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('./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	

Create Salary Brackets

In [2]:
```
# look at distribution of salaries (suppressing scientific notation)
df['Salary'].describe().apply(lambda x: format(x, 'f'))
```

Out[2]:
```
count        4937.000000
mean      3011304.443387
std       4265619.190449
min        100000.000000
25%        327000.000000
50%        980000.000000
75%       4000000.000000
max      33000000.000000
Name: Salary, dtype: object
```

In [3]:
```
# create salary brackets and labels
bins = [0, 499999, 4999999, 9999999, 34999999]
labels = ['low', 'mid', 'high', 'top']
```

In [4]:
```
# apply salary brackets
df['salBin'] = pd.cut(df['Salary'], bins=bins, labels=labels)
df
```

Out[4]:

	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

	Year	Full Name	Age	Salary	ERA	Hits	Earned Runs	Strike Outs	Home Runs	Wins	Losses	Outs Pitched	Batters Faced by Pitcher	Games Finished
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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 × 20 columns

In [5]:
```
### Drop unnecessary columns
df= df.drop(["Full Name","Team","League","Age","Year","Salary"],1)
df.head()
```

```
C:\Users\alyss\anaconda3\envs\mlenv\lib\site-packages\ipykernel_launcher.py:2: FutureWarning: In a future
version of pandas all arguments of DataFrame.drop except for the argument 'labels' will be keyword-only
```

Out[5]:

	ERA	Hits	Earned Runs	Strike Outs	Home Runs	Wins	Losses	Outs Pitched	Batters Faced by Pitcher	Games Finished	Weight	Height	Games Started	salBin
0	4.51	246	106	105	16	10	14	635	925	0	200	75	33	low
1	5.97	37	23	25	0	0	5	104	162	0	185	75	7	low
2	3.77	13	6	7	0	1	2	43	63	0	195	76	3	low
3	4.53	214	95	82	20	7	18	566	797	0	178	71	31	low
4	2.76	179	57	127	13	12	8	557	784	1	180	74	24	low

Reduce number of rows

kept getting error in one-hot encoding, `ValueError: Buffer has wrong number of dimensions (expected 1, got 2)`

some suggested reducing sample size would solve issue (https://github.com/lmcinnes/umap/issues/496)

-- Update: reducing sample size did not solve issue with one-hot encoding

Encode Salary Bins column

In [6]:
```
# use get_dummies to one-hot encode the salarybin column
encoded_df=pd.get_dummies(df,columns=['salBin'],prefix="salBin")
encoded_df
```

Out[6]:

	ERA	Hits	Earned Runs	Strike Outs	Home Runs	Wins	Losses	Outs Pitched	Batters Faced by Pitcher	Games Finished	Weight	Height	Games Started	salBin_low	salB
0	4.51	246	106	105	16	10	14	635	925	0	200	75	33	1	

	ERA	Hits	Earned Runs	Strike Outs	Home Runs	Wins	Losses	Outs Pitched	Batters Faced by Pitcher	Games Finished	Weight	Height	Games Started	salBin_low	salE
1	5.97	37	23	25	0	0	5	104	162	0	185	75	7	1	
2	3.77	13	6	7	0	1	2	43	63	0	195	76	3	1	
3	4.53	214	95	82	20	7	18	566	797	0	178	71	31	1	
4	2.76	179	57	127	13	12	8	557	784	1	180	74	24	1	
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
4932	3.53	84	34	56	11	2	2	260	365	13	240	74	4	0	
4933	5.79	81	48	50	12	3	4	224	328	5	240	78	12	0	
4934	3.33	138	58	127	12	13	6	470	656	0	215	74	24	0	
4935	6.19	104	61	94	28	3	9	266	406	7	255	82	13	0	
4936	4.87	118	57	66	14	9	7	316	450	1	225	74	18	0	

