

# ml-lab2

February 28, 2024

## 1 ML LAB Assignment-2

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1. Take two 3D coordinates from the user. Find out the distance between these points using following distance functions. x and y are vectors representing the coordinates of two points. Here,  $k=3$

```
[1]: import math

def euclidean_distance(x, y):
    return math.sqrt(sum([(a - b) ** 2 for a, b in zip(x, y)]))

def minkowski_distance(x, y, p):
    return sum([abs(a - b) ** p for a, b in zip(x, y)]) ** (1/p)

def manhattan_distance(x, y):
    return sum([abs(a - b) for a, b in zip(x, y)])

def take_coordinates():
    coordinates = []
    for i in range(3):
        coordinate = []
        print(f"Enter the coordinates for point {i + 1}:")
        for j in range(3):
            value = float(input(f"Enter the value for dimension {j + 1}: "))
            coordinate.append(value)
        coordinates.append(coordinate)
    return coordinates

def main():
    coordinates = take_coordinates()

    euclidean_dist = euclidean_distance(coordinates[0], coordinates[1])
    minkowski_dist = minkowski_distance(coordinates[0], coordinates[1], 3)
    manhattan_dist = manhattan_distance(coordinates[0], coordinates[1])

    print(f"Euclidean Distance: {euclidean_dist}")
```

```

print(f"Minkowski Distance: {minkowski_dist}")
print(f"Manhattan Distance: {manhattan_dist}")

if __name__ == "__main__":
    main()

```

Enter the coordinates for point 1:  
Enter the coordinates for point 2:  
Enter the coordinates for point 3:  
Euclidean Distance: 5.744562646538029  
Minkowski Distance: 5.2048278633942004  
Manhattan Distance: 9.0

2. Import the Iris dataset. Write a program to obtain the Euclidian Distance Matrix for all the data samples in the feature space. Distance metric is a 2D array, where the (i,j)th entry represents the distance between the ith and jth sample points in the feature space.

```

[2]: import numpy as np
import pandas as pd

```

```

[3]: df=pd.read_csv("/Users/saikarthik/Desktop/ml algorithms from scratch /ML_Lab/
↳Iris.csv")

```

```

[4]: df.head()

```

```

[4]:   Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthCm  Species
0    1             5.1             3.5             1.4             0.2  Iris-setosa
1    2             4.9             3.0             1.4             0.2  Iris-setosa
2    3             4.7             3.2             1.3             0.2  Iris-setosa
3    4             4.6             3.1             1.5             0.2  Iris-setosa
4    5             5.0             3.6             1.4             0.2  Iris-setosa

```

```

[5]: def euclidean(x, y):
    return math.sqrt(sum([(a - b) ** 2 for a, b in zip(x, y)]))

```

```

[6]: from sklearn.datasets import load_iris
import numpy as np

iris = load_iris()
data = iris.data

def euclidean_distance_matrix(data):
    n_samples = len(data)
    distance_matrix = np.zeros((n_samples, n_samples))
    for i in range(n_samples):
        for j in range(n_samples):
            distance_matrix[i][j] = euclidean(data[i], data[j])
    return distance_matrix

```

```

distance_matrix = euclidean_distance_matrix(data)

print("Euclidean Distance Matrix:")
for i in range(len(distance_matrix)):
    for j in range(len(distance_matrix[0])):
        print(str(distance_matrix[i][j])+" ")
    print("\n")

```

Euclidean Distance Matrix:

```

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0.4690415759823426
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0.14142135623730995
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```

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```

3. Import the Iris dataset. Prepare a dataset considering samples belong to any two output classes. Draw the scatter plot for all the samples in the new dataset considering any two input attributes. Examine the scatter plot to find the equation of a line that can separate sample of two classes.

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

```
[7]:   Id  SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthCm  Species
0    1             5.1             3.5             1.4             0.2  Iris-setosa
1    2             4.9             3.0             1.4             0.2  Iris-setosa
2    3             4.7             3.2             1.3             0.2  Iris-setosa
3    4             4.6             3.1             1.5             0.2  Iris-setosa
4    5             5.0             3.6             1.4             0.2  Iris-setosa
```

```
[8]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.datasets import load_iris
```

```
[9]: iris = load_iris()
iris_df = pd.DataFrame(data=np.c_[iris['data'], iris['target']],
    ↪ columns=iris['feature_names'] + ['target'])
```

```
[10]: target_names = {0: 'setosa', 1: 'versicolor'}
iris_df['target_names'] = iris_df['target'].map(target_names)
```

```
[11]: target_names = {0: 'setosa', 1: 'versicolor', 2: 'virginica'}
iris_df['target_names'] = iris_df['target'].map(target_names)
```

```
[12]: class_1 = iris_df[iris_df['target_names'] == 'setosa']
class_2 = iris_df[iris_df['target_names'] == 'versicolor']
```

```
[13]: attribute1 = 'sepal length (cm)'
attribute2 = 'sepal width (cm)'
```

```
[14]: plt.figure(figsize=(10, 6))
plt.scatter(class_1[attribute1], class_1[attribute2], label='Setosa')
plt.scatter(class_2[attribute1], class_2[attribute2], label='Versicolor')
plt.xlabel(attribute1)
plt.ylabel(attribute2)
plt.title(f'Scatter plot of {attribute1} vs {attribute2}')
plt.legend()
plt.grid(True)
plt.show()
```

