732A97 Multivariate Statistics Lab 1

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Question 1: Describing individual variables

Consider the data set in the T1-9.dat file, National track records for women. For 55 different countries we have the national records for 7 variables (100, 200, 400, 800, 1500, 3000m and marathon). Use R to do the following analyses.

input

```
trackrcs <- read.table("T1-9.dat")
colnames(trackrcs) <- c("countries", "100m", "200m", "400m", "800m", "1500m", "3000m", "marathon")
```

a) Describe the 7 variables with mean values, standard deviations e.t.c

mean values

```
colMeans((trackrcs)[,-1])
```

```
##       100m       200m       400m       800m      1500m      3000m 
##  11.357778  23.118519  51.989074   2.022407   4.189444   9.080741 
##   marathon 
## 153.619259
```

median

```
apply((trackrcs)[,-1], 2, median)
```

```
##     100m     200m     400m     800m    1500m    3000m marathon 
##   11.325   22.980   51.645    2.005    4.100    8.845  148.430
```

standard deviation

```
apply((trackrcs)[,-1], 2, sd)
```

```
##        100m        200m        400m        800m       1500m       3000m 
##  0.39410116  0.92902547  2.59720188  0.08687304  0.27236502  0.81532689 
##    marathon 
## 16.43989508
```

maximum

```
apply((trackrcs)[,-1], 2, max)
```

```
##     100m     200m     400m     800m    1500m    3000m marathon
##    12.52    25.91    61.65     2.29     5.42    13.12   221.14
```

minimum

```
apply((trackrcs)[,-1], 2, min)
```

```
##     100m     200m     400m     800m    1500m    3000m marathon
##    10.49    21.34    47.60     1.89     3.84     8.10   135.25
```

b) Illustrate the variables with different graphs (explore what plotting possibilities R has). Make sure that the graphs look attractive (it is absolutely necessary to look at the labels, font sizes, point types). Are there any apparent extreme values? Do the variables seem normally distributed? Plot the best fitting (match the mean and standard deviation, i.e. method of moments) Gaussian density curve on the datas histogram. For the last part you may be interested in the hist() and density() functions.

Question 2: Relationships between the variables

a) Compute the covariance and correlation matrices for the 7 variables. Is there any apparent structure in them? Save these matrices for future use.

```
cov_m <- cov((trackrcs)[,-1])
corr_m <- cor((trackrcs)[,-1])

cov_m
```

```
##                100m       200m       400m         800m      1500m
## 100m     0.15531572  0.3445608  0.8912960 0.027703564 0.08389119
## 200m     0.34456080  0.8630883  2.1928363 0.066165898 0.20276331
## 400m     0.89129602  2.1928363  6.7454576 0.181807932 0.50917683
## 800m     0.02770356  0.0661659  0.1818079 0.007546925 0.02141457
## 1500m    0.08389119  0.2027633  0.5091768 0.021414570 0.07418270
## 3000m    0.23388281  0.5543502  1.4268158 0.061379315 0.21615514
## marathon 4.33417757 10.3849876 28.9037314 1.219654647 3.53983732
##                3000m   marathon
## 100m      0.23388281   4.334178
## 200m      0.55435017  10.384988
## 400m      1.42681579  28.903731
## 800m      0.06137932   1.219655
## 1500m     0.21615514   3.539837
## 3000m     0.66475793  10.706091
## marathon 10.70609113 270.270150
```

