Chapter 3: ANN

Ex3: Predict Hourly Wage

- Cho dữ liệu Income_training.csv, hãy xây dựng mô hình dự đoán compositeHourlyWages từ những thuộc tính còn lại.
- https://www.kaggle.com/c/predict-hourly-wage/data (https://www.kaggle.com/c/predict-hourly-wage/data)

In [1]:
```
# from google.colab import drive
# drive.mount("/content/gdrive", force_remount=True)
```

In [2]:
```
# %cd '/content/gdrive/My Drive/LDS8_DeepLearning/Practice/Chapter3'
```

In [3]:
```
import warnings
warnings.filterwarnings('ignore')
```

In [4]:
```
# Import
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras import Sequential
from tensorflow.keras.layers import Dense
import numpy as np
import pandas as pd
```

In [5]:
```
print(tf.__version__)
print(keras.__version__)
```

```
2.5.0
2.5.0
```

In [6]:
```
df = pd.read_csv("all/Income_training.csv")
```

In [7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3197 entries, 0 to 3196
Data columns (total 4 columns):
 #   Column               Non-Null Count  Dtype  
---  ------               --------------  -----  
 0   compositeHourlyWages  3197 non-null   float64
 1   age                  3197 non-null   int64  
 2   yearsEducation       3197 non-null   int64  
 3   sex1M0F              3197 non-null   int64  
dtypes: float64(1), int64(3)
memory usage: 100.0 KB
```

In [8]:
```
df.head()
```

Out[8]:

	compositeHourlyWages	age	yearsEducation	sex1M0F
0	21.38	58	10	1
1	25.15	42	16	1
2	8.57	31	12	0
3	12.07	43	13	0
4	10.97	46	12	0

In [9]:
```
#create a dataframe with all training data except the target column
train_X = df.drop(columns=['compositeHourlyWages'])
#check that the target variable has been removed
train_X.head()
```

Out[9]:

	age	yearsEducation	sex1M0F
0	58	10	1
1	42	16	1
2	31	12	0
3	43	13	0
4	46	12	0

In [10]:
```
#create a dataframe with only the target column
train_y = df[['compositeHourlyWages']]

#view dataframe
train_y.head()
```

Out[10]:

	compositeHourlyWages
0	21.38
1	25.15
2	8.57
3	12.07
4	10.97

In [11]:
```
#get number of columns in training data
n_cols = train_X.shape[1]
print(n_cols)
```

```
3
```

In [12]:
```
#create model
model = Sequential()
#add model layers
model.add(Dense(16, activation='relu', input_shape=(n_cols,))) # (3+1)^2
model.add(Dense(8, activation='relu'))
model.add(Dense(8, activation='relu')) # cải tiến bằng cách thử cho học sâu hơn,
model.add(Dense(1))
```

- Tham khảo tại https://towardsdatascience.com/building-a-deep-learning-model-using-keras-1548ca149d37 (https://towardsdatascience.com/building-a-deep-learning-model-using-keras-1548ca149d37)
- As you increase the number of nodes and layers in a model, the model capacity increases. Increasing model capacity can lead to a more accurate model, up to a certain point, at which the model will stop improving. Generally, the more training data you provide, the larger the model should be. We are only using a tiny amount of data, so our model is pretty small. The larger the model, the more computational capacity it requires and it will take longer to train.

In [13]:
```
#compile model using mse as a measure of model performance
model.compile(optimizer='adam', loss='mean_squared_error')
```

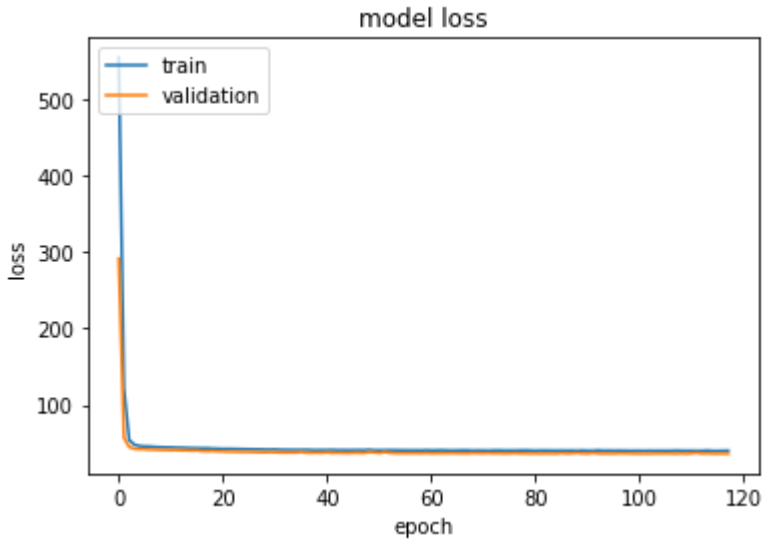
In [14]:
```
from tensorflow.keras.callbacks import EarlyStopping
#set early stopping monitor so the model stops training when it won't improve any
early_stopping_monitor = EarlyStopping(patience=10)
#train model
history = model.fit(train_X, train_y,
                    epochs=300,
                    batch_size=32,
                    validation_split=0.2,
                    callbacks=[early_stopping_monitor])
```

```
Epoch 1/300
80/80 [==============================] - 1s 2ms/step - loss: 554.3127 - val_l
oss: 291.1755
Epoch 2/300
80/80 [==============================] - 0s 1ms/step - loss: 121.4552 - val_l
oss: 56.9086
Epoch 3/300
80/80 [==============================] - 0s 1ms/step - loss: 53.8414 - val_lo
ss: 44.8211
Epoch 4/300
80/80 [==============================] - 0s 1ms/step - loss: 47.6723 - val_lo
ss: 42.3061
Epoch 5/300
80/80 [==============================] - 0s 1ms/step - loss: 45.9391 - val_lo
ss: 41.8040
Epoch 6/300
80/80 [==============================] - 0s 1ms/step - loss: 45.4002 - val_lo
ss: 41.9626
Epoch 7/300
```

In [15]:
```
import matplotlib.pyplot as plt
```

In [16]:
```
print(history.history.keys())
# "Loss"
plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title('model loss')
plt.ylabel('loss')
plt.xlabel('epoch')
plt.legend(['train', 'validation'], loc='upper left')
plt.show()
```

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



In [17]:
```
# evaluate the model
scores = model.evaluate(train_X, train_y)
print(scores)
```

```
100/100 [==============================] - 0s 947us/step - loss: 38.7078
38.70783233642578
```

In [18]:
```
# Making predict on new data
df_test = pd.read_csv("all/Income_testing.csv")
df_test.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 800 entries, 0 to 799
Data columns (total 4 columns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   ID              800 non-null    int64
 1   age             800 non-null    int64
 2   yearsEducation  800 non-null    int64
 3   sex1M0F         800 non-null    int64
dtypes: int64(4)
memory usage: 25.1 KB
```

In [19]:
```
df_test.head()
```

Out[19]:

	ID	age	yearsEducation	sex1M0F
0	1	36	20	0
1	2	38	17	0
2	3	24	10	0
3	4	39	12	1
4	5	50	12	0

In [20]:
```
test_X = df_test.drop(columns=["ID"])
```

In [21]:
```
test_y_predictions = model.predict(test_X)
```

In [22]:
```
test_y_predictions[:10]
```

Out[22]:
```
array([[20.074055],
       [19.615782],
       [10.581363],
       [19.18266 ],
       [14.226417],
       [19.229832],
       [18.195614],
       [18.803473],
       [14.020133],
       [14.366348]], dtype=float32)
```