms/step - loss: 0.3330 - accuracy: 0.0016
Epoch 379/500
116/116 [=====] - 0s 2ms/step - loss: 0.3372 - accuracy: 0.0030
Epoch 380/500
116/116 [=====] - 0s 1ms/step - loss: 0.3332 - accuracy: 0.0014
Epoch 381/500
116/116 [=====] - 0s 2ms/step - loss: 0.3357 - accuracy: 0.0019
Epoch 382/500
116/116 [=====] - 0s 2ms/step - loss: 0.3367 - accuracy: 2.7012e-04
Epoch 383/500
116/116 [=====] - 0s 2ms/step - loss: 0.3307 - accuracy: 0.0024
Epoch 384/500
116/116 [=====] - 0s 2ms/step - loss: 0.3327 - accuracy: 8.1037e-04
Epoch 385/500

116/116 [=====] - 0s 1ms/step - loss: 0.3323 - accuracy: 0.0014
Epoch 386/500
116/116 [=====] - 0s 2ms/step - loss: 0.3410 - accuracy: 0.0030
Epoch 387/500
116/116 [=====] - 0s 2ms/step - loss: 0.3392 - accuracy: 0.0027
Epoch 388/500
116/116 [=====] - 0s 2ms/step - loss: 0.3332 - accuracy: 0.0032
Epoch 389/500
116/116 [=====] - 0s 2ms/step - loss: 0.3333 - accuracy: 0.0024
Epoch 390/500
116/116 [=====] - 0s 2ms/step - loss: 0.3279 - accuracy: 0.0014
Epoch 391/500
116/116 [=====] - 0s 2ms/step - loss: 0.3343 - accuracy: 0.0022
Epoch 392/500
116/116 [=====] - 0s 1ms/step - loss: 0.3335 - accuracy: 0.0024
Epoch 393/500
116/116 [=====] - 0s 2ms/step - loss: 0.3337 - accuracy: 0.0035
Epoch 394/500
116/116 [=====] - 0s 1ms/step - loss: 0.3306 - accuracy: 0.0014
Epoch 395/500
116/116 [=====] - 0s 2ms/step - loss: 0.3318 - accuracy: 0.0022
Epoch 396/500
116/116 [=====] - 0s 2ms/step - loss: 0.3339 - accuracy: 0.0022
Epoch 397/500
116/116 [=====] - 0s 2ms/step - loss: 0.3331 - accuracy: 0.0030
Epoch 398/500
116/116 [=====] - 0s 2ms/step - loss: 0.3299 - accuracy: 5.4025e-04
Epoch 399/500
116/116 [=====] - 0s 2ms/step - loss: 0.3354 - accuracy: 0.0027
Epoch 400/500
116/116 [=====] - 0s 2ms/step - loss: 0.3333 - accuracy: 0.0027
Epoch 401/500
116/116 [=====] - 0s 2ms/step - loss: 0.3351 - accuracy: 0.0019
Epoch 402/500
116/116 [=====] - 0s 2ms/step - loss: 0.3301 - accuracy: 0.0027
Epoch 403/500
116/116 [=====] - 0s 2ms/step - loss: 0.3342 - accuracy: 0.0027
Epoch 404/500
116/116 [=====] - 0s 2ms/step - loss: 0.3287 - accuracy: 0.0011
Epoch 405/500
116/116 [=====] - 0s 2ms/step - loss: 0.3307 - accuracy: 0.0022
Epoch 406/500
116/116 [=====] - 0s 2ms/step - loss: 0.3262 - accuracy: 0.0014
Epoch 407/500
116/116 [=====] - 0s 2ms/step - loss: 0.3322 - accuracy: 0.0011
Epoch 408/500
116/116 [=====] - 0s 2ms/step - loss: 0.3288 - accuracy: 0.0016
Epoch 409/500
116/116 [=====] - 0s 2ms/step - loss: 0.3290 - accuracy: 5.4025e-04
Epoch 410/500
116/116 [=====] - 0s 2ms/step - loss: 0.3319 - accuracy: 0.0019
Epoch 411/500
116/116 [=====] - 0s 2ms/step - loss: 0.3351 - accuracy: 0.0027
Epoch 412/500
116/116 [=====] - 0s 2ms/step - loss: 0.3302 - accuracy: 0.0011
Epoch 413/500
116/116 [=====] - 0s 2ms/step - loss: 0.3302 - accuracy: 0.0022
Epoch 414/500
116/116 [=====] - 0s 2ms/step - loss: 0.3321 - accuracy: 0.0027
Epoch 415/500
116/116 [=====] - 0s 2ms/step - loss: 0.3360 - accuracy: 0.0024
Epoch 416/500
116/116 [=====] - 0s 2ms/step - loss: 0.3350 - accuracy: 0.0024
Epoch 417/500
116/116 [=====] - 0s 2ms/step - loss: 0.3316 - accuracy: 0.0016
Epoch 418/500
116/116 [=====] - 0s 2ms/step - loss: 0.3278 - accuracy: 0.0019
Epoch 419/500
116/116 [=====] - 0s 2ms/step - loss: 0.3338 - accuracy: 0.0027
Epoch 420/500
116/116 [=====] - 0s 2ms/step - loss: 0.3341 - accuracy: 0.0032
Epoch 421/500
116/116 [=====] - 0s 2ms/step - loss: 0.3305 - accuracy: 0.0022
Epoch 422/500
116/116 [=====] - 0s 2ms/step - loss: 0.3333 - accuracy: 0.0019
Epoch 423/500

