day-29-pipeline-of-ml

May 26, 2025

1 Project Terget

To Predict Survivance of Titanic Passenger

###Project will be done by 2 or 3 way 1. Raw way 2. Using ColumnTransformation 3. Using Pipeline(Most Organized way)

```
[ ]: import numpy as np
     import pandas as pd
     import matplotlib.pyplot as plt
     import seaborn as sns
```

```
[ ]: df=pd.read_csv('/content/Titanic-Dataset.csv')
     df.head(3)
```

```
[ ]:    PassengerId  Survived  Pclass  \
     0            1         0       3
     1            2         1       1
     2            3         1       3

                                                     Name     Sex   Age  SibSp  \
     0                            Braund, Mr. Owen Harris    male  22.0      1
     1  Cumings, Mrs. John Bradley (Florence Briggs Th…  female  38.0      1
     2                             Heikkinen, Miss. Laina  female  26.0      0

        Parch            Ticket     Fare Cabin Embarked
     0      0         A/5 21171   7.2500   NaN        S
     1      0          PC 17599  71.2833   C85        C
     2      0  STON/O2. 3101282   7.9250   NaN        S
```

```
[ ]: df=df.drop(columns=['PassengerId','Name','Ticket','Cabin'])
     df.head(3)
```

```
[ ]:    Survived  Pclass     Sex   Age  SibSp  Parch     Fare Embarked
     0         0       3    male  22.0      1      0   7.2500        S
     1         1       1  female  38.0      1      0  71.2833        C
     2         1       3  female  26.0      0      0   7.9250        S
```

#Important Note ##>in this Stage we have to Analyze data by Asking verious Question and Visulize data ##>See Day-15-22 Data Aanlysis NoteBook from Google

```
[ ]: df.isnull().sum()
```

```
[ ]: Survived      0
     Pclass        0
     Sex           0
     Age         177
     SibSp         0
     Parch         0
     Fare          0
     Embarked      2
     dtype: int64
```

```
[ ]: from sklearn.model_selection import train_test_split
     X_train,X_test,y_train,y_test=train_test_split(df.
      ↪drop('Survived',axis=1),df['Survived'],test_size=0.2)
```

```
[ ]: X_train.head(2)
     #Sex & Embarked -->Nominal Catagorical--->OneHotEncoding
     #Age & Embarked -->Has Missing value --->SimpleImputer or Do Pandas .fillna␣
      ↪previous
     #Age # Fare --->Scaling(jodi kora lage korte paro nahoi bad)--->StandardScaler/
      ↪MinMaxScaler
     #Reminder Column-->Passthrough
```

```
[ ]:      Pclass     Sex   Age  SibSp  Parch     Fare Embarked
     781       1  female  17.0      1      0  57.0000        S
     25        3  female  38.0      1      5  31.3875        S
```

#1. Raw Way(Amm Jindigi)

```
[ ]: #missing value Handeling
     from sklearn.impute import SimpleImputer
     si_age=SimpleImputer()
     si_emb=SimpleImputer(strategy='most_frequent')#most_frequent== mode
     #stratagy alada ar karone alada object create kora hoise
     age_train_imp=si_age.fit_transform(X_train[['Age']])
     age_test_imp=si_age.fit_transform(X_test[['Age']])

     emb_train_imp=si_emb.fit_transform(X_train[['Embarked']])
     emb_test_imp=si_emb.fit_transform(X_test[['Embarked']])
```

