

# Python Cheat Sheet for Data Analysis

## Data Loading

### Read CSV dataset

```
# load without header
df = pd.read_csv(<CSV path>, header = None)
# load using first row as header
df = pd.read_csv(<CSV path>, header = 0)
```

### Print first few entries

```
#n=number of entries; default 5
df.head(n)
```

### Print last few entries

```
#n=number of entries; default 5
df.tail(n)
```

### Assign header names

```
df.columns = headers
```

### Replace “?” with NaN

```
df = df.replace("?", np.nan)
```

### Retrieve data types

```
df.dtypes
```

### Retrieve statistical description

```
# default use
df.describe()
# include all attributes
df.describe(include="all")
```

### Retrieve data set summary

```
df.info()
```

### Save data frame to csv

```
df.to_csv(<output CSV path>)
```

## Data Wrangling

### Replace missing data with frequency

```
MostFrequentEntry =
df['attribute_name'].value_counts().idxmax()

df['attribute_name'].replace(np.nan,MostFrequentEntry,
inplace=True)
```

### Replace missing data with mean

```
AverageValue=
df['attribute'].astype(<data_type>).mean(axis=0)

df['attribute'].replace(np.nan, AverageValue,
inplace=True)
```

### Fix the data types

```
df[['attribute1', 'attribute2', ...]] =
df[['attribute1', 'attribute2',
...]].astype('data_type')
#data_type can be int, float, char, etc.
```

### Data normalization

```
df['attribute_name'] =
df['attribute_name']/df['attribute_name'].max()
```

### Binning

```
bins = np.linspace(min(df['attribute_name']),
max(df['attribute_name'],n)
# n is the number of bins needed
```

```
GroupNames = ['Group1','Group2','Group3',...]
```

```
df['binned_attribute_name'] =
pd.cut(df['attribute_name'], bins, labels=GroupNames,
include_lowest=True)
```

### Change column name

```
df.rename(columns={'old_name':'new_name'},
inplace=True)
```

### Indicator variables

```
dummy_variable = pd.get_dummies(df['attribute_name'])
df = pd.concat([df, dummy_variable],axis = 1)
```

## Exploratory Data Analysis

### Complete data frame correlation

```
df.corr()
```

### Specific attribute correlation

```
df[['attribute1','attribute2',...]].corr()
```

### Scatter plot

```
from matplotlib import pyplot as plt
plt.scatter(df[['attribute_1']], df[['attribute_2']])
```

### Regression plot

```
import seaborn as sns
sns.regplot(x='attribute_1',y='attribute_2', data=df)
```

### Box plot

```
import seaborn as sns
sns.boxplot(x='attribute_1',y='attribute_2', data=df)
```

### Grouping by attributes

```
df_group = df[['attribute_1','attribute_2',...]]
```

### GroupBy statements

```
# Group by a single attribute
df_group = df_group.groupby(['attribute_1'],
as_index=False).mean()
```

```
# Group by multiple attributes
df_group = df_group.groupby(['attribute_1',
'attribute_2'],as_index=False).mean()
```

### Pivot tables

```
grouped_pivot =
df_group.pivot(index='attribute_1',columns='attribute_2')
```

### Pseudocolor plot

```
from matplotlib import pyplot as plt
plt.pcolor(grouped_pivot, cmap='RdBu')
```

### Pearson Coefficient and p-value

```
from scipy import stats
pearson_coef,p_value=stats.pearsonr(df['attribute_1'],
df['attribute_2'])
```

# Python Cheat Sheet for Data Analysis

## Model Development

### Linear regression

```
from sklearn.linear_model import LinearRegression
lr = LinearRegression()
```

### Train linear regression model

```
X = df[['attribute_1', 'attribute_2', ...]]
Y = df['target_attribute']
lr.fit(X,Y)
```