116/116 [=====] - 0s 2ms/step - loss: 0.3300 - accuracy: 0.0011
Epoch 424/500
116/116 [=====] - 0s 1ms/step - loss: 0.3285 - accuracy: 0.0019
Epoch 425/500
116/116 [=====] - 0s 2ms/step - loss: 0.3289 - accuracy: 0.0022
Epoch 426/500
116/116 [=====] - 0s 2ms/step - loss: 0.3295 - accuracy: 0.0022
Epoch 427/500
116/116 [=====] - 0s 2ms/step - loss: 0.3328 - accuracy: 0.0014
Epoch 428/500
116/116 [=====] - 0s 2ms/step - loss: 0.3311 - accuracy: 8.1037e-04
Epoch 429/500
116/116 [=====] - 0s 1ms/step - loss: 0.3319 - accuracy: 0.0024
Epoch 430/500
116/116 [=====] - 0s 1ms/step - loss: 0.3302 - accuracy: 0.0016
Epoch 431/500
116/116 [=====] - 0s 2ms/step - loss: 0.3256 - accuracy: 2.7012e-04
Epoch 432/500
116/116 [=====] - 0s 2ms/step - loss: 0.3279 - accuracy: 0.0046
Epoch 433/500
116/116 [=====] - 0s 2ms/step - loss: 0.3334 - accuracy: 0.0022
Epoch 434/500
116/116 [=====] - 0s 1ms/step - loss: 0.3343 - accuracy: 0.0024
Epoch 435/500
116/116 [=====] - 0s 2ms/step - loss: 0.3287 - accuracy: 0.0035
Epoch 436/500
116/116 [=====] - 0s 2ms/step - loss: 0.3342 - accuracy: 0.0030
Epoch 437/500
116/116 [=====] - 0s 2ms/step - loss: 0.3271 - accuracy: 0.0011
Epoch 438/500
116/116 [=====] - 0s 1ms/step - loss: 0.3300 - accuracy: 0.0024
Epoch 439/500
116/116 [=====] - 0s 3ms/step - loss: 0.3356 - accuracy: 0.0014
Epoch 440/500
116/116 [=====] - 0s 2ms/step - loss: 0.3283 - accuracy: 0.0011
Epoch 441/500
116/116 [=====] - 0s 2ms/step - loss: 0.3363 - accuracy: 0.0014
Epoch 442/500
116/116 [=====] - 0s 2ms/step - loss: 0.3288 - accuracy: 8.1037e-04
Epoch 443/500
116/116 [=====] - 0s 2ms/step - loss: 0.3299 - accuracy: 0.0011
Epoch 444/500
116/116 [=====] - 0s 2ms/step - loss: 0.3355 - accuracy: 0.0022
Epoch 445/500
116/116 [=====] - 0s 2ms/step - loss: 0.3326 - accuracy: 0.0016
Epoch 446/500
116/116 [=====] - 0s 2ms/step - loss: 0.3312 - accuracy: 0.0011
Epoch 447/500
116/116 [=====] - 0s 2ms/step - loss: 0.3400 - accuracy: 0.0014
Epoch 448/500
116/116 [=====] - 0s 2ms/step - loss: 0.3310 - accuracy: 0.0024
Epoch 449/500
116/116 [=====] - 0s 3ms/step - loss: 0.3323 - accuracy: 0.0022
Epoch 450/500
116/116 [=====] - 0s 3ms/step - loss: 0.3275 - accuracy: 0.0014
Epoch 451/500
116/116 [=====] - 0s 2ms/step - loss: 0.3293 - accuracy: 0.0014
Epoch 452/500
116/116 [=====] - 0s 2ms/step - loss: 0.3295 - accuracy: 0.0014
Epoch 453/500
116/116 [=====] - 0s 2ms/step - loss: 0.3289 - accuracy: 0.0019
Epoch 454/500
116/116 [=====] - 0s 2ms/step - loss: 0.3302 - accuracy: 0.0016
Epoch 455/500
116/116 [=====] - 0s 2ms/step - loss: 0.3234 - accuracy: 0.0016
Epoch 456/500
116/116 [=====] - 0s 2ms/step - loss: 0.3255 - accuracy: 0.0019
Epoch 457/500
116/116 [=====] - 0s 2ms/step - loss: 0.3274 - accuracy: 0.0011
Epoch 458/500
116/116 [=====] - 0s 1ms/step - loss: 0.3328 - accuracy: 0.0022
Epoch 459/500
116/116 [=====] - 0s 2ms/step - loss: 0.3289 - accuracy: 2.7012e-04
Epoch 460/500
116/116 [=====] - 0s 1ms/step - loss: 0.3358 - accuracy: 0.0016
Epoch 461/500