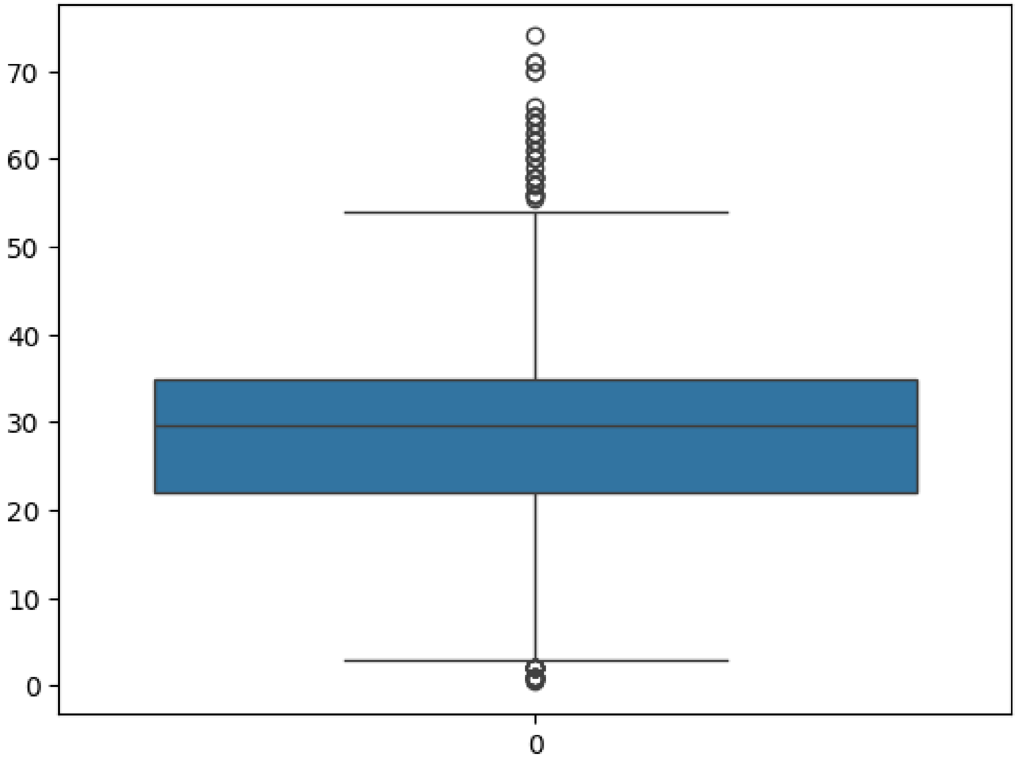
```
[ ]: #Encoding
     from sklearn.preprocessing import OneHotEncoder
```

```
ohe=OneHotEncoder(dtype=np.
  ↪int32,sparse_output=False,handle_unknown='ignore')#ignore->if inFuture new␣
  ↪catagories Arise then will ignore(0)
#Though,Embarked contain null value,it's good to use seperate object for SEX &␣
  ↪EMBARKED

X_train_enc=ohe.fit_transform(X_train[['Sex']],emb_train_imp)#jeheto Embarked␣
  ↪ar missing value impput kore  'emb_train_imp' te rakha hoise(like pipeline)
X_test_enc=ohe.fit_transform(X_test[['Sex']],emb_test_imp)
#sex(2)-1 & embaarked(3)-1 unique value
```

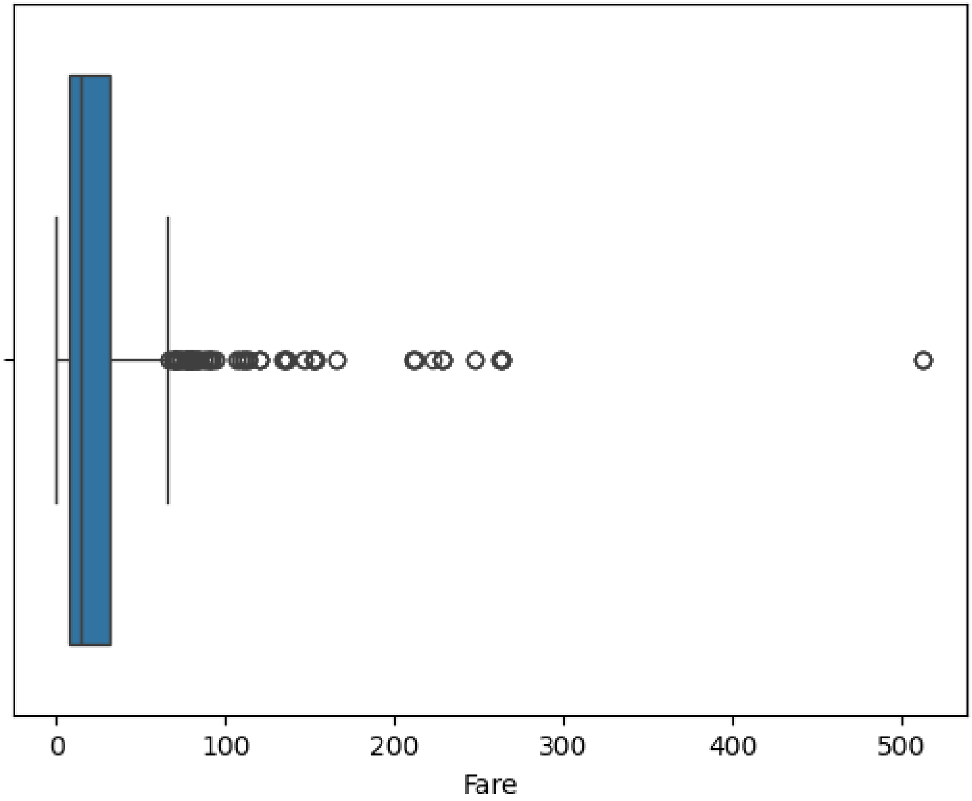
[ ]:
```
#analyze which scaling will be best
sns.boxplot(age_train_imp)
```

