Introduction to Matrix Algebra

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Why should I learn matrix algebra?

$$\mathbf{A} = \begin{bmatrix} a_{11} & a_{12} & ... & a_{1p} \\ a_{21} & a_{22} & ... & a_{2p} \\ . & . & . & . \\ a_{n1} & a_{n2} & ... & a_{np} \end{bmatrix},$$

which is referred to as a $n \times p$ matrix.

A vector is a special kind of matrix used often in statistics. a row vector is a matrix with a single row and two or more columns, while a column vector is a vector with one column and two or more rows:

row vector:

$$x = \begin{bmatrix} 1, 3, 5, 7 \end{bmatrix},$$

column vector:

$$y = \begin{bmatrix} 1 \\ 3 \\ 5 \\ 7 \end{bmatrix}.$$

Note that x is a 1×4 row vector and y is a 4×1 column matrix. The convention is that when the type of vector is not specified, it is a column vector. Think of variables in a data frame as iconic vectors, which are column vectors.

A scalar can be thought of as a one dimensional matrix.

Matrix Operations

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R version 3.2.2 (2015-08-14)
Platform: x86_64-pc-linux-gnu (64-bit)
Running under: Ubuntu 14.04.3 LTS

locale:
 [1] LC_CTYPE=en_US.UTF-8       LC_NUMERIC=C
 [3] LC_TIME=en_US.UTF-8        LC_COLLATE=en_US.UTF-8
 [5] LC_MONETARY=en_US.UTF-8    LC_MESSAGES=en_US.UTF-8
 [7] LC_PAPER=en_US.UTF-8       LC_NAME=C
 [9] LC_ADDRESS=C               LC_TELEPHONE=C
[11] LC_MEASUREMENT=en_US.UTF-8 LC_IDENTIFICATION=C

attached base packages:
[1] stats     graphics  grDevices utils     datasets  methods   base

other attached packages:
[1] knitr_1.11       mosaic_0.12      mosaicData_0.9.1 car_2.1-0
[5] ggplot2_1.0.1    lattice_0.20-33  dplyr_0.4.3
```

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loaded via a namespace (and not attached):
 [1] Rcpp_0.12.2        formatR_1.2.1      nloptr_1.0.4
 [4] plyr_1.8.3         tools_3.2.2        digest_0.6.8
 [7] lme4_1.1-10        evaluate_0.8       gtable_0.1.2
[10] nlme_3.1-122       mgcv_1.8-9         Matrix_1.2-3
[13] DBI_0.3.1          yaml_2.1.13        parallel_3.2.2
[16] SparseM_1.7        ggdendro_0.1-17    proto_0.3-10
[19] gridExtra_2.0.0    stringr_1.0.0      MatrixModels_0.4-1
[22] grid_3.2.2         nnet_7.3-11        R6_2.1.1
[25] rmarkdown_0.8.1    minqa_1.2.4        reshape2_1.4.1
[28] magrittr_1.5       scales_0.3.0       htmltools_0.2.6
[31] MASS_7.3-45        splines_3.2.2      assertthat_0.1
[34] pbkrtest_0.4-2     colorspace_1.2-6   quantreg_5.19
[37] stringi_1.0-1      munsell_0.4.2
```