116/116 [=====] - 0s 1ms/step - loss: 0.3282 - accuracy: 0.0016
Epoch 462/500
116/116 [=====] - 0s 2ms/step - loss: 0.3277 - accuracy: 0.0019
Epoch 463/500
116/116 [=====] - 0s 1ms/step - loss: 0.3289 - accuracy: 0.0016
Epoch 464/500
116/116 [=====] - 0s 2ms/step - loss: 0.3265 - accuracy: 0.0016
Epoch 465/500
116/116 [=====] - 0s 2ms/step - loss: 0.3283 - accuracy: 0.0035
Epoch 466/500
116/116 [=====] - 0s 2ms/step - loss: 0.3314 - accuracy: 0.0022
Epoch 467/500
116/116 [=====] - 0s 1ms/step - loss: 0.3285 - accuracy: 8.1037e-04
Epoch 468/500
116/116 [=====] - 0s 2ms/step - loss: 0.3314 - accuracy: 5.4025e-04
Epoch 469/500
116/116 [=====] - 0s 2ms/step - loss: 0.3371 - accuracy: 0.0016
Epoch 470/500
116/116 [=====] - 0s 2ms/step - loss: 0.3303 - accuracy: 0.0027
Epoch 471/500
116/116 [=====] - 0s 2ms/step - loss: 0.3244 - accuracy: 0.0027
Epoch 472/500
116/116 [=====] - 0s 2ms/step - loss: 0.3282 - accuracy: 0.0024
Epoch 473/500
116/116 [=====] - 0s 2ms/step - loss: 0.3253 - accuracy: 0.0016
Epoch 474/500
116/116 [=====] - 0s 1ms/step - loss: 0.3267 - accuracy: 0.0016
Epoch 475/500
116/116 [=====] - 0s 1ms/step - loss: 0.3262 - accuracy: 0.0024
Epoch 476/500
116/116 [=====] - 0s 2ms/step - loss: 0.3275 - accuracy: 0.0024
Epoch 477/500
116/116 [=====] - 0s 2ms/step - loss: 0.3305 - accuracy: 0.0014
Epoch 478/500
116/116 [=====] - 0s 2ms/step - loss: 0.3272 - accuracy: 0.0030
Epoch 479/500
116/116 [=====] - 0s 2ms/step - loss: 0.3268 - accuracy: 0.0014
Epoch 480/500
116/116 [=====] - 0s 1ms/step - loss: 0.3278 - accuracy: 0.0027
Epoch 481/500
116/116 [=====] - 0s 1ms/step - loss: 0.3244 - accuracy: 0.0011
Epoch 482/500
116/116 [=====] - 0s 1ms/step - loss: 0.3277 - accuracy: 0.0022
Epoch 483/500
116/116 [=====] - 0s 1ms/step - loss: 0.3291 - accuracy: 2.7012e-04
Epoch 484/500
116/116 [=====] - 0s 2ms/step - loss: 0.3275 - accuracy: 0.0035
Epoch 485/500
116/116 [=====] - 0s 1ms/step - loss: 0.3293 - accuracy: 0.0027
Epoch 486/500
116/116 [=====] - 0s 1ms/step - loss: 0.3295 - accuracy: 8.1037e-04
Epoch 487/500
116/116 [=====] - 0s 2ms/step - loss: 0.3330 - accuracy: 0.0027
Epoch 488/500
116/116 [=====] - 0s 2ms/step - loss: 0.3223 - accuracy: 0.0016
Epoch 489/500
116/116 [=====] - 0s 2ms/step - loss: 0.3317 - accuracy: 0.0032
Epoch 490/500
116/116 [=====] - 0s 1ms/step - loss: 0.3278 - accuracy: 0.0014
Epoch 491/500
116/116 [=====] - 0s 1ms/step - loss: 0.3237 - accuracy: 0.0022
Epoch 492/500
116/116 [=====] - 0s 1ms/step - loss: 0.3255 - accuracy: 0.0019
Epoch 493/500
116/116 [=====] - 0s 2ms/step - loss: 0.3300 - accuracy: 0.0027
Epoch 494/500
116/116 [=====] - 0s 1ms/step - loss: 0.3279 - accuracy: 0.0022
Epoch 495/500
116/116 [=====] - 0s 2ms/step - loss: 0.3292 - accuracy: 0.0024
Epoch 496/500
116/116 [=====] - 0s 2ms/step - loss: 0.3225 - accuracy: 0.0014
Epoch 497/500
116/116 [=====] - 0s 2ms/step - loss: 0.3254 - accuracy: 0.0016
Epoch 498/500
116/116 [=====] - 0s 2ms/step - loss: 0.3300 - accuracy: 0.0041
Epoch 499/500


```
116/116 [=====] - 0s 1ms/step - loss: 0.3251 - accuracy: 0.0022
Epoch 500/500
116/116 [=====] - 0s 2ms/step - loss: 0.3284 - accuracy: 0.0016
```