[ ]:
```
<Axes: >
```



[ ]:
```
sns.boxplot(data=df,x='Fare')
```

[ ]:
```
<Axes: xlabel='Fare'>
```



```
[ ]: #   scaling                scale
     #   Age    Fare   scaling              ,
     #Age --> StandardScaler    Fare --> RobustScaler

     from sklearn.preprocessing import StandardScaler,RobustScaler

     ss=StandardScaler()
     rs=RobustScaler()

     age_train_slr=ss.fit_transform(age_train_imp)#    Embarked    missing value␣
      ↪imput    'age_train_imp'          (like pipeline)
     age_test_slr=ss.fit_transform(age_test_imp)

     fare_train_slr=rs.fit_transform(X_train[['Fare']])
     fare_test_slr=rs.fit_transform(X_test[['Fare']])
```

```
[ ]: X_train.head(2)
```

```
[ ]:      Pclass     Sex   Age  SibSp  Parch     Fare Embarked
     781       1  female  17.0      1      0  57.0000        S
     25        3  female  38.0      1      5  31.3875        S
```

[ ]:
```
#now Concatinate or hstack all
X_train_tf=np.
 ↪hstack((X_train[['Pclass','SibSp','Parch','Age','Fare']],X_train_enc))
X_test_tf=np.
 ↪hstack((X_test[['Pclass','SibSp','Parch','Age','Fare']],X_test_enc))
X_train_tf.shape


#accuracy=77.somthing
```

[ ]:
```
(712, 7)
```

[ ]:
```
#now Concatinate or hstack all
# X_train_tf=np.
 ↪hstack((X_train[['Pclass','SibSp','Parch']],age_train_slr,fare_train_slr,X_train_enc))
# X_test_tf=np.
 ↪hstack((X_test[['Pclass','SibSp','Parch']],age_test_slr,fare_test_slr,X_test_enc))
# X_train_tf.shape

#accuracy=74.somthing with "MULTICOLLinearity"
```

[ ]:
```
#now Concatinate or hstack all
# X_train_tf=np.
 ↪concatenate((X_train[['Pclass','SibSp','Parch']],age_train_slr,fare_train_slr,X_train_enc),
# X_test_tf=np.
 ↪concatenate((X_test[['Pclass','SibSp','Parch']],age_test_slr,fare_test_slr,X_test_enc),axis
# X_train_tf.shape
```

[ ]:
```
#Now, Constract Machine-Learning Model
from sklearn.linear_model import LogisticRegression #Survived is Nominal␣
 ↪catagorical (0,1)
from sklearn.tree import DecisionTreeClassifier
clf=DecisionTreeClassifier()
clf.fit(X_train_tf,y_train)
```

[ ]:
```
DecisionTreeClassifier()
```

[ ]:
```
y_pred=clf.predict(X_test_tf)
```

[ ]:
```
#find accuricy
from sklearn.metrics import accuracy_score
accuracy_score(y_test,y_pred)
```

[ ]:
```
0.770949720670391
```

[ ]:
```
df.head(3)
```

```
[ ]:    Survived  Pclass     Sex   Age  SibSp  Parch     Fare Embarked
     0         0       3    male  22.0      1      0   7.2500        S
     1         1       1  female  38.0      1      0  71.2833        C
     2         1       3  female  26.0      0      0   7.9250        S
```

```
[ ]: #     model       production level   (.pkl)
     #          user data input        \[0 3 male 22.0 1 0 7.2500 S]           Sex   ␣
      ↪Embarked    Encode
     #       concatinate   hstack
     #    predict

     #      model   change                                "PIPELINE" Use
```

```
[ ]:
```

