

# How can Manhattan Distance be calculated in R, and what are some examples of its use?

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## RECOMMENDED CITATION

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Manhattan Distance is a mathematical measure used to calculate the distance between two points on a grid, where movement is restricted to horizontal and vertical paths. In R, Manhattan Distance can be calculated using the "dist" function, which takes the coordinates of the two points as input and returns the distance between them. This distance can be used in various applications such as route planning, image processing, and data analysis. For example, in route planning, Manhattan Distance can be used to find the shortest path between two locations on a map, taking into account the block structure of a city. In image processing, it can be used to measure the similarity between two images by comparing their pixel values. In data analysis, it can be used to identify clusters or patterns in a dataset by measuring the distances between data points. Overall, Manhattan Distance is a useful tool for calculating distance in situations where movement is constrained to a grid-like structure.

## Calculate Manhattan Distance in R (With Examples)

**The Manhattan distance between two vectors,  $A$  and  $B$ , is calculated as:**

$$\sum |a_i - b_i|$$

**where  $i$  is the  $i$ th element in each vector.**

**This distance is used to measure the dissimilarity between any two vectors and is commonly used in many different machine learning algorithms.**

**This tutorial provides a couple examples of how to calculate Manhattan distance in R.**

### Example 1: Manhattan Distance Between Two Vectors

**The following code shows how to create a custom**

**function to calculate the Manhattan distance between two vectors in R:**

**#create function to calculate Manhattan distance**

```
manhattan_dist <- function(a, b){
```

```
  dist <- abs(a-b)
```

```
  dist <- sum(dist)
```

```
  return(dist)
```

```
}
```

**#define two vectors**

```
a <- c(2, 4, 4, 6)
```

```
b <- c(5, 5, 7, 8)
```

**#calculate Manhattan distance between vectors**

```
manhattan_dist(a, b)
```

```
9
```

**The Manhattan distance between these two vectors turns out to be 9.**

**We can confirm this is correct by quickly calculating the Manhattan distance by hand:**

$$\sum |a_i - b_i| = |2-5| + |4-5| + |4-7| + |6-8| = 3 + 1 + 3 + 2 = 9.$$

## Example 2: Manhattan Distance Between Vectors in a Matrix

To calculate the Manhattan distance between several vectors in a matrix, we can use the built-in `dist()` function in R:

```
#create four vectors
```

```
a <- c(2, 4, 4, 6)
```

```
b <- c(5, 5, 7, 8)
```

```
c <- c(9, 9, 9, 8)
```

```
d <- c(1, 2, 3, 3)
```

```
#bind vectors into one matrix
```

```
mat <- rbind(a, b, c, d)
```

```
#calculate Manhattan distance between each vector in  
the matrix
```

```
dist(mat, method = "manhattan")
```

```
a b c
```

```
b 9
```

```
c 19 10
```

```
d 7 16 26
```

**The way to interpret this output is as follows:**

**The Manhattan distance between vector  $a$  and  $b$  is 9. The Manhattan distance between vector  $a$  and  $c$  is 19. The Manhattan distance between vector  $a$  and  $d$  is 7. The Manhattan distance between vector  $b$  and  $c$  is 10. The Manhattan distance between vector  $b$  and  $d$  is 16. The Manhattan distance between vector  $c$  and  $d$  is 26.**

**Note that each vector in the matrix should be the same length.**

**How to Calculate Euclidean Distance in R**

**How to Calculate Mahalanobis Distance in R**

**How to Calculate Minkowski Distance in R**