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Assignment 6

Human Activity Recognition Using Smartphones dataset

https://www.kaggle.com/datasets/uciml/human-activity-recognition-with-smartphones?resource=download

```
import warnings
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import plotly.express as px
```

```
train_data = pd.read_csv("archive/train.csv")
test_data = pd.read_csv("archive/test.csv")
```

```
train_data.shape
```

```
(7352, 563)
```

```
train_data.describe()
```

	tBodyAcc-mean()-X	tBodyAcc-mean()-Y	tBodyAcc-mean()-Z	tBodyAcc-std()-X	tBodyAcc-std()-Y	tBodyAcc-std()-Z	tBodyAcc-mad()-X	tBodyAcc-mad()-Y	tBodyAcc-mad()-Z	tBodyAcc-max()-X
count	7352.000000	7352.000000	7352.000000	7352.000000	7352.000000	7352.000000	7352.000000	7352.000000	7352.000000	7352.000000
mean	0.274488	-0.017695	-0.109141	-0.605438	-0.510938	-0.604754	-0.630512	-0.526907	-0.606150	-0.468604
std	0.070261	0.040811	0.056635	0.448734	0.502645	0.418687	0.424073	0.485942	0.414122	0.544547
min	-1.000000	-1.000000	-1.000000	-1.000000	-0.999873	-1.000000	-1.000000	-1.000000	-1.000000	-1.000000
25%	0.262975	-0.024863	-0.120993	-0.992754	-0.978129	-0.980233	-0.993591	-0.978162	-0.980251	-0.936219
50%	0.277193	-0.017219	-0.108676	-0.946196	-0.851897	-0.859365	-0.950709	-0.857328	-0.857143	-0.881637
75%	0.288461	-0.010783	-0.097794	-0.242813	-0.034231	-0.262415	-0.292680	-0.066701	-0.265671	-0.017129
max	1.000000	1.000000	1.000000	1.000000	0.916238	1.000000	1.000000	0.967664	1.000000	1.000000

8 rows × 563 columns

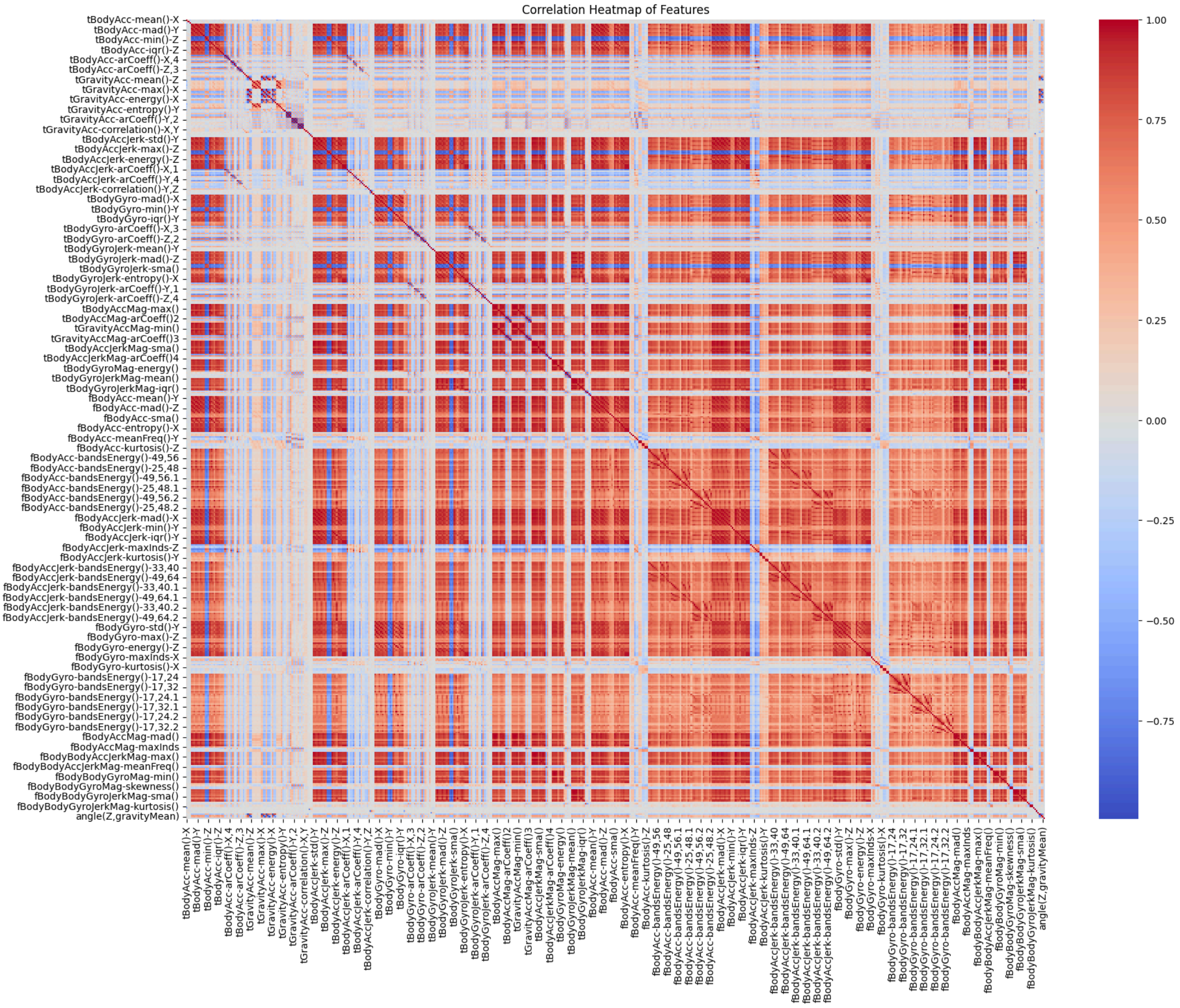
```
train_data.duplicated().sum()
```

```
0
```

```
# Exclude non-numeric columns
numeric_columns = train_data.select_dtypes(include=[np.number]).columns
train_data_numeric = train_data[numeric_columns]

# Calculate the correlation matrix
corr_matrix = train_data_numeric.corr()

# Plot the heatmap
plt.figure(figsize=(20, 15))
sns.heatmap(corr_matrix, annot=False, cmap='coolwarm', fmt=".2f")
plt.title('Correlation Heatmap of Features')
plt.show()
```




```
from sklearn.ensemble import RandomForestClassifier

# Separate features and target variable
X = train_data.drop(columns=["subject", "Activity"])
y = train_data["Activity"]

# Feature importance using Random Forest
rf = RandomForestClassifier(n_estimators=100, random_state=42)
rf.fit(X, y)

# Get feature importances
importances = rf.feature_importances_

# Sort feature importances in descending order
indices = np.argsort(importances)[::-1]

# Select top 10 features
top_features = X.columns[indices][:10]

print("Top 10 features based on importance scores:")
print(top_features)
```

```
Top 10 features based on importance scores:
Index(['tGravityAcc-mean()-X', 'tGravityAcc-max()-X', 'angle(X,gravityMean)',
       'tGravityAcc-mean()-Y', 'tGravityAcc-energy()-X',
       'angle(Y,gravityMean)', 'tGravityAcc-min()-X', 'tGravityAcc-max()-Y',
       'tGravityAcc-min()-Y', 'tGravityAcc-energy()-Y'],
      dtype='object')
```

```
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler

# Extract the top 10 features based on importance scores
top_features = ['tGravityAcc-mean()-X', 'tGravityAcc-max()-X', 'angle(X,gravityMean)',
                'tGravityAcc-mean()-Y', 'tGravityAcc-energy()-X',
                'angle(Y,gravityMean)', 'tGravityAcc-min()-X', 'tGravityAcc-max()-Y',
                'tGravityAcc-min()-Y', 'tGravityAcc-energy()-Y']

# Create a new DataFrame with only the top features
X = train_data[top_features]

# Standardize the features
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)

# Train the K-means model
kmeans = KMeans(n_clusters=3, random_state=42)  # You need to choose the number of clusters
kmeans.fit(X_scaled)

# Predict cluster labels
cluster_labels = kmeans.labels_

# Add cluster labels to the DataFrame
train_data['Cluster'] = cluster_labels

# Filter out non-numeric columns
numeric_columns = train_data.select_dtypes(include=[np.number]).columns
```

```
from sklearn.metrics import silhouette_score

# After fitting the kmeans model
silhouette_coeff = silhouette_score(X_scaled, kmeans.labels_)
print("Silhouette Coefficient: ", (silhouette_coeff * 100) ,"% Higher silhouette scores indicate better clustering")
```

```
Silhouette Coefficient: %.3f 56.60532382348744 % Higher silhouette scores indicate better clustering
```

GitHub Link

https://colab.research.google.com/drive/1ZRmRBZG0mfnS7UiSYZ9zbAQAjDX2IWNJ?usp=sharing

learning outcome

- Understanding of K-means clustering algorithm
- Data preprocessing
- Feature visualization
- Interpretation of clustering results

Inference

- Feature importance analysis: Identifies key variables driving model predictions.
- Clustering: Uncovers patterns by grouping similar data points together.
- Silhouette scores: Quantify clustering effectiveness by assessing cluster separation and cohesion.