#2| ColumnTransformer (Mantos Jindigi Lite)

```
[ ]: from sklearn.compose import ColumnTransformer
     tf=ColumnTransformer(transformers=[
        ␣
      ↪('tf1',SimpleImputer(),['Age']),('tf2',SimpleImputer(strategy='most_frequent'),['Embarked']
         ('tf4',OneHotEncoder(dtype=np.
      ↪int32,sparse_output=False,handle_unknown='ignore'),['Sex','tf2'])#amra␣
      ↪chacci modified Embarked pass hoi kinto tf2 dataset ar kono column noi,ata␣
      ↪vul hobe
         #    Embarked   missing value    impute         encode   impute
         #   Embarked     impute →      encode       ,      Pipeline       SimpleImputer␣
      ↪  OneHotEncoder
     ],remainder='passthrough')
```

```
[ ]:
```

#3-1| Pipeline-1(not Stable) (Mantos Jindigi)[Moja ar Moja]

```
[ ]: df.head(3)
```

```
[ ]:    Survived  Pclass     Sex   Age  SibSp  Parch     Fare Embarked
     0         0       3    male  22.0      1      0   7.2500        S
     1         1       1  female  38.0      1      0  71.2833        C
     2         1       3  female  26.0      0      0   7.9250        S
```

```
[ ]: from sklearn.model_selection import train_test_split
     X_train,X_test,y_train,y_test=train_test_split(df.
      ↪drop(['Survived'],axis=1),df['Survived'],test_size=0.2, random_state=42)
```

```
[ ]: X_test.head()
```

[ ]:

```
     Pclass     Sex   Age  SibSp  Parch     Fare Embarked
709       3    male   NaN      1      1  15.2458        C
439       2    male  31.0      0      0  10.5000        S
840       3    male  20.0      0      0   7.9250        S
720       2  female   6.0      0      1  33.0000        S
39        3  female  14.0      1      0  11.2417        C
```

[ ]:

```
from sklearn.impute import SimpleImputer
from sklearn.preprocessing import OneHotEncoder, OrdinalEncoder
from sklearn.preprocessing import StandardScaler,MinMaxScaler
from sklearn.feature_selection import SelectKBest,chi2
from sklearn.compose import  ColumnTransformer
from sklearn.tree import DecisionTreeClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.pipeline import Pipeline,make_pipeline
```

[ ]:

```
#Hendel Missing value Using Column transformer

tf1=ColumnTransformer([
    ('age_imp',SimpleImputer(),[2]),
    ('emb_imp',SimpleImputer(strategy='most_frequent'),[6])
],remainder='passthrough')

#use index instade of columnName,cause next
```

[ ]:

```
#Encoding

tf2=ColumnTransformer([
    ('sex_emb_enc',OneHotEncoder(dtype=np.
 ↪int32,sparse_output=False,handle_unknown='ignore',drop='first'),[1,6])
],remainder='passthrough')
```

[ ]:

```
#Scaling

tf3=ColumnTransformer([
    ('all_scal',MinMaxScaler(),slice(0,8))
])# ai khane remainder='passthrough' use korle error ashbe
```

[ ]:

```
#Feature Selection

tf4=SelectKBest(score_func=chi2,k=8)
```

[ ]:

```
#Model Training

tf5=DecisionTreeClassifier()
```

[ ]:

```
pipe=Pipeline([
    ('impute',tf1),
    ('encode',tf2),
    ('scaling',tf3),
    ('F_select',tf4),
    ('model_train',tf5)
])
```

[ ]:

```
#Alternative Syntex
# pipe=make_pipeline(tf1,tf2,tf3,tf4,tf5)
```

[ ]:

```
#

pipe.fit(X_train,y_train)
```

[ ]:

```
Pipeline(steps=[('impute',
                 ColumnTransformer(remainder='passthrough',
                                   transformers=[('age_imp', SimpleImputer(),
                                                  [2]),
                                                 ('emb_imp',
SimpleImputer(strategy='most_frequent'),
                                                  [6])])),
                ('encode',
                 ColumnTransformer(remainder='passthrough',
                                   transformers=[('sex_emb_enc',
                                                  OneHotEncoder(drop='first',
                                                                dtype=<class
'numpy.int32'>,
handle_unknown='ignore',
sparse_output=False),
                                                  [1, 6])])),
                ('scaling',
                 ColumnTransformer(transformers=[('all_scal', MinMaxScaler(),
                                                  slice(0, 8, None))])),
                ('F_select',
                 SelectKBest(k=8,
                             score_func=<function chi2 at 0x7c319269e3e0>)),
                ('model_train', DecisionTreeClassifier())])
```

[ ]:

```
#predict
y_pred=pipe.predict(X_test)
```

```
/usr/local/lib/python3.11/dist-packages/sklearn/preprocessing/_encoders.py:246:
UserWarning: Found unknown categories in columns [1] during transform. These
unknown categories will be encoded as all zeros
  warnings.warn(
```

[ ]:

```
#Accuracy
from sklearn.metrics import accuracy_score
accuracy_score(y_test,y_pred)
```

[ ]:

```
0.6256983240223464
```

[ ]:

```

```

#3-2| Pipeline-2(Stable) (Mantos Jindigi)[Moja ar Moja]

> You Should Always Use This Method #See more in Function and Power Transformation.ipynb(Day-30-31)

1.1 Algorithm of Pipeline(Me)

```
#Pre-Knowledge

> Pipelline Takes List of Tupples and each Tupple take two value:
('anyname',Transfomer-Function)

> ColumnTransfomer Takes List of Tupples and each Tupple take 3 value:('anyname',Transfomer-Fun


1.   First,makes pipeline for each individul column that need to be Transform

    *   Age --->missing value handeling-->Function/Power Transfrom (if needed)
    *   Fare--->Function/Power Transform
    *   Embarked---> missing value handeling --->Encoding
    *   Sex ---->Encoding

2.   Second,Pass all Pipeline into A columnTransformer as Trasnfomer-Function with Proper inde

3.   3rd,Make a Final Pipeline

    *   pass the ColumnTransformer(2nd step),
    *   ('scaling',SimpleImputer()),      [if need scaling]
    *   ------------------------------
    *   ------------------------------
    *   ('feture_select',SelectKbest()),
    *   ('model',LogisticRegression())
```

[ ]:

```
df.head(2)
```

[ ]:

```
   Survived  Pclass     Sex   Age  SibSp  Parch     Fare Embarked
0         0       3    male  22.0      1      0   7.2500        S
1         1       1  female  38.0      1      0  71.2833        C
```

```
[ ]: from sklearn.model_selection import train_test_split
     X_train,X_test,y_train,y_test=train_test_split(df.
      ↪drop(['Survived'],axis=1),df['Survived'],test_size=0.2, random_state=42)
     X_train.head(2)
```

```
[ ]:      Pclass   Sex   Age  SibSp  Parch  Fare Embarked
     331       1  male  45.5      0      0  28.5        S
     733       2  male  23.0      0      0  13.0        S
```

```
[ ]: #Age --->missing value handeling
     age_pipe=Pipeline([
         ('age_imp',SimpleImputer())
     ])
```

```
[ ]: #Embarked---> missing value handeling --->Encoding

     emb_pipe=Pipeline([
         ('emb_imp',SimpleImputer(strategy='most_frequent')),
         ('emb_ohe',OneHotEncoder(dtype=np.
      ↪int32,drop='first',sparse_output=False,handle_unknown='ignore'))
     ])
```

```
[ ]: #Sex ---->Encoding

     sex_pipe=Pipeline([
         ('sex_ohe',OneHotEncoder(dtype=np.
      ↪int32,drop='first',sparse_output=False,handle_unknown='ignore'))
     ])



     #aikhane Sex ar jonne alada pipeline and Embarked ar jonne alada pipeline kora.␣
      ↪Tobe Akshte korle shobche valo hoi
```

```
[ ]: #Second,Pass all Pipeline into A columnTransformer as Trasnfomer-Function with␣
      ↪Proper index to Transform and Others Column/index will passthrough

     #Note: Amra ata use korbo
     preprocessed=ColumnTransformer([
         ('age_pipe',age_pipe,['Age']),
         ('emb_pipe',emb_pipe,['Embarked']),
         ('sex_pipe',sex_pipe,['Sex'])
     ],remainder='passthrough')
```

```
[ ]: preprocessed.fit_transform(X_train)
[ ]: array([[ 45.5   ,   0.    ,   1.    , …,   0.    ,   0.    ,  28.5   ],
            [ 23.    ,   0.    ,   1.    , …,   0.    ,   0.    ,  13.    ],
            [ 32.    ,   0.    ,   1.    , …,   0.    ,   0.    ,   7.925 ],
            …,
            [ 41.    ,   0.    ,   1.    , …,   2.    ,   0.    ,  14.1083],
            [ 14.    ,   0.    ,   1.    , …,   1.    ,   2.    , 120.    ],
            [ 21.    ,   0.    ,   1.    , …,   0.    ,   1.    ,  77.2875]])
```