In [36]:

```
# Evaluate the model using the test data
model_loss, model_accuracy = nn.evaluate(X_test_scaled,y_test,verbose=2)
print(f"Loss: {model_loss}, Accuracy: {model_accuracy}")
```

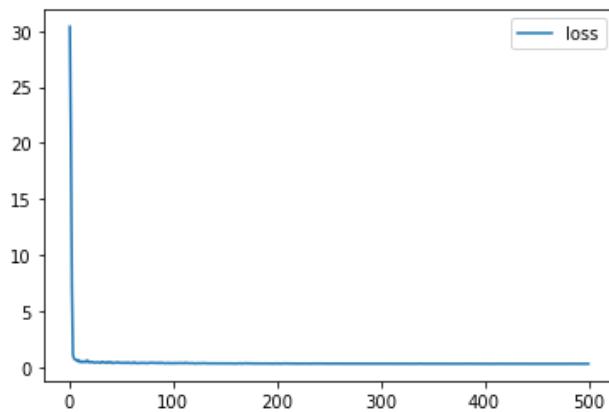
```
39/39 - 0s - loss: 5.5427 - accuracy: 0.0130 - 151ms/epoch - 4ms/step
Loss: 5.542662143707275, Accuracy: 0.012955465354025364
```

In [37]:

```
# Create a DataFrame containing training history
history_df = pd.DataFrame(fit_model.history, index=range(1,len(fit_model.history["loss"])+1))

# Plot the loss
history_df.plot(y="loss")
```

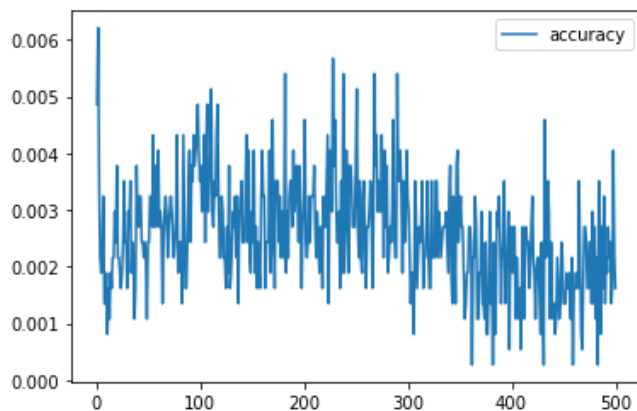
Out[37]: <AxesSubplot:>



In [38]:

```
# Plot the accuracy
history_df.plot(y="accuracy")
```

Out[38]: <AxesSubplot:>



In []: