2016년 분기별 경북,강원 회귀분석석

2016년 분기별 경북,강원

```
load("../../../refinedata/analysis/analysis_total_Fixed.rda")
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 3.6.3
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
analysis_2016_quarter1 <- analysis_total_Fixed  %>% filter(substr(일시,1,7)=='2016-01'|substr(일시,1,7)=='2016-02')

analysis_2016_quarter1 <- analysis_2016_quarter1 %>% filter(시도 %in% c("경북","강원"))

analysis_2016_quarter1 <- analysis_2016_quarter1 %>% dplyr::select(-일시,-시도,-년도,-인구수,-`최다풍향(16방위)`,-발생건수, -`일 최심신적설(cm)`,-`강수 계속시간(hr)`,-`최고기온(°C)`,-`최저기온(°C)`)

analysis_2016_quarter1 <- analysis_2016_quarter1[-1]

analysis_2016_quarter1 <- as.data.frame(scale(analysis_2016_quarter1))
```

```
analysis_2016_quarter2 <- analysis_total_Fixed %>% filter(substr(일시,1,7)=='2016-03'|substr(일시,1,7)=='2016-04'|substr(일시,1,7)=='2016-05')

analysis_2016_quarter2 <- analysis_2016_quarter2 %>% filter(시도 %in% c("경북","강원"))


analysis_2016_quarter2 <- analysis_2016_quarter2 %>% dplyr::select(-일시,-시도,-년도,-인구수,-`최다풍향(16방위)`,-발생건수, -`일 최심신적설(cm)`,-`강수 계속시간(hr)`,-`최고기온(°C)`,-`최저기온(°C)`)

analysis_2016_quarter2 <- analysis_2016_quarter2[-1]

analysis_2016_quarter2 <- as.data.frame(scale(analysis_2016_quarter2))
```

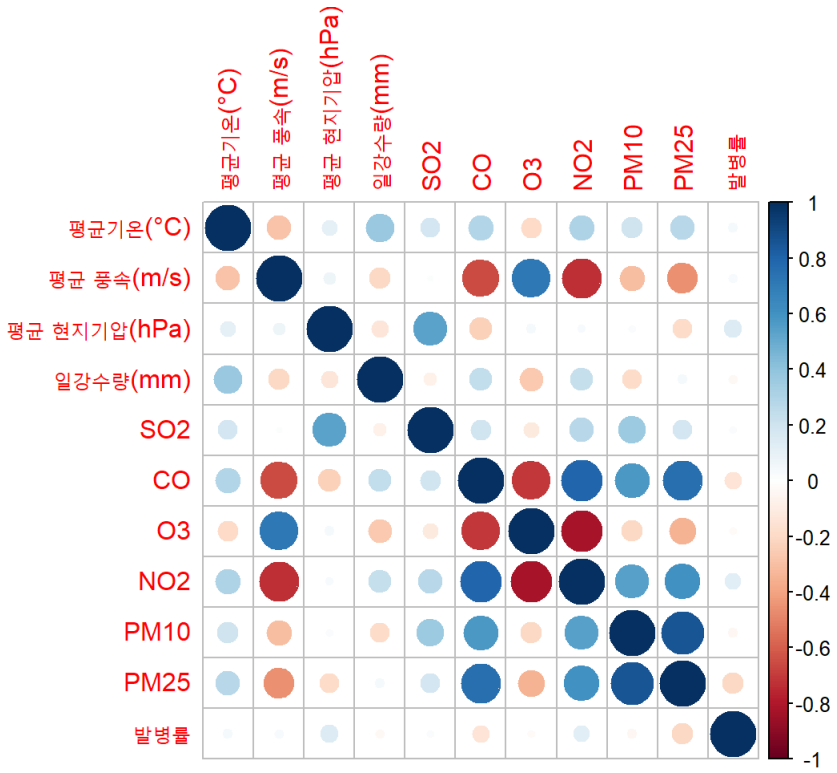
```
analysis_2016_quarter3 <- analysis_total_Fixed %>% filter(substr(일시,1,7)=='2016-06'|substr(일시,1,7)=='2016-07'|substr(일시,1,7)=='2016-08')

analysis_2016_quarter3 <- analysis_2016_quarter3 %>% filter(시도 %in% c("경북","강원"))

analysis_2016_quarter3 <- analysis_2016_quarter3 %>% dplyr::select(-일시,-시도,-년도,-인구수,-`최다풍향(16방위)`,-발생건수, -`일 최심신적설(cm)`,-`강수 계속시간(hr)`,-`최고기온(°C)`,-`최저기온(°C)`)

analysis_2016_quarter3 <- analysis_2016_quarter3[-1]

analysis_2016_quarter3 <- as.data.frame(scale(analysis_2016_quarter3))
```

```
analysis_2016_quarter4 <- analysis_total_Fixed %>% filter(substr(일시,1,7)=='2016-09'|substr(일시,1,7)=='2016-10'|substr(일시,1,7)=='2016-11')

analysis_2016_quarter4 <- analysis_2016_quarter4 %>% filter(시도 %in% c("경북","강원"))

analysis_2016_quarter4 <- analysis_2016_quarter4 %>% dplyr::select(-일시,-시도,-년도,-인구수,-`최다풍향(16방위)`,-발생건수, -`일 최심신적설(cm)`,-`강수 계속시간(hr)`,-`최고기온(°C)`,-`최저기온(°C)`)

analysis_2016_quarter4 <- analysis_2016_quarter4[-1]

analysis_2016_quarter4 <- as.data.frame(scale(analysis_2016_quarter4))
```

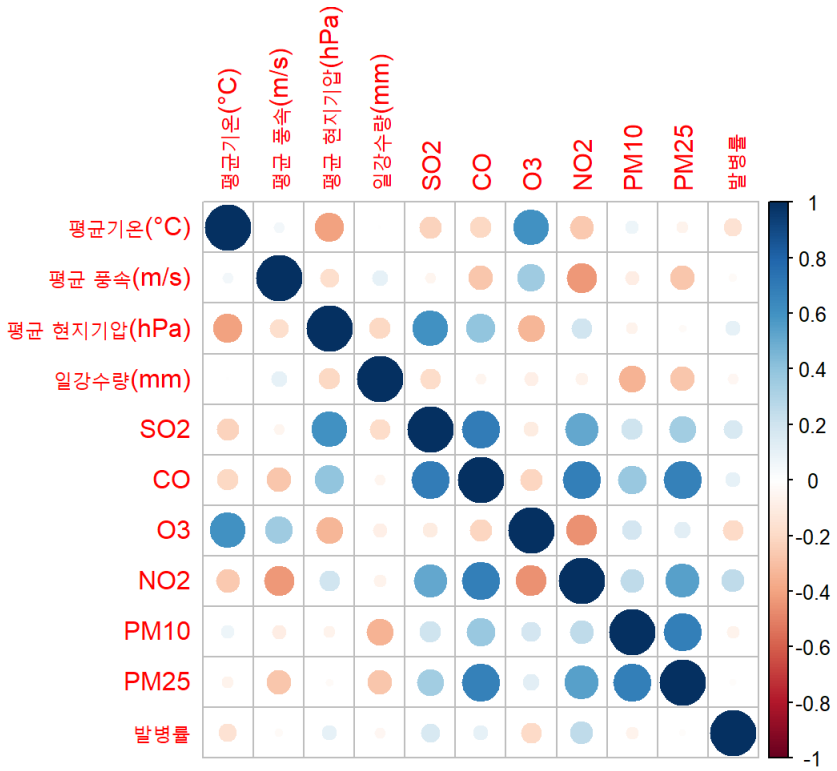
```
library(corrplot, quietly = TRUE)
```

```
## corrplot 0.84 loaded
```

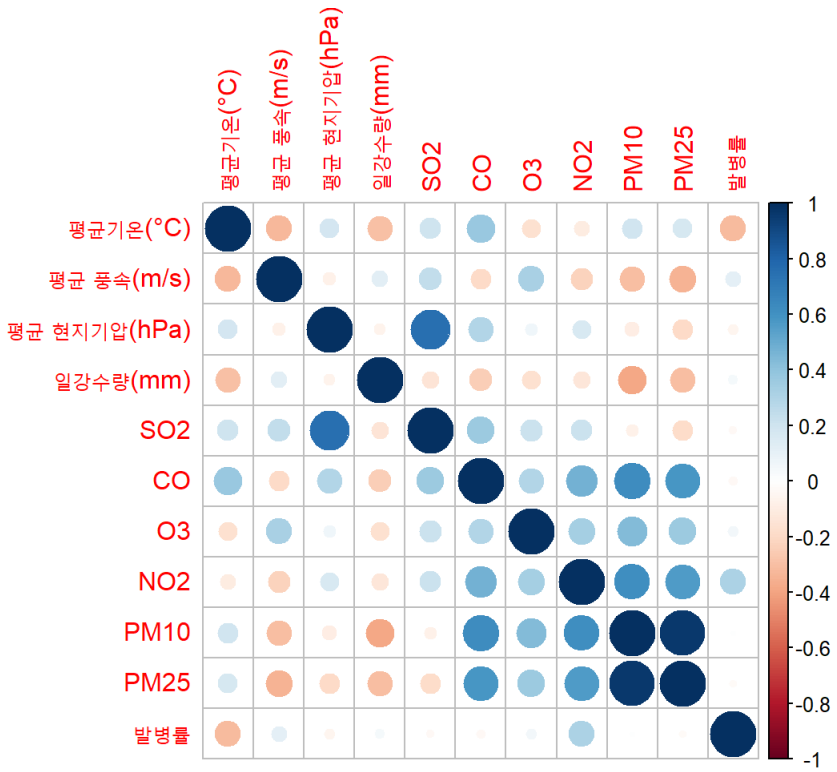
```
corrplot(cor(analysis_2016_quarter1 ), method="circle")
```



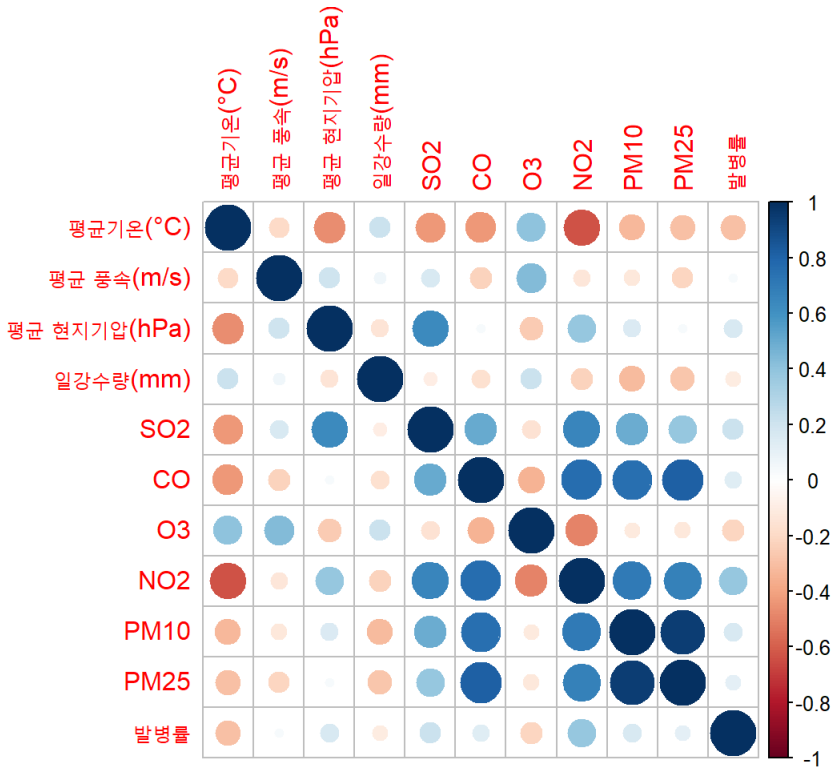

```
corrplot(cor(analysis_2016_quarter2 ), method="circle")
```




```
corrplot(cor(analysis_2016_quarter3 ), method="circle")
```




```
corrplot(cor(analysis_2016_quarter4 ), method="circle")
```




```
cor(analysis_2016_quarter1 )
```

```
##                    평균기온(°C) 평균 풍속(m/s) 평균 현지기압(hPa) 일강수량(mm)
## 평균기온(°C)          1.00000000    -0.28052808          0.11003446   0.37177163
## 평균 풍속(m/s)       -0.28052808     1.00000000          0.07328170  -0.20244974
## 평균 현지기압(hPa)    0.11003446     0.07328170          1.00000000  -0.13821754
## 일강수량(mm)          0.37177163    -0.20244974         -0.13821754   1.00000000
## SO2                   0.18342199     0.01411072          0.53763830  -0.07972467
## CO                    0.29806736    -0.65630567         -0.23666002   0.24176332
## O3                   -0.19575120     0.71371704          0.04426049  -0.26578010
## NO2                   0.30149796    -0.73002896          0.03103910   0.23665448
## PM10                  0.20579226    -0.30731572          0.02323465  -0.18452812
## PM25                  0.27310104    -0.45668750         -0.18028806   0.04215788
## 발병률                0.04524993     0.03449402          0.14994088  -0.03817591
##                             SO2          CO          O3         NO2         PM10
## 평균기온(°C)          0.18342199  0.2980674 -0.19575120  0.3014980  0.20579226
## 평균 풍속(m/s)        0.01411072 -0.6563057  0.71371704 -0.7300290 -0.30731572
## 평균 현지기압(hPa)    0.53763830 -0.2366600  0.04426049  0.0310391  0.02323465
## 일강수량(mm)         -0.07972467  0.2417633 -0.26578010  0.2366545 -0.18452812
## SO2                   1.00000000  0.1937303 -0.11668763  0.2713735  0.36529991
## CO                    0.19373034  1.0000000 -0.70576286  0.7975550  0.57562031
## O3                   -0.11668763 -0.7057629  1.00000000 -0.8201197 -0.20402813
## NO2                   0.27137349  0.7975550 -0.82011970  1.0000000  0.54456492
## PM10                  0.36529991  0.5756203 -0.20402813  0.5445649  1.00000000
## PM25                  0.18266769  0.7575040 -0.34350228  0.6085302  0.85854553
## 발병률                0.02685706 -0.1417012 -0.02704603  0.1238783 -0.04184271
##                            PM25       발병률
## 평균기온(°C)          0.27310104  0.04524993
## 평균 풍속(m/s)       -0.45668750  0.03449402
## 평균 현지기압(hPa)   -0.18028806  0.14994088
## 일강수량(mm)          0.04215788 -0.03817591
## SO2                   0.18266769  0.02685706
## CO                    0.75750402 -0.14170122
## O3                   -0.34350228 -0.02704603
## NO2                   0.60853021  0.12387827
## PM10                  0.85854553 -0.04184271
## PM25                  1.00000000 -0.20576142
## 발병률               -0.20576142  1.00000000
```

```
cor(analysis_2016_quarter2 )
```

```
##                      평균기온(°C) 평균 풍속(m/s) 평균 현지기압(hPa)
## 평균기온(°C)        1.0000000000     0.05419493        -0.40018639
## 평균 풍속(m/s)       0.0541949264     1.00000000         -0.17110347
## 평균 현지기압(hPa) -0.4001863939    -0.17110347          1.00000000
## 일강수량(mm)        -0.0006914536     0.10924740         -0.20972344
## SO2                  -0.2247419048    -0.05313031           0.60485278
## CO                   -0.2017827429    -0.27029535           0.39579912
## O3                    0.6073906457     0.35648300          -0.33145055
## NO2                  -0.2648317933    -0.43000678           0.19019881
## PM10                  0.0776373909    -0.09011639          -0.06196355
## PM25                 -0.0606375677    -0.27608959          -0.02750038
## 발병률               -0.1533856733    -0.02860840           0.10298720
##                       일강수량(mm)          SO2           CO          O3          NO2
## 평균기온(°C)       -0.0006914536 -0.22474190 -0.20178274  0.6073906 -0.26483179
## 평균 풍속(m/s)       0.1092473999 -0.05313031 -0.27029535  0.3564830 -0.43000678
## 평균 현지기압(hPa) -0.2097234393  0.60485278  0.39579912 -0.3314506  0.19019881
## 일강수량(mm)         1.0000000000 -0.18890805 -0.05484353 -0.0889476 -0.06807911
## SO2                  -0.1889080505  1.00000000  0.69157463 -0.1049355  0.51522540
## CO                   -0.0548435294  0.69157463  1.00000000 -0.2184923  0.68570776
## O3                   -0.0889475953 -0.10493550 -0.21849227  1.0000000 -0.45512448
## NO2                  -0.0680791086  0.51522540  0.68570776 -0.4551245  1.00000000
## PM10                 -0.3439550077  0.20959197  0.37450130  0.1853426  0.25648050
## PM25                 -0.2743316654  0.34573191  0.67188095  0.1240939  0.54961767
## 발병률               -0.0490164196  0.16706803  0.10558721 -0.1945052  0.25033074
##                              PM10        PM25       발병률
## 평균기온(°C)        0.07763739 -0.06063757 -0.15338567
## 평균 풍속(m/s)      -0.09011639 -0.27608959 -0.02860840
## 평균 현지기압(hPa) -0.06196355 -0.02750038  0.10298720
## 일강수량(mm)        -0.34395501 -0.27433167 -0.04901642
## SO2                   0.20959197  0.34573191  0.16706803
## CO                    0.37450130  0.67188095  0.10558721
## O3                    0.18534262  0.12409392 -0.19450517
## NO2                   0.25648050  0.54961767  0.25033074
## PM10                  1.00000000  0.68487089 -0.06745960
## PM25                  0.68487089  1.00000000 -0.01771428
## 발병률               -0.06745960 -0.01771428  1.00000000
```

```
cor(analysis_2016_quarter3 )
```

```
##                       평균기온(°C) 평균 풍속(m/s) 평균 현지기압(hPa) 일강수량(mm)
## 평균기온(°C)           1.0000000    -0.32323359         0.18556204  -0.29241252
## 평균 풍속(m/s)        -0.3232336     1.00000000        -0.07572066   0.12374265
## 평균 현지기압(hPa)     0.1855620    -0.07572066         1.00000000  -0.06172555
## 일강수량(mm)          -0.2924125     0.12374265        -0.06172555   1.00000000
## SO2                     0.2057324     0.24139195          0.75409816  -0.14157845
## CO                      0.3769187    -0.19776225          0.29312368  -0.24258230
## O3                     -0.1640574     0.32254843          0.06974691  -0.16764955
## NO2                    -0.1075855    -0.22378262          0.16318318  -0.13685883
## PM10                    0.1973339    -0.30048744         -0.09500149  -0.38542084
## PM25                    0.1750850    -0.34318482         -0.19343357  -0.30461855
## 발병률                 -0.3194222     0.11166176         -0.05160215   0.04739930
##                              SO2          CO          O3         NO2          PM10
## 평균기온(°C)          0.20573244  0.37691872 -0.16405742 -0.1075855  0.197333950
## 평균 풍속(m/s)        0.24139195 -0.19776225  0.32254843 -0.2237826 -0.300487440
## 평균 현지기압(hPa)    0.75409816  0.29312368  0.06974691  0.1631832 -0.095001490
## 일강수량(mm)         -0.14157845 -0.24258230 -0.16764955 -0.1368588 -0.385420842
## SO2                    1.00000000  0.36636807  0.21963620  0.2158210 -0.070144489
## CO                     0.36636807  1.00000000  0.29734248  0.4737501  0.629194112
## O3                     0.21963620  0.29734248  1.00000000  0.3368444  0.435257882
## NO2                    0.21582103  0.47375009  0.33684436  1.0000000  0.612225116
## PM10                  -0.07014449  0.62919411  0.43525788  0.6122251  1.000000000
## PM25                  -0.18709381  0.58604309  0.36067374  0.5623084  0.965952337
## 발병률                -0.03076462 -0.03552843  0.05337216  0.3172821  0.008125503
##                             PM25       발병률
## 평균기온(°C)          0.17508503 -0.319422224
## 평균 풍속(m/s)       -0.34318482  0.111661762
## 평균 현지기압(hPa)   -0.19343357 -0.051602147
## 일강수량(mm)         -0.30461855  0.047399300
## SO2                   -0.18709381 -0.030764622
## CO                     0.58604309 -0.035528429
## O3                     0.36067374  0.053372161
## NO2                    0.56230837  0.317282095
## PM10                   0.96595234  0.008125503
## PM25                   1.00000000 -0.026036964
## 발병률                -0.02603696  1.000000000
```

```
cor(analysis_2016_quarter4 )
```

```
##                       평균기온(°C) 평균 풍속(m/s) 평균 현지기압(hPa) 일강수량(mm)
## 평균기온(°C)           1.0000000    -0.19328719        -0.46615499   0.21292253
## 평균 풍속(m/s)        -0.1932872     1.00000000         0.20512597   0.06593799
## 평균 현지기압(hPa)    -0.4661550     0.20512597         1.00000000  -0.14696053
## 일강수량(mm)           0.2129225     0.06593799        -0.14696053   1.00000000
## SO2                   -0.4355517     0.16990035         0.63425333  -0.09255405
## CO                    -0.4390501    -0.22414470         0.03987387  -0.16286153
## O3                     0.4057642     0.43490891        -0.25699127   0.21397900
## NO2                   -0.6318323    -0.13863374         0.38601603  -0.22344844
## PM10                  -0.3224531    -0.12953418         0.15379400  -0.31911982
## PM25                  -0.2985021    -0.21518616         0.03944054  -0.27241475
## 발병률                -0.2944951     0.03873028         0.16911731  -0.10965498
##                             SO2          CO          O3         NO2        PM10
## 평균기온(°C)       -0.43555171 -0.43905012  0.4057642 -0.6318323 -0.3224531
## 평균 풍속(m/s)      0.16990035 -0.22414470  0.4349089 -0.1386337 -0.1295342
## 평균 현지기압(hPa)  0.63425333  0.03987387 -0.2569913  0.3860160  0.1537940
## 일강수량(mm)       -0.09255405 -0.16286153  0.2139790 -0.2234484 -0.3191198
## SO2                 1.00000000  0.50423695 -0.1595614  0.6582848  0.4923039
## CO                  0.50423695  1.00000000 -0.3425305  0.7695870  0.7596086
## O3                 -0.15956136 -0.34253054  1.0000000 -0.4998666 -0.1139794
## NO2                 0.65828484  0.76958696 -0.4998666  1.0000000  0.7088838
## PM10                0.49230391  0.75960860 -0.1139794  0.7088838  1.0000000
## PM25                0.38537608  0.81765951 -0.1263378  0.6772270  0.9471588
## 발병률              0.21063485  0.13626306 -0.2189502  0.3860741  0.1649859
##                            PM25      발병률
## 평균기온(°C)       -0.29850215 -0.29449507
## 평균 풍속(m/s)     -0.21518616  0.03873028
## 평균 현지기압(hPa)  0.03944054  0.16911731
## 일강수량(mm)       -0.27241475 -0.10965498
## SO2                 0.38537608  0.21063485
## CO                  0.81765951  0.13626306
## O3                 -0.12633781 -0.21895021
## NO2                 0.67722701  0.38607407
## PM10                0.94715881  0.16498585
## PM25                1.00000000  0.11031363
## 발병률              0.11031363  1.00000000
```

```
library(MASS)
```

```
##
## Attaching package: 'MASS'
```

```
## The following object is masked from 'package:dplyr':
##
##     select
```

```
fitdata <- analysis_2016_quarter1
fit1 <- lm(발병률 ~ .,data = fitdata)
fit2 <- lm(발병률 ~ 1,data = fitdata)
stepAIC(fit2,direction="both",scope=list(upper=fit1,lower=fit2))
```

```
## Start:  AIC=1
## 발병률 ~ 1
##
##                         Df Sum of Sq    RSS      AIC
## + PM25                   1    5.0382 113.96 -2.19541
## + `평균 현지기압(hPa)`   1    2.6754 116.33  0.26715
## + CO                     1    2.3894 116.61  0.56178
## <none>                                119.00  0.99581
## + NO2                    1    1.8262 117.17  1.14004
## + `평균기온(°C)`         1    0.2437 118.76  2.74985
## + PM10                   1    0.2083 118.79  2.78553
## + `일강수량(mm)`         1    0.1734 118.83  2.82079
## + `평균 풍속(m/s)`       1    0.1416 118.86  2.85294
## + O3                     1    0.0870 118.91  2.90800
## + SO2                    1    0.0858 118.91  2.90922
##
## Step:  AIC=-2.2
## 발병률 ~ PM25
```

```
##
##                          Df Sum of Sq    RSS      AIC
## + NO2                     1   11.7255 102.24 -13.2246
## + PM10                    1    8.2266 105.73  -9.1864
## <none>                                 113.96  -2.1954
## + `평균 현지기압(hPa)`    1    1.5662 112.40  -1.8561
## + `평균기온(°C)`          1    1.3233 112.64  -1.5970
## + O3                      1    1.2885 112.67  -1.5599
## + `평균 풍속(m/s)`        1    0.5319 113.43  -0.7568
## + SO2                     1    0.5113 113.45  -0.7350
## + `일강수량(mm)`          1    0.1038 113.86  -0.3047
## + CO                      1    0.0560 113.91  -0.2544
## - PM25                    1    5.0382 119.00   0.9958
##
## Step:  AIC=-13.22
## 발병률 ~ PM25 + NO2
##
##                          Df Sum of Sq     RSS      AIC
## + O3                      1    8.5399  93.696 -21.6919
## + PM10                    1    7.2149  95.021 -20.0068
## + CO                      1    6.8408  95.395 -19.5353
## + `평균 풍속(m/s)`        1    3.6326  98.604 -15.5660
## <none>                                 102.236 -13.2246
## + `일강수량(mm)`          1    1.6373 100.599 -13.1620
## + `평균 현지기압(hPa)`    1    0.4155 101.821 -11.7133
## + `평균기온(°C)`          1    0.3049 101.931 -11.5830
## + SO2                     1    0.0001 102.236 -11.2248
## - NO2                     1   11.7255 113.962  -2.1954
## - PM25                    1   14.9376 117.174   1.1400
##
## Step:  AIC=-21.69
## 발병률 ~ PM25 + NO2 + O3
##
##                          Df Sum of Sq     RSS      AIC
## + PM10                    1    2.6753  91.021 -23.1682
## + CO                      1    2.1511  91.545 -22.4789
## <none>                                 93.696 -21.6919
## + `일강수량(mm)`          1    1.0425  92.654 -21.0346
## + `평균 풍속(m/s)`        1    1.0416  92.655 -21.0334
## + SO2                     1    0.3280  93.368 -20.1127
## + `평균기온(°C)`          1    0.1476  93.549 -19.8810
## + `평균 현지기압(hPa)`    1    0.0006  93.696 -19.6927
## - O3                      1    8.5399 102.236 -13.2246
## - NO2                     1   18.9769 112.673  -1.5599
## - PM25                    1   21.4575 115.154   1.0533
##
## Step:  AIC=-23.17
## 발병률 ~ PM25 + NO2 + O3 + PM10
##
##                          Df Sum of Sq     RSS      AIC
## + SO2                     1    1.6103  89.411 -23.3102
## <none>                                 91.021 -23.1682
## + CO                      1    1.3719  89.649 -22.9907
## + `평균 풍속(m/s)`        1    0.5427  90.478 -21.8858
## - PM10                    1    2.6753  93.696 -21.6919
## + `평균기온(°C)`          1    0.3059  90.715 -21.5721
## + `평균 현지기압(hPa)`    1    0.2678  90.753 -21.5218
## + `일강수량(mm)`          1    0.0831  90.938 -21.2778
## - O3                      1    4.0003  95.021 -20.0068
## - NO2                     1   11.7999 102.821 -10.5404
## - PM25                    1   17.9814 109.002  -3.5346
##
## Step:  AIC=-23.31
## 발병률 ~ PM25 + NO2 + O3 + PM10 + SO2
##
##                          Df Sum of Sq     RSS      AIC
## <none>                                 89.411 -23.3102
## - SO2                     1    1.6103  91.021 -23.1682
## + `평균 풍속(m/s)`        1    1.1282  88.282 -22.8340
## + CO                      1    1.0797  88.331 -22.7681
## + `평균기온(°C)`          1    0.5621  88.849 -22.0670
## + `일강수량(mm)`          1    0.0544  89.356 -21.3833
## + `평균 현지기압(hPa)`    1    0.0198  89.391 -21.3368
```

```
## + 평균 온시간값(hPa)    1    0.0196  89.591 -21.5568
## - PM10                  1    3.9577  93.368 -20.1127
## - O3                    1    4.1697  93.580 -19.8405
## - NO2                   1   12.7905 102.201  -9.2658
## - PM25                  1   19.5688 108.979  -1.5599
```

```
##
## Call:
## lm(formula = 발병률 ~ PM25 + NO2 + O3 + PM10 + SO2, data = fitdata)
##
## Coefficients:
## (Intercept)          PM25           NO2            O3          PM10           SO2
##   1.331e-16   -8.888e-01    7.850e-01    3.817e-01    4.201e-01   -1.327e-01
```

```
fit <-  lm(formula = 발병률 ~ PM25 + NO2 + PM10 + SO2 + O3, data = analysis_2016_quarter1)

summary(fit)
```

```
##
## Call:
## lm(formula = 발병률 ~ PM25 + NO2 + PM10 + SO2 + O3, data = analysis_2016_quarter1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.98988 -0.41644 -0.01122  0.55627  1.92506
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.331e-16  8.084e-02   0.000   1.0000
## PM25        -8.888e-01  1.779e-01  -4.995 2.14e-06 ***
## NO2          7.850e-01  1.944e-01   4.038 9.79e-05 ***
## PM10         4.201e-01  1.870e-01   2.246   0.0266 *
## SO2         -1.327e-01  9.264e-02  -1.433   0.1546
## O3           3.817e-01  1.655e-01   2.306   0.0229 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8856 on 114 degrees of freedom
## Multiple R-squared:  0.2486, Adjusted R-squared:  0.2157
## F-statistic: 7.545 on 5 and 114 DF,  p-value: 3.751e-06
```

```
fitdata <- analysis_2016_quarter2
fit1 <- lm(발병률 ~ .,data = fitdata)
fit2 <- lm(발병률 ~ 1,data = fitdata)
stepAIC(fit2,direction="both",scope=list(upper=fit1,lower=fit2))
```

```
## Start:  AIC=1
## 발병률 ~ 1
##
##                         Df Sum of Sq    RSS     AIC
## + NO2                    1   11.4678 171.53 -8.9103
## + O3                     1    6.9233 176.08 -4.0990
## + SO2                    1    5.1078 177.89 -2.2115
## + `평균기온(°C)`         1    4.3055 178.69 -1.3835
## + CO                     1    2.0402 180.96  0.9344
## <none>                               183.00  0.9973
## + `평균 현지기압(hPa)`   1    1.9410 181.06  1.0353
## + PM10                   1    0.8328 182.17  2.1580
## + `일강수량(mm)`         1    0.4397 182.56  2.5547
## + `평균 풍속(m/s)`       1    0.1498 182.85  2.8466
## + PM25                   1    0.0574 182.94  2.9395
##
## Step:  AIC=-8.91
## 발병률 ~ NO2
##
##                         Df Sum of Sq    RSS      AIC
## + PM25                   1    6.3240 165.21 -13.8221
## + PM10                   1    3.3958 168.14 -10.5894
## <none>                               171.53  -8.9103
## + CO                     1    1.5076 170.03  -8.5347
## + O3                     1    1.4984 170.03  -8.5247
## + `평균기온(°C)`         1    1.4927 170.04  -8.5185
## + `평균 풍속(m/s)`       1    1.4025 170.13  -8.4209
## + `평균 현지기압(hPa)`   1    0.5822 170.95  -7.5359
## + SO2                    1    0.3615 171.17  -7.2985
## + `일강수량(mm)`         1    0.1880 171.34  -7.1120
## - NO2                    1   11.4678 183.00   0.9973
##
## Step:  AIC=-13.82
## 발병률 ~ NO2 + PM25
##
##                         Df Sum of Sq    RSS      AIC
## <none>                               165.21 -13.8221
## + `일강수량(mm)`         1    1.4346 163.77 -13.4269
## + `평균 풍속(m/s)`       1    1.1092 164.10 -13.0617
## + `평균기온(°C)`         1    0.9255 164.28 -12.8558
## + SO2                    1    0.6791 164.53 -12.5801
## + `평균 현지기압(hPa)`   1    0.1317 165.08 -11.9689
## + PM10                   1    0.0406 165.17 -11.8673
## + O3                     1    0.0023 165.21 -11.8247
## + CO                     1    0.0001 165.21 -11.8222
## - PM25                   1    6.3240 171.53  -8.9103
## - NO2                    1   17.7343 182.94   2.9395
```

```
##
## Call:
## lm(formula = 발병률 ~ NO2 + PM25, data = fitdata)
##
## Coefficients:
## (Intercept)          NO2         PM25
##  -1.513e-16    3.726e-01   -2.225e-01
```

```
fit <- lm(formula = 발병률 ~ NO2 + PM25 + `평균 풍속(m/s)` + CO, data = analysis_2016_quarter2)

summary(fit)
```

```
##
## Call:
## lm(formula = 발병률 ~ NO2 + PM25 + `평균 풍속(m/s)` + CO, data = analysis_2016_quarter2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.13042 -0.35101  0.09854  0.54752  2.16829
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)      -1.747e-16  7.058e-02   0.000 1.000000
## NO2               4.118e-01  1.046e-01   3.936 0.000119 ***
## PM25             -2.134e-01  9.721e-02  -2.195 0.029439 *
## `평균 풍속(m/s)`  8.686e-02  7.871e-02   1.104 0.271278
## CO               -9.912e-03  1.115e-01  -0.089 0.929256
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9575 on 179 degrees of freedom
## Multiple R-squared:  0.1033, Adjusted R-squared:  0.08329
## F-statistic: 5.157 on 4 and 179 DF,  p-value: 0.0005909
```

```
fitdata <- analysis_2016_quarter3
fit1 <- lm(발병률 ~ .,data = fitdata)
fit2 <- lm(발병률 ~ 1,data = fitdata)
stepAIC(fit2,direction="both",scope=list(upper=fit1,lower=fit2))
```

```
## Start:  AIC=1
## 발병률 ~ 1
##
##                          Df Sum of Sq    RSS      AIC
## + `평균기온(°C)`       1   18.6716 164.33 -16.8047
## + NO2                    1   18.4222 164.58 -16.5257
## + `평균 풍속(m/s)`      1    2.2817 180.72   0.6887
## <none>                               183.00   0.9973
## + O3                     1    0.5213 182.48   2.4724
## + `평균 현지기압(hPa)`  1    0.4873 182.51   2.5067
## + `일강수량(mm)`        1    0.4111 182.59   2.5834
## + CO                     1    0.2310 182.77   2.7649
## + SO2                    1    0.1732 182.83   2.8230
## + PM25                   1    0.1241 182.88   2.8725
## + PM10                   1    0.0121 182.99   2.9851
##
## Step:  AIC=-16.8
## 발병률 ~ `평균기온(°C)`
##
##                          Df Sum of Sq    RSS     AIC
## + NO2                    1   14.8192 149.51 -32.194
## <none>                               164.33 -16.805
## + CO                     1    1.5363 162.79 -16.533
## + PM10                   1    0.9642 163.36 -15.887
## + `일강수량(mm)`        1    0.4235 163.91 -15.279
## + SO2                    1    0.2334 164.09 -15.066
## + PM25                   1    0.1687 164.16 -14.994
## + `평균 풍속(m/s)`      1    0.0145 164.31 -14.821
## + `평균 현지기압(hPa)`  1    0.0112 164.32 -14.817
## + O3                     1    0.0002 164.33 -14.805
## - `평균기온(°C)`       1   18.6716 183.00   0.997
##
## Step:  AIC=-32.19
## 발병률 ~ `평균기온(°C)` + NO2
##
##                          Df Sum of Sq    RSS     AIC
## + PM25                   1    5.4286 144.08 -37.000
## + PM10                   1    4.0003 145.51 -35.185
## + O3                     1    1.7187 147.79 -32.322
## <none>                               149.51 -32.194
## + `평균 풍속(m/s)`      1    1.5016 148.01 -32.052
## + CO                     1    1.2048 148.30 -31.683
## + `평균 현지기압(hPa)`  1    0.3934 149.12 -30.679
## + SO2                    1    0.2235 149.29 -30.470
```

```
## + `일강수량(mm)`         1    0.0010 149.51 -30.196
## - NO2                     1   14.8192 164.33 -16.805
## - `평균기온(°C)`        1   15.0686 164.58 -16.526
##
## Step:  AIC=-37
## 발병률 ~ `평균기온(°C)` + NO2 + PM25
##
##                          Df Sum of Sq    RSS     AIC
## + `평균 현지기압(hPa)`  1    3.3367 140.74 -39.311
## + SO2                     1    3.3295 140.75 -39.301
## <none>                                 144.08 -37.000
## + `평균 풍속(m/s)`       1    0.6474 143.43 -35.828
## + O3                      1    0.4923 143.59 -35.629
## + PM10                    1    0.4122 143.67 -35.527
## + `일강수량(mm)`         1    0.2129 143.87 -35.272
## + CO                      1    0.0802 144.00 -35.102
## - PM25                    1    5.4286 149.51 -32.194
## - `평균기온(°C)`        1    9.3110 153.39 -27.477
## - NO2                     1   20.0791 164.16 -14.994
##
## Step:  AIC=-39.31
## 발병률 ~ `평균기온(°C)` + NO2 + PM25 + `평균 현지기압(hPa)`
##
##                          Df Sum of Sq    RSS     AIC
## <none>                                 140.74 -39.311
## + PM10                    1    1.1973 139.55 -38.883
## + SO2                     1    0.6704 140.07 -38.189
## + `평균 풍속(m/s)`       1    0.5082 140.24 -37.976
## + `일강수량(mm)`         1    0.3556 140.39 -37.776
## + CO                      1    0.2190 140.53 -37.597
## + O3                      1    0.1301 140.61 -37.481
## - `평균 현지기압(hPa)`  1    3.3367 144.08 -37.000
## - `평균기온(°C)`        1    5.0258 145.77 -34.855
## - PM25                    1    8.3719 149.12 -30.679
## - NO2                     1   23.3729 164.12 -13.042
```

```
##
## Call:
## lm(formula = 발병률 ~ `평균기온(°C)` + NO2 + PM25 + `평균 현지기압(hPa)`,
##     data = fitdata)
##
## Coefficients:
##          (Intercept)        `평균기온(°C)`                   NO2
##           -5.969e-16            -1.852e-01             4.914e-01
##                 PM25  `평균 현지기압(hPa)`
##           -3.000e-01            -1.555e-01
```

```
 fit <- lm(formula = 발병률 ~ NO2 + `평균기온(°C)` + PM25 + SO2 + `평균 풍속(m/s)`,
data = analysis_2016_quarter3)

summary(fit)
```

```
##
## Call:
## lm(formula = 발병률 ~ NO2 + `평균기온(°C)` + PM25 + SO2 + `평균 풍속(m/s)`,
##     data = analysis_2016_quarter3)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.98891 -0.44018  0.05016  0.45035  2.73667
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)       1.492e-16  6.491e-02   0.000 1.000000
## NO2               5.652e-01  9.799e-02   5.767  3.5e-08 ***
## `평균기온(°C)`  -1.088e-01  8.256e-02  -1.318 0.189305
## PM25             -3.158e-01  9.385e-02  -3.365 0.000937 ***
## SO2              -2.254e-01  8.521e-02  -2.645 0.008891 **
## `평균 풍속(m/s)`  1.490e-01  7.921e-02   1.881 0.061594 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8805 on 178 degrees of freedom
## Multiple R-squared:  0.2459, Adjusted R-squared:  0.2247
## F-statistic: 11.61 on 5 and 178 DF,  p-value: 1.025e-09
```

```
fitdata <- analysis_2016_quarter4
fit1 <- lm(발병률 ~ .,data = fitdata)
fit2 <- lm(발병률 ~ 1,data = fitdata)
stepAIC(fit2,direction="both",scope=list(upper=fit1,lower=fit2))
```

```
