**Assignment**

**Principle Component Analysis**

data("iris")

str(iris)

data.frame': 150 obs. of 5 variables:

$ Sepal.Length: num 5.1 4.9 4.7 4.6 5 5.4 4.6 5 4.4 4.9 ...

$ Sepal.Width :num 3.5 3 3.2 3.1 3.6 3.9 3.4 3.4 2.9 3.1 ...

$ Petal.Length: num 1.4 1.4 1.3 1.5 1.4 1.7 1.4 1.5 1.4 1.5 ...

$ Petal.Width :num 0.2 0.2 0.2 0.2 0.2 0.4 0.3 0.2 0.2 0.1 ...

$ Species : Factor w/ 3 levels "setosa","versicolor",..: 1 1 1 1 1 1 1 1 1 1 ...

set.seed(111)

ind<- sample(2,nrow(iris),replace =TRUE, prob = c(0.8,0.2))

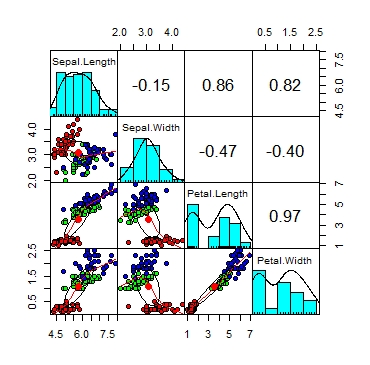
training<- iris[ind==1,]

testing<- iris[ind==2,]

library(psych)

pairs.panels(training[,-5], gap=0, bg=c("red","green" , "blue")[training$Species],

pch=21)



pr<- prcomp(training[,-5],center =TRUE ,scale. =TRUE)

attributes(pr)

$`names`

[1] "sdev" "rotation" "center" "scale" "x"

$class

[1] "prcomp"

pr$center

Sepal.LengthSepal.WidthPetal.LengthPetal.Width

5.790000 3.069167 3.597500 1.111667

pr$scale

Sepal.LengthSepal.WidthPetal.LengthPetal.Width

0.8234382 0.4588615 1.7872782 0.7556158

print(pr)

Standard deviations (1, .., p=4):

[1] 1.7173318 0.9403519 0.3843232 0.1371332

Rotation (n x k) = (4 x 4):

PC1 PC2 PC3 PC4

Sepal.Length 0.5147163 -0.39817685 0.7242679 0.2279438

Sepal.Width -0.2926048 -0.91328503 -0.2557463 -0.1220110

Petal.Length 0.5772530 -0.02932037 -0.1755427 -0.7969342

Petal.Width 0.5623421 -0.08065952 -0.6158040 0.5459403

summary(pr)

Importance of components:

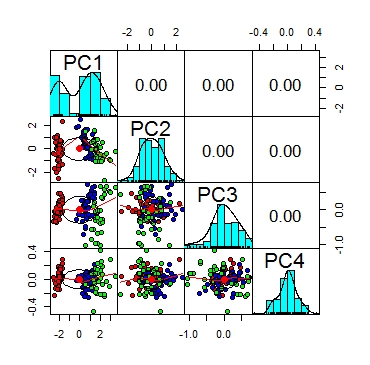
PC1 PC2 PC3 PC4

Standard deviation 1.7173 0.9404 0.38432 0.1371

Proportion of Variance 0.7373 0.2211 0.03693 0.0047

Cumulative Proportion 0.7373 0.9584 0.99530 1.0000

pairs.panels(pr$x, gap=0,bg=c("red","blue","green")[training$Species],pch=21)



