In [1]:

```
import pandas as pd
```

In [2]:

```
df=pd.read_csv("BankNote_Authentication.csv")
```

In [3]:

```
df.head()
```

Out[3]:

	variance	skewness	curtosis	entropy	class
0	3.62160	8.6661	-2.8073	-0.44699	0
1	4.54590	8.1674	-2.4586	-1.46210	0
2	3.86600	-2.6383	1.9242	0.10645	0
3	3.45660	9.5228	-4.0112	-3.59440	0
4	0.32924	-4.4552	4.5718	-0.98880	0

In [4]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1372 entries, 0 to 1371
Data columns (total 5 columns):
variance    1372 non-null float64
skewness    1372 non-null float64
curtosis    1372 non-null float64
entropy     1372 non-null float64
class       1372 non-null int64
dtypes: float64(4), int64(1)
memory usage: 53.7 KB
```

In [5]:

```
df.describe()
```

Out[5]:

	variance	skewness	curtosis	entropy	class
count	1372.000000	1372.000000	1372.000000	1372.000000	1372.000000
mean	0.433735	1.922353	1.397627	-1.191657	0.444606
std	2.842763	5.869047	4.310030	2.101013	0.497103
min	-7.042100	-13.773100	-5.286100	-8.548200	0.000000
25%	-1.773000	-1.708200	-1.574975	-2.413450	0.000000
50%	0.496180	2.319650	0.616630	-0.586650	0.000000
75%	2.821475	6.814625	3.179250	0.394810	1.000000
max	6.824800	12.951600	17.927400	2.449500	1.000000

In [6]:

```
df["class"].value_counts()
```

Out[6]:

```
0    762
1    610
Name: class, dtype: int64
```

In [7]:

```
X=df.drop('class',axis=1)
```

In [8]:

In [8]:

```
y=df["class"]
```

In [9]:

```
from sklearn.model_selection import train_test_split
```

In [10]:

```
X_train, X_test, y_train, y_test = train_test_split( X, y, test_size=0.3)
```

In [11]:

```
import tensorflow as tf
```

In [12]:

```
feat_col=[]

for col in X.columns:
    feat_col.append(tf.feature_column.numeric_column(col))
```

In [13]:

```
feat_col
```

Out[13]:

```
[NumericColumn(key='variance', shape=(1,), default_value=None, dtype=tf.float32, normalizer_fn=None),
 NumericColumn(key='skewness', shape=(1,), default_value=None, dtype=tf.float32, normalizer_fn=None),
 NumericColumn(key='curtosis', shape=(1,), default_value=None, dtype=tf.float32, normalizer_fn=None),
 NumericColumn(key='entropy', shape=(1,), default_value=None, dtype=tf.float32, normalizer_fn=None)]
```

In [14]:

```
input_fun=tf.estimator.inputs.pandas_input_fn(X_train,y_train,batch_size=20,shuffle=True)
```

In [15]:

```
classifier=tf.estimator.DNNClassifier(hidden_units=[10,20,10],feature_columns=feat_col,n_classes=2)
```

```
INFO:tensorflow:Using default config.
WARNING:tensorflow:Using temporary folder as model directory: C:\Users\Dell\AppData\Local\Temp\tmp0ziw
i2wx
INFO:tensorflow:Using config: {'_model_dir': 'C:\\Users\\Dell\\AppData\\Local\\Temp\\tmp0ziwi2wx', '_
tf_random_seed': None, '_save_summary_steps': 100, '_save_checkpoints_steps': None, '_save_checkpoints_
secs': 600, '_session_config': allow_soft_placement: true
graph_options {
  rewrite_options {
    meta_optimizer_iterations: ONE
  }
}
, '_keep_checkpoint_max': 5, '_keep_checkpoint_every_n_hours': 10000, '_log_step_count_steps': 100, '_t
rain_distribute': None, '_device_fn': None, '_protocol': None, '_eval_distribute': None, '_experimental
_distribute': None, '_service': None, '_cluster_spec': <tensorflow.python.training.server_lib.ClusterSp
ec object at 0x000002679CFC2908>, '_task_type': 'worker', '_task_id': 0, '_global_id_in_cluster': 0, '_
master': '', '_evaluation_master': '', '_is_chief': True, '_num_ps_replicas': 0, '_num_worker_replicas'
: 1}
```

In [16]:

```
classifier.train(input_fn=input_fun,steps=500)
```

```
WARNING:tensorflow:From C:\Users\Dell\Anaconda3\lib\site-packages\tensorflow\python\framework\op_def_l
ibrary.py:263: colocate_with (from tensorflow.python.framework.ops) is deprecated and will be removed i
n a future version.
Instructions for updating:
Colocations handled automatically by placer.
WARNING:tensorflow:From C:\Users\Dell\Anaconda3\lib\site-packages\tensorflow_estimator\python\estimato
r\inputs\queues\feeding_queue_runner.py:62: QueueRunner.__init__ (from tensorflow.python.training.queue
_runner_impl) is deprecated and will be removed in a future version.
Instructions for updating:
To construct input pipelines, use the `tf.data` module.
WARNING:tensorflow:From C:\Users\Dell\Anaconda3\lib\site-packages\tensorflow_estimator\python\estimato
r\inputs\queues\feeding_functions.py:500: add_queue_runner (from tensorflow.python.training.queue_runne
r_impl) is deprecated and will be removed in a future version.
Instructions for updating:
To construct input pipelines, use the `tf.data` module.
```

```
INFO:tensorflow:Calling model_fn.
WARNING:tensorflow:From C:\Users\Dell\Anaconda3\lib\site-packages\tensorflow\python\feature_column\fea
ture_column_v2.py:2703: to_float (from tensorflow.python.ops.math_ops) is deprecated and will be remove
d in a future version.
Instructions for updating:
Use tf.cast instead.
INFO:tensorflow:Done calling model_fn.
INFO:tensorflow:Create CheckpointSaverHook.
INFO:tensorflow:Graph was finalized.
INFO:tensorflow:Running local_init_op.
INFO:tensorflow:Done running local_init_op.
WARNING:tensorflow:From C:\Users\Dell\Anaconda3\lib\site-packages\tensorflow\python\training\monitored
_session.py:809: start_queue_runners (from tensorflow.python.training.queue_runner_impl) is deprecated
and will be removed in a future version.
Instructions for updating:
To construct input pipelines, use the `tf.data` module.
INFO:tensorflow:Saving checkpoints for 0 into C:\Users\Dell\AppData\Local\Temp\tmp0ziwi2wx\model.ckpt.
INFO:tensorflow:loss = 21.351234, step = 1
INFO:tensorflow:Saving checkpoints for 48 into C:\Users\Dell\AppData\Local\Temp\tmp0ziwi2wx\model.ckpt
.
INFO:tensorflow:Loss for final step: 0.57993174.
```

Out[16]:

```
<tensorflow_estimator.python.estimator.canned.dnn.DNNClassifier at 0x2679cfc2438>
```

In [17]:

```
test_inp=tf.estimator.inputs.pandas_input_fn(x=X_test,batch_size=len(X_test),shuffle=False)
```

In [18]:

```
prediction=list(classifier.predict(input_fn=test_inp))
```

```
INFO:tensorflow:Calling model_fn.
INFO:tensorflow:Done calling model_fn.
INFO:tensorflow:Graph was finalized.
WARNING:tensorflow:From C:\Users\Dell\Anaconda3\lib\site-packages\tensorflow\python\training\saver.py:
1266: checkpoint_exists (from tensorflow.python.training.checkpoint_management) is deprecated and will
be removed in a future version.
Instructions for updating:
Use standard file APIs to check for files with this prefix.
INFO:tensorflow:Restoring parameters from C:\Users\Dell\AppData\Local\Temp\tmp0ziwi2wx\model.ckpt-48
INFO:tensorflow:Running local_init_op.
INFO:tensorflow:Done running local_init_op.
```

In [19]:

```
target =[]

for x in prediction:
    target.append(x["class_ids"][0])
```

In [20]:

```
target
```

Out[20]:

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In [21]:

```
from sklearn.metrics import classification_report, confusion_matrix
```

In [22]:

```
print(confusion_matrix(y_test,target))
```

```
[[236   0]
 [  3 173]]
```

In [23]:

```
print(classification_report(y_test,target))
```

```
             precision    recall  f1-score   support

          0       0.99      1.00      0.99       236
          1       1.00      0.98      0.99       176

avg / total       0.99      0.99      0.99       412
```

In [ ]:

```

```