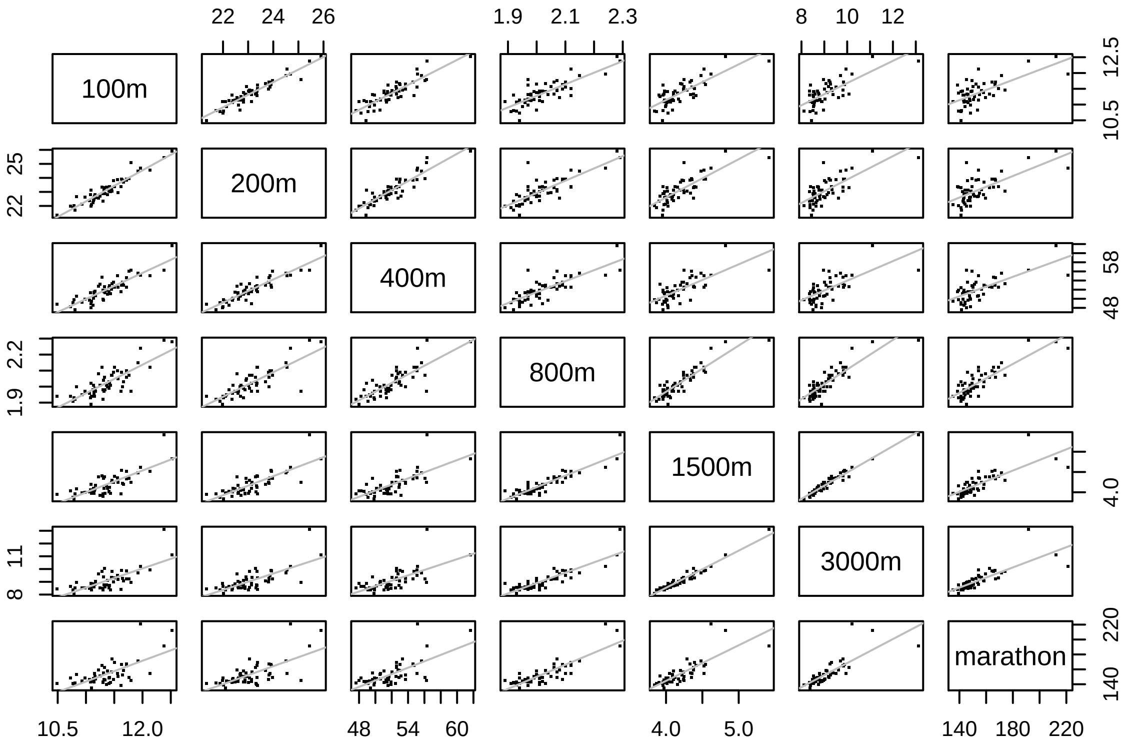
```
corr_m
```

```
##               100m      200m      400m      800m     1500m     3000m
## 100m     1.0000000 0.9410886 0.8707802 0.8091758 0.7815510 0.7278784
## 200m     0.9410886 1.0000000 0.9088096 0.8198258 0.8013282 0.7318546
## 400m     0.8707802 0.9088096 1.0000000 0.8057904 0.7197996 0.6737991
## 800m     0.8091758 0.8198258 0.8057904 1.0000000 0.9050509 0.8665732
## 1500m    0.7815510 0.8013282 0.7197996 0.9050509 1.0000000 0.9733801
## 3000m    0.7278784 0.7318546 0.6737991 0.8665732 0.9733801 1.0000000
## marathon 0.6689597 0.6799537 0.6769384 0.8539900 0.7905565 0.7987302
##           marathon
## 100m     0.6689597
## 200m     0.6799537
## 400m     0.6769384
## 800m     0.8539900
## 1500m    0.7905565
## 3000m    0.7987302
## marathon 1.0000000
```

Both matrices are symmetric. The correlation matrix has ones on the main diagonal.

b) Generate and study the scatterplots between each pair of variables. Any extreme values?

```r
pairs(trackrcs[,-1], pch = ".", cex = 1.5, panel = function(x, y, ...){
   points(x, y, ...)
   abline(lm(y ~ x), col = "grey") })
```

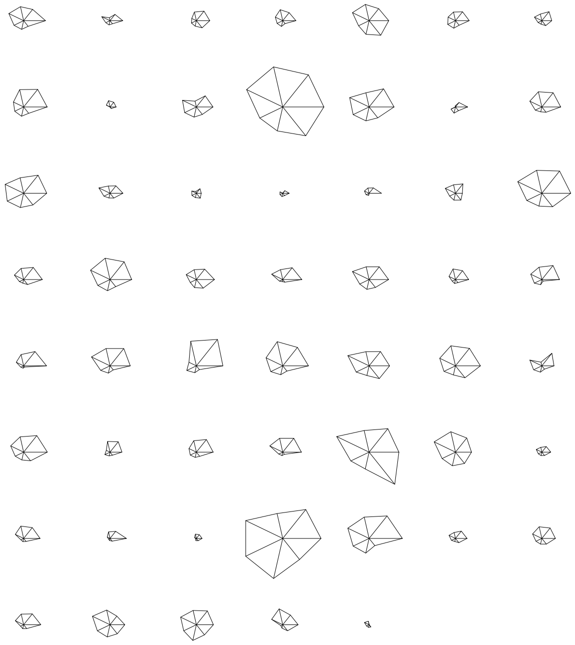


The scatterplot matrix tells us that "marathon" is quite an outlier.

c) Explore what other plotting possibilities R offers for multivariate data. Present other (at least two) graphs that you find interesting with respect to this data set.

stars plot

```r
stars(trackrcs[,-1], cex = 0.55)
```



A stars plot is not very useful. We can tell from literature that it is also outdated.