4937 rows × 17 columns

Split Features/Target & Training/Testing Sets

Split into features and target

- **y variable**: Our target variables, `Salary-Bin_low` , `Salary-Bin_mid` , `Salary-Bin_high` , `Salary-Bin_top`
- **X variable**: Our features

In [10]:
```
# Split our preprocessed data into our features and target arrays
y = encoded_df[["salBin_low","salBin_mid","salBin_high","salBin_top"]].values
X = encoded_df.drop(["salBin_low","salBin_mid","salBin_high","salBin_top"],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 [11]:
```
# Create a StandardScaler instance
scaler = StandardScaler()

# 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)
```

Build Neural Net Framework

In [12]:
```
# Define the model - deep neural net
```

```
number_input_features = len(X_train[0])
hidden_nodes_layer1 = 20
hidden_nodes_layer2 = 20
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="relu")
)

# 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_layer3, activation="relu"))

# Output layer
nn.add(tf.keras.layers.Dense(units=4, activation="softmax"))

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

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense (Dense)               (None, 20)                280

 dense_1 (Dense)             (None, 20)                420

 dense_2 (Dense)             (None, 20)                420

 dense_3 (Dense)             (None, 4)                 84

=================================================================
Total params: 1,204
Trainable params: 1,204
Non-trainable params: 0
_________________________________________________________________
```

Compile the Model

In [14]:
```
# Compile the model
nn.compile(loss="CategoricalCrossentropy", optimizer="adam", metrics=["accuracy"])
```

Train the model

In [ ]:
```
# Train the model
fit_model = nn.fit(X_train,y_train,epochs=200)
```

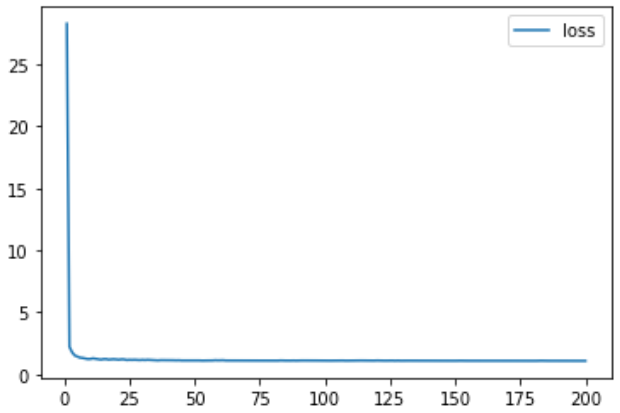
In [16]:
```
# Evaluate the model using the test data
model_loss, model_accuracy = nn.evaluate(X_test_scaled,y_test,verbose=2)
print(f"Loss: {model_loss*100:.2f}%, Accuracy: {model_accuracy*100:.2f}%")
```

```
39/39 - 0s - loss: 1.2962 - accuracy: 0.3789 - 106ms/epoch - 3ms/step
Loss: 129.62%, Accuracy: 37.89%
```

In [17]:
```
# 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")
```

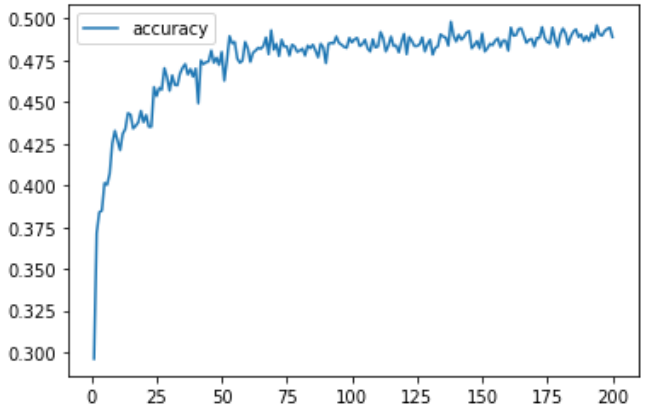
Out[17]: <AxesSubplot:>



In [18]:

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

Out[18]: <AxesSubplot:>



In [ ]: