

# Final Project

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## Clustering Model of Depth of an Earthquake

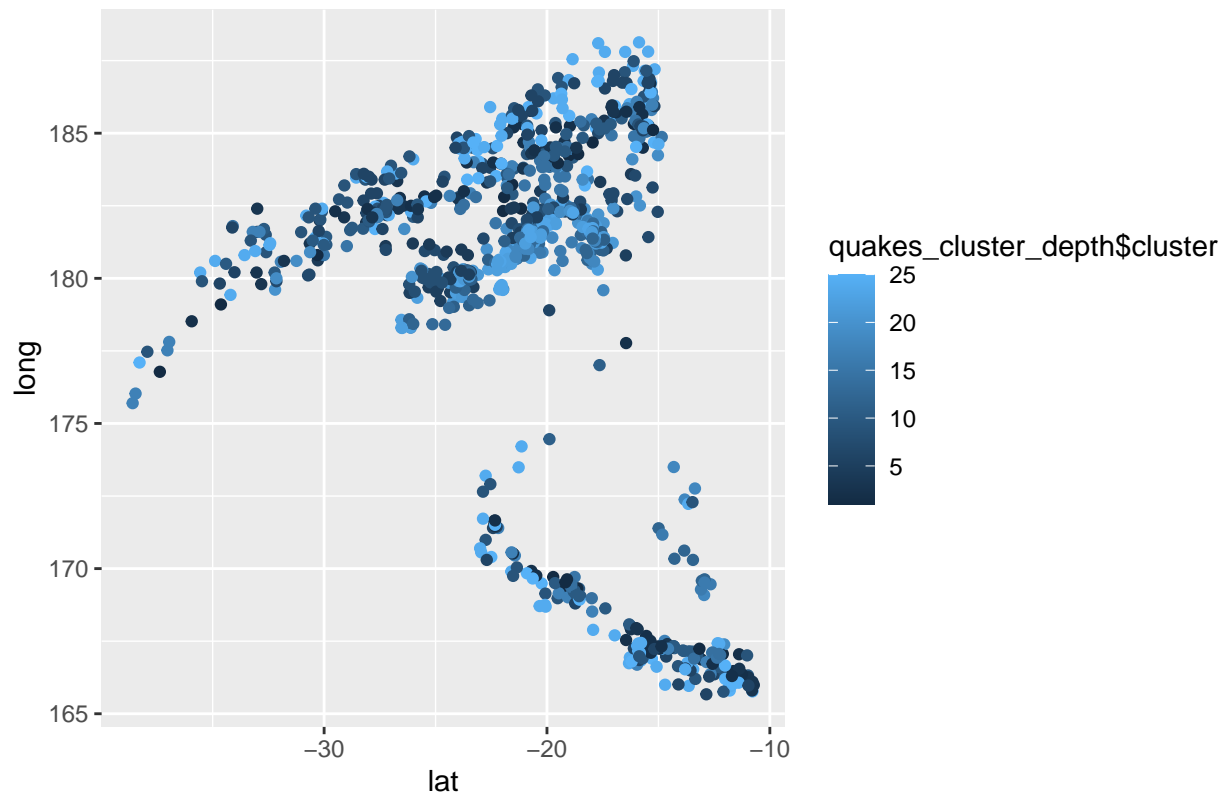
```
## K-means clustering with 25 clusters of sizes 25, 57, 37, 16, 39, 69, 26, 28, 69, 60, 44, 23, 43, 34,
##
## Cluster means:
##      [,1]
## 1  266.52000
## 2  129.43860
## 3  183.29730
## 4  362.93750
## 5  502.25641
## 6   75.63768
## 7  397.00000
## 8  477.21429
## 9   60.00000
## 10 211.86667
## 11 541.90909
## 12 640.17391
## 13 560.58140
## 14 240.76471
## 15 297.13043
## 16 660.90000
## 17 155.10256
## 18 620.18919
## 19 330.53333
## 20 433.93750
## 21 525.31250
## 22 599.05357
## 23 580.22034
## 24  45.43023
## 25 100.03509
##
## Clustering vector:
##      [1] 13 12 24 18 12  3  6  3 10 18 23 14 13 22  2 15 24 22 13 22 23 10  5  2
##     [25] 20 11 17  5 23 19 13 24 15  4 24 22 10 23 23 14  1 25  5 25 14  9 19  6
##     [49]  5  2 13 10 24 22  8 13 20 23 11 21 23  1 18  6 22 15 23 18 21 24 17 10
##     [73] 25  5 11 13  3  1 19 15  6  4 23 15 20  3  2 11  2  6  2 14  5  1 10  4
##     [97]  4 15 24  8 25 23 22  6 12 15 24 25 24 17  1  7  8 18 22 22 24  9  3 14
##    [121]  6  6 22 23 19 24 21 22 25 15  3 21  9  5 18  9 24 10 17 10 16 23 10 10
##    [145] 18  3 25 24  8 23  9  2 14 25  2 22  6 20 25 25 18  5 10 24  9 24 10 14
##    [169] 13 14 12 20 18 25  7 10 11 10 11 19 12  9 17  4 11 24 15 23 21 15 14 10
##    [193] 13 22 20 12 10  3 11 22  4 20  4  3 18  1 22  5  4 21  7 19 10 25 11 23
```

```

## [217] 3 18 14 19 25 2 9 7 5 6 10 17 14 25 16 7 20 9 21 23 6 18 24 8
## [241] 15 17 24 25 10 22 18 24 13 17 3 25 23 25 3 16 15 1 21 21 1 11 17 13
## [265] 15 9 2 6 8 22 25 22 5 5 23 21 21 5 13 23 7 13 2 7 1 21 16 2
## [289] 23 21 12 9 11 5 17 17 13 22 3 1 16 14 2 13 12 5 21 23 5 9 12 12
## [313] 20 8 10 8 5 10 5 19 2 10 23 2 6 24 8 25 2 6 9 11 24 10 11 9
## [337] 6 6 24 24 9 6 24 6 6 25 9 6 24 9 9 9 23 9 9 23 17 7 9 2
## [361] 22 2 23 7 10 24 5 25 20 17 21 10 11 18 14 24 13 25 17 2 3 10 2 10
## [385] 22 10 23 7 3 9 25 24 13 20 22 12 13 24 11 12 24 25 24 11 2 22 5 2
## [409] 8 17 25 25 9 8 2 10 17 10 14 24 8 2 6 23 9 3 22 8 17 11 19 21
## [433] 13 11 19 6 1 8 5 1 17 2 17 21 6 25 2 5 11 8 3 11 24 14 17 2
## [457] 22 25 11 12 24 12 18 12 10 13 2 15 13 17 1 17 25 2 25 17 9 9 8 2
## [481] 18 15 3 24 22 25 10 11 22 12 6 10 21 7 10 9 9 24 5 14 9 9 10 2
## [505] 11 23 24 24 9 8 9 9 6 11 22 24 25 17 9 8 6 13 6 2 24 23 2 10
## [529] 7 24 9 24 15 24 24 6 11 17 24 11 24 25 6 25 9 2 25 22 24 11 5 24
## [553] 24 6 9 25 25 9 23 6 23 24 9 1 7 1 3 23 15 6 3 24 20 9 22 24
## [577] 23 13 7 6 24 22 2 23 22 6 24 8 13 13 18 7 10 6 6 2 17 7 14 25
## [601] 9 6 22 18 11 3 24 9 4 3 24 9 14 22 9 5 24 24 11 6 9 1 11 21
## [625] 2 21 6 5 9 4 23 24 9 18 15 20 1 19 6 21 18 3 9 6 22 17 17 6
## [649] 17 13 12 16 25 21 12 24 11 17 18 18 15 7 18 11 18 12 12 15 5 1 11 3
## [673] 22 23 2 2 17 5 13 13 14 10 7 18 25 10 16 4 13 11 16 7 21 22 8 23
## [697] 22 14 10 23 10 11 23 8 14 9 21 25 1 8 6 3 9 17 23 18 21 2 10 7
## [721] 6 13 22 22 10 15 7 4 11 8 23 4 1 5 17 6 2 13 22 4 22 24 24 17
## [745] 15 9 10 9 22 20 18 9 18 25 5 1 2 6 24 6 3 18 10 17 24 24 14 3
## [769] 3 6 6 7 10 22 22 18 10 18 3 23 6 2 6 6 24 6 9 11 24 5 22 12
## [793] 23 10 23 3 14 5 6 13 24 5 25 16 18 10 13 23 7 8 23 9 24 2 11 21
## [817] 14 25 22 22 5 25 23 4 25 4 14 25 9 10 19 6 10 7 19 2 10 5 9 14
## [841] 23 6 25 24 20 23 8 8 23 5 6 6 6 6 23 14 16 19 10 1 12 18 13 13
## [865] 25 1 7 3 24 14 21 2 9 23 21 13 5 11 23 22 10 13 25 2 17 13 10 9
## [889] 24 25 14 22 24 3 13 21 6 22 1 11 19 24 24 13 21 11 8 2 1 2 11 25
## [913] 17 22 6 9 10 25 2 23 3 2 22 22 17 18 2 9 10 6 10 13 21 24 25 24
## [937] 23 2 13 23 18 3 11 2 24 9 20 6 9 9 13 2 3 11 21 5 9 6 22 14
## [961] 24 24 2 10 25 22 5 18 9 24 3 9 6 10 25 3 14 24 23 24 23 24 6 6
## [985] 9 15 2 6 18 25 23 7 14 12 24 8 14 14 24 17
##
## Within cluster sum of squares by cluster:
## [1] 1444.2400 3020.0351 2073.7297 1526.9375 1725.4359 2641.9420 2048.0000
## [8] 1914.7143 1212.0000 4074.9333 1001.6364 625.3043 1176.4651 1540.1176
## [15] 1342.6087 712.9000 2053.5897 1145.6757 823.7333 2046.9375 744.8750
## [22] 1934.8393 1690.1356 1229.0814 2517.9298
## (between_SS / total_SS = 99.9 %)
##
## Available components:
##
## [1] "cluster" "centers" "totss" "withinss" "tot.withinss"
## [6] "betweenss" "size" "iter" "ifault"

```

## Depth of an Earthquake



## Clustering Model of Magnitude of an Earthquake

```
## K-means clustering with 5 clusters of sizes 173, 191, 293, 264, 79
##
## Cluster means:
##      [,1]
## 1 5.027168
## 2 4.123037
## 3 4.407509
## 4 4.686364
## 5 5.501266
##
## Clustering vector:
##      [1] 4 2 5 2 2 2 4 3 4 3 3 4 3 3 5 3 5 3 3 3 3 2 3 4 5 2 4 1 3 3 4 4 4 2 3 3 3
##     [38] 4 2 3 4 4 3 3 4 1 3 3 3 1 2 2 4 3 2 3 3 2 3 3 4 2 1 4 1 4 2 1 3 5 2 3 3 1
##    [75] 3 3 2 3 2 5 1 3 4 3 2 3 4 3 2 3 1 4 1 2 2 2 3 1 1 4 2 4 4 4 4 2 3 4 5 1 3
##   [112] 2 2 4 3 2 5 4 4 2 4 3 4 3 3 1 2 1 4 3 3 2 3 4 3 4 1 4 1 2 4 2 1 3 2 2 3 1
##   [149] 5 2 5 5 3 2 4 4 2 3 1 4 2 4 4 4 4 1 5 5 4 3 3 4 2 2 2 5 1 3 2 4 3 3 3 2 2
##   [186] 1 3 1 4 4 5 4 4 2 4 2 4 3 3 1 3 2 4 3 3 3 1 3 4 2 4 3 2 5 3 3 2 4 3 2 4 4
##   [223] 1 2 3 1 2 3 1 1 4 3 3 1 3 2 3 1 4 4 3 2 5 4 1 4 3 4 5 2 4 3 1 1 3 2 4 4 2
##   [260] 1 1 4 3 3 2 1 4 3 4 3 3 1 2 2 5 4 1 3 3 1 3 2 4 2 3 4 2 4 3 1 1 4 4 4 1 1
##   [297] 5 2 2 4 3 4 4 4 3 4 2 1 4 4 1 1 5 3 1 3 2 5 3 1 4 1 3 3 1 3 2 4 4 5 5 3 3
##   [334] 1 1 3 3 5 3 4 2 4 3 3 3 3 4 3 1 4 4 1 2 5 4 1 1 5 4 4 2 2 5 3 3 4 1 3 2 2
##   [371] 1 5 1 1 3 5 3 1 4 5 1 3 1 1 1 1 2 3 2 1 3 4 3 2 1 2 5 1 5 5 4 4 3 5 3 3 3
##   [408] 4 3 2 3 4 4 3 3 1 3 3 3 4 3 3 2 1 4 4 4 4 3 2 2 4 2 4 3 3 3 3 3 4 3 4 4 4
```

```
## [445] 1 4 3 1 5 3 3 3 4 3 3 4 3 3 5 4 3 1 1 3 1 3 3 4 3 4 4 3 3 1 3 4 5 4 3 3 3
## [482] 2 2 1 2 1 3 2 1 4 3 4 2 2 2 5 3 4 2 4 1 4 3 3 4 2 4 3 3 1 4 5 4 4 2 4 4 3
## [519] 3 4 3 2 4 3 5 3 4 1 3 4 5 4 2 4 4 4 4 2 5 4 5 2 3 3 4 4 5 4 1 3 3 4 4 4 4
## [556] 2 2 5 4 3 1 4 1 5 2 2 3 1 3 5 1 4 3 1 3 3 4 3 1 1 4 3 1 4 4 4 4 3 4 1 3 3
## [593] 4 4 2 4 1 2 4 4 1 4 4 1 5 4 3 1 4 4 3 4 4 2 1 4 1 1 3 3 4 4 5 1 1 3 4 2 1
## [630] 4 2 4 3 3 3 5 2 1 2 4 4 3 1 4 4 4 4 3 5 2 5 4 5 3 4 4 1 4 3 2 4 1 5 1 2 1
## [667] 4 3 4 3 2 1 4 3 5 4 4 4 4 1 5 3 4 3 3 2 2 2 1 2 3 1 2 3 3 3 1 2 4 1 2 1 1
## [704] 3 3 3 4 1 3 3 4 5 1 1 4 3 4 2 4 2 4 2 1 1 3 3 2 3 4 3 4 4 2 2 3 4 3 2 4 3
## [741] 4 1 4 4 1 1 3 4 3 2 2 5 5 1 3 3 5 5 1 2 3 3 2 1 5 3 2 3 4 2 1 2 3 3 2 2 3
## [778] 3 2 2 3 4 1 3 1 4 5 1 3 1 2 1 2 2 3 3 3 3 3 3 1 3 3 3 3 2 1 4 3 4 4 1 3 3
## [815] 4 2 3 4 4 2 1 4 2 3 3 2 4 3 3 4 2 2 2 2 2 2 4 4 1 1 4 3 1 1 2 2 4 3 1 1 2
## [852] 4 1 4 3 2 4 2 3 3 2 4 2 2 4 4 2 2 5 5 2 3 1 3 2 3 2 3 4 3 2 2 1 2 1 3 4 1
## [889] 1 5 4 2 5 3 2 3 1 3 1 2 3 1 1 3 2 2 2 1 3 1 4 4 3 3 1 1 2 4 2 5 5 1 3 2 1
## [926] 3 1 5 4 4 3 2 4 4 5 5 2 1 2 4 3 4 4 5 4 4 2 5 4 4 3 5 3 2 2 3 4 1 3 4 3 4
## [963] 3 2 5 2 4 2 4 5 3 1 4 1 1 2 3 3 3 1 1 4 1 3 3 2 1 4 2 4 3 3 1 2 2 3 4 3 3
## [1000] 5
##
## Within cluster sum of squares by cluster:
## [1] 2.002312 1.258639 1.903481 1.610909 3.689873
## (between_SS / total_SS = 93.5 %)
##
## Available components:
##
## [1] "cluster"      "centers"      "totss"        "withinss"     "tot.withinss"
## [6] "betweenss"   "size"         "iter"         "ifault"       "
```