## Start:  AIC=1
## 발병률 ~ 1
##
##                          Df Sum of Sq    RSS      AIC
## + NO2                     1   26.9786 154.02 -26.3786
## + `평균기온(°C)`          1   15.6976 165.30 -13.5139
## + O3                      1    8.6770 172.32  -5.9438
## + SO2                     1    8.0304 172.97  -5.2622
## + `평균 현지기압(hPa)`    1    5.1767 175.82  -2.2840
## + PM10                    1    4.9269 176.07  -2.0255
## + CO                      1    3.3607 177.64  -0.4138
## + PM25                    1    2.2026 178.80   0.7689
## + `일강수량(mm)`          1    2.1764 178.82   0.7956
## <none>                                 181.00   0.9972
## + `평균 풍속(m/s)`        1    0.2715 180.73   2.7240
##
## Step:  AIC=-26.38
## 발병률 ~ NO2
##
##                          Df Sum of Sq    RSS     AIC
## + CO                      1   11.4859 142.53 -38.484
## + PM25                    1    7.6381 146.38 -33.636
## + PM10                    1    4.2986 149.72 -29.530
## <none>                                 154.02 -26.379
## + `평균 풍속(m/s)`        1    1.5706 152.45 -26.244
## + `평균기온(°C)`          1    0.7702 153.25 -25.291
## + SO2                     1    0.6047 153.42 -25.095
## + O3                      1    0.1627 153.86 -24.571
## + `일강수량(mm)`          1    0.1042 153.92 -24.502
## + `평균 현지기압(hPa)`    1    0.0858 153.94 -24.480
## - NO2                     1   26.9786 181.00   0.997
##
## Step:  AIC=-38.48
## 발병률 ~ NO2 + CO
##
##                          Df Sum of Sq    RSS     AIC
## + `평균 현지기압(hPa)`    1     1.740 140.79 -38.720
## <none>                                 142.53 -38.484
## + PM25                    1     0.649 141.89 -37.315
## + SO2                     1     0.631 141.90 -37.291
## + `평균 풍속(m/s)`        1     0.403 142.13 -36.999
## + `평균기온(°C)`          1     0.310 142.22 -36.880
## + PM10                    1     0.276 142.26 -36.837
## + `일강수량(mm)`          1     0.075 142.46 -36.579
## + O3                      1     0.021 142.51 -36.511
## - CO                      1    11.486 154.02 -26.379
## - NO2                     1    35.104 177.64  -0.414
##
## Step:  AIC=-38.72
## 발병률 ~ NO2 + CO + `평균 현지기압(hPa)`
##
##                          Df Sum of Sq    RSS     AIC
## <none>                                 140.79 -38.720
## - `평균 현지기압(hPa)`    1     1.740 142.53 -38.484
## + `평균기온(°C)`          1     0.999 139.80 -38.016
## + `평균 풍속(m/s)`        1     0.925 139.87 -37.919
## + PM25                    1     0.820 139.97 -37.783
## + PM10                    1     0.237 140.56 -37.027
## + `일강수량(mm)`          1     0.132 140.66 -36.891
## + O3                      1     0.046 140.75 -36.779
## + SO2                     1     0.000 140.79 -36.720
## - CO                      1    13.141 153.94 -24.480
## - NO2                     1    31.987 172.78  -3.460
```

```
##
## Call:
## lm(formula = 발병률 ~ NO2 + CO + `평균 현지기압(hPa)`, data = fitdata)
##
## Coefficients:
##          (Intercept)                   NO2                    CO
##           -5.237e-16             7.927e-01            -4.690e-01
## `평균 현지기압(hPa)`
##           -1.182e-01
```

```
fit<- lm(formula = 발병률 ~ NO2 + CO + PM25 + PM10, data =analysis_2016_quarter4)

summary(fit)
```

```
##
## Call:
## lm(formula = 발병률 ~ NO2 + CO + PM25 + PM10, data = analysis_2016_quarter4)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.10355 -0.30117  0.08693  0.45488  2.09434
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -2.131e-16  6.633e-02   0.000    1.000
## NO2          6.835e-01  1.136e-01   6.015 1.01e-08 ***
## CO          -3.018e-01  1.396e-01  -2.162    0.032 *
## PM25        -1.972e-01  2.446e-01  -0.806    0.421
## PM10         9.648e-02  2.250e-01   0.429    0.669
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8949 on 177 degrees of freedom
## Multiple R-squared:  0.2169, Adjusted R-squared:  0.1992
## F-statistic: 12.26 on 4 and 177 DF,  p-value: 8.082e-09
```