### Generate output predictions

```
Y_hat = lr.predict(X)
```

### Identify the coefficient and intercept

```
coeff = lr.coef
intercept = lr.intercept_
```

### Residual plot

```
import seaborn as sns
sns.residplot(x=df[['attribute_1']],
y=df[['attribute_2']])
```

### Distribution plot

```
import seaborn as sns
sns.distplot(df['attribute_name'], hist=False)
# can include other parameters like color, label,
etc.
```

### Polynomial regression

```
f = np.polyfit(x, y, n)
#creates the polynomial features of order n
```

```
p = np.polyd(f)
#p becomes the polynomial model used to generate the
predicted output
```

```
Y_hat = p(x)
# Y_hat is the predicted output
```

### Multi-variate polynomial regression

```
from sklearn.preprocessing import PolynomialFeatures
```

```
Z = df[['attribute_1','attribute_2',...]]
pr=PolynomialFeatures(degree=n)
Z_pr=pr.fit_transform(Z)
```

## Pipeline

```
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler
Input=[('scale',StandardScaler()), ('polynomial',
PolynomialFeatures(include_bias=False)),
('model',LinearRegression())]
```

```
pipe=Pipeline(Input)
```

```
Z = Z.astype(float)
pipe.fit(Z,y)
ypipe=pipe.predict(Z)
```

### R<sup>2</sup> value

```
# For linear regression model
X = df[['attribute_1', 'attribute_2', ...]]
Y = df['target_attribute']
```

```
lr.fit(X,Y)
R2_score = lr.score(X,Y)
```

```
# For polynomial regression model
from sklearn.metrics import r2_score
```

```
f = np.polyfit(x, y, n)
p = np.polyd(f)
R2_score = r2_score(y, p(x))
```

### MSE value

```
from sklearn.metrics import mean_squared_error
mse = mean_squared_error(Y, Yhat)
```

## Model Evaluation and Refinement

### Split data for training and testing

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

```
y_data = df['target_attribute']
x_data=df.drop('target_attribute',axis=1)
```

```
x_train, x_test, y_train, y_test =
train_test_split(x_data, y_data, test_size=0.10,
random_state=1)
```

### Cross-validation score

```
from sklearn.model_selection import cross_val_score
```

```
from sklearn.linear_model import LinearRegression
```

```
lre=LinearRegression()
```

```
Rcross =
cross_val_score(lre,x_data[['attribute_1']],y_data,cv
=n)
# n indicates number of times, or folds, for which
the cross validation is to be done
```

```
Mean = Rcross.mean()
Std_dev = Rcross.std()
```

### Cross-validation prediction

```
from sklearn.model_selection import cross_val_score
```

```
from sklearn.linear_model import LinearRegression
```

```
lre=LinearRegression()
```

```
yhat = cross_val_predict(lre,x_data[['attribute_1']],
y_data,cv=4)
```

### Ridge regression and prediction

```
from sklearn.linear_model import Ridge
pr=PolynomialFeatures(degree=2)
```

```
x_train_pr=pr.fit_transform(x_train[['attribute_1',
'attribute_2', ...]])
```

```
x_test_pr=pr.fit_transform(x_test[['attribute_1',
'attribute_2', ...]])
```

```
RidgeModel=Ridge(alpha=1)
RidgeModel.fit(x_train_pr, y_train)
yhat = RigeModel.predict(x_test_pr)
```

### Grid search

```
from sklearn.model_selection import GridSearchCV
from sklearn.linear_model import Ridge
```

```
parameters= [{'alpha': [0.001,0.1,1, 10, 100, 1000,
10000, ...]}]
```

```
RR=Ridge()
Grid1 = GridSearchCV(RR, parameters1,cv=4)
```

```
Grid1.fit(x_data[['attribute_1', 'attribute_2',
...]], y_data)
```

```
BestRR=Grid1.best_estimator_
```

```
BestRR.score(x_test[['attribute_1', 'attribute_2',
...]], y_te
```