[ ]:

```
#Note: ata o use kora jai but amra ata use korbo na


# preprocess=ColumnTransformer([
#     ('age_pipe',age_pipe,['Age']),
#     ('emb_pipe',emb_pipe,['Embarked']),
#     ('sex_pipe',sex_pipe,['Sex']),
#     ('pass','passthrough',['Pclass'        ,'SibSp','Parch','Fare'])
# ])


# preprocess.fit_transform(X_train)
```

[ ]:

```
#3rd : Final Pipeline

pipe=Pipeline([
    ('preprocessed',preprocessed),
    ('scaling_all',StandardScaler()),
    ('model',LogisticRegression())
])
```

[ ]:

```
pipe.fit(X_train,y_train)
```

```
/usr/local/lib/python3.11/dist-
packages/sklearn/compose/_column_transformer.py:1667: FutureWarning:
The format of the columns of the 'remainder' transformer in
ColumnTransformer.transformers_ will change in version 1.7 to match the format
of the other transformers.
At the moment the remainder columns are stored as indices (of type int). With
the same ColumnTransformer configuration, in the future they will be stored as
column names (of type str).
To use the new behavior now and suppress this warning, use
ColumnTransformer(force_int_remainder_cols=False).

  warnings.warn(
```

```
[ ]: Pipeline(steps=[('preprocessed',
                      ColumnTransformer(remainder='passthrough',
                                        transformers=[('age_pipe',
                                                       Pipeline(steps=[('age_imp',
     SimpleImputer())]),
                                                       ['Age']),
                                                      ('emb_pipe',
                                                       Pipeline(steps=[('emb_imp',
     SimpleImputer(strategy='most_frequent')),
                                                                       ('emb_ohe',
     OneHotEncoder(drop='first',
      dtype=<class 'numpy.int32'>,
      handle_unknown='ignore',
      sparse_output=False))]),
                                                       ['Embarked']),
                                                      ('sex_pipe',
                                                       Pipeline(steps=[('sex_ohe',
     OneHotEncoder(drop='first',
      dtype=<class 'numpy.int32'>,
      handle_unknown='ignore',
      sparse_output=False))]),
                                                       ['Sex'])])),
                     ('scaling_all', StandardScaler()),
                     ('model', LogisticRegression())])
```

[ ]:

```
y_pred=pipe.predict(X_test)
```

[ ]:

```
from sklearn.metrics import accuracy_score
accuracy_score(y_pred,y_test)
```

[ ]:

```
0.8100558659217877
```

[ ]:

```
from sklearn.model_selection import cross_val_score
cross_val_score(pipe,X_train,y_train,cv=5,scoring='accuracy').mean()
```

[ ]:

```
np.float64(0.7906628582684921)
```

#Cross Validation Using Pipeline (future a pora hobe)

[ ]:

```
from sklearn.model_selection import cross_val_score
cross_val_score(pipe,X_train,y_train,cv=5,scoring='accuracy').mean()
```

[ ]:

```
np.float64(0.7906628582684921)
```

#GridSearch Using Pipeline(Future Learning)

[ ]:

[ ]:

[ ]:

[ ]:

```

```

#Export The Pipeline to Production Level

[ ]:

```
#Export
import pickle
pickle.dump(pipe,open('pipe.pkl','wb'))
```

1.2 Then Open New NoteBook and Do Following Setps for production

[ ]:

```
import pickle
import numpy as np
```

[ ]:

```
pipe=pickle.load(open('pipe.pkl','rb'))
```

[ ]:

```
# test_input=np.array([3,'female',14.0,1,0,11.2417,'C'],dtype=object).
 ↪reshape(1,7)



#ai vabe age age kaj korto jokhon Pipeline-1 use korci but Pipeline-2 a hocce␣
 ↪na tai nicher ta use koro
```

[ ]:

```
test_input = pd.DataFrame([{
    'Pclass': 3,
    'Sex': 'male',
    'Age': 22,
    'SibSp': 1,
    'Parch': 0,
    'Fare': 7.25,
    'Embarked': 'S'
}])
```

[ ]:

```
pipe.predict(test_input)
```

[ ]:

```
array([0])
```

#kono kico change korle just Column transformatin a change korle ei kaj hoia jabe .ar kothw change korte hobe na