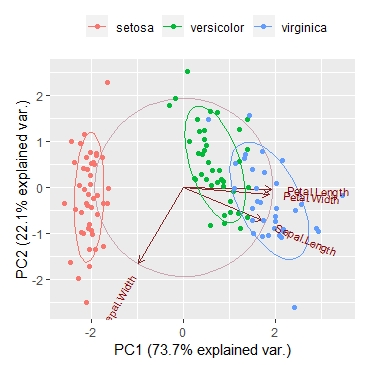
library(devtools)

library(ggbiplot)

g<- ggbiplot(pr,obs.scale = 1,var.scale = 1,groups = training$Species,ellipse = TRUE,circle = TRUE,ellipse.prob = 0.68)

g<- g+ scale\_color\_discrete(name='')

g<- g+theme(legend.direction = "horizontal",legend.position = "top")



trg<- predict(pc,training)

trg

|  |
| --- |
| PC1 PC2 PC3 PC4  1 -2.0942621 -0.390479892 0.1117895752 0.0155964510  2 -1.9004407 0.701394964 0.2145512665 0.0931822321  3 -2.1852900 0.401680656 -0.0630099904 0.0292277018  4 -2.1194349 0.645787862 -0.1148751719 -0.0610428409  5 -2.2205378 -0.541157297 -0.0319019490 -0.0386754453  6 -1.9160708 -1.357948199 -0.0397399215 0.0030168844  7 -2.2686138 0.039655263 -0.3537552466 -0.0239723433  8 -2.0607048 -0.144732182 0.0697461852 -0.0300848294  9 -2.1492140 1.142204792 -0.1694965776 -0.0186376148  10 -2.0063320 0.511396324 0.2304914899 -0.0502480219  11 -2.0019748 -0.935252226 0.2543675423 0.0008731820  12 -2.1534233 -0.049661878 -0.1159887290 -0.1300380062  13 -2.0373705 0.760425041 0.2080916828 -0.0067507777  14 -2.4468051 1.007123571 -0.2022257498 -0.0113927767  15 -2.0401384 -1.720850758 0.4684542738 0.1655989805  16 -2.1119798 -2.494897451 -0.0349014685 0.0422915851  17 -2.0452623 -1.351386184 -0.0004527557 0.1813739337  19 -1.7392003 -1.293306927 0.3613617031 0.0404016425  20 -2.1788452 -0.999893498 -0.1467340823 -0.0365115761  21 -1.7460763 -0.341434804 0.4019288479 -0.0085355253  22 -2.0406559 -0.811535362 -0.1724960972 0.0623294156  23 -2.5997621 -0.341173667 -0.3444410287 0.0289537752  24 -1.6465682 -0.029359804 -0.0506968065 0.1517617000  26 -1.7733367 0.649758553 0.2828642450 0.0316856647  27 -1.8795636 -0.167722033 -0.1030695616 0.0698280134  28 -1.9994560 -0.440475799 0.1899243452 -0.0013108542  29 -1.9679863 -0.239802486 0.2554810995 0.0698683473  30 -2.0883964 0.396759145 -0.0924753648 -0.1045400851  31 -1.9621206 0.547436550 0.0512161594 -0.0502681888  32 -1.6618287 -0.359503144 0.2585784755 0.2251451046  33 -2.4564831 -1.623997983 -0.0629884540 -0.2331015414  34 -2.2906023 -1.977131174 0.0734710811 -0.0598052940  35 -1.9319103 0.500721651 0.1489945123 0.0220030307  36 -2.0300634 0.258254949 0.2106814852 0.1568628357  37 -1.8765272 -0.582261002 0.4734376123 0.1709135421  38 -2.3574677 -0.482127220 -0.0383615327 -0.1386084551  39 -2.2452795 0.944812486 -0.2154097490 -0.0006382916  41 -2.1146465 -0.351158658 -0.0478421724 0.1047548087  42 -1.6619766 2.279012076 0.1811945744 0.2854242920  43 -2.3728146 0.546746867 -0.3268796746 -0.0538181698  45 -1.9752320 -1.017130186 -0.2675182258 -0.1426175728  46 -1.8885271 0.739075694 0.0450977275 0.1377513275  47 -2.2209690 -0.990859328 -0.0750588961 -0.1533518910  49 -2.0644830 -0.886896822 0.1664109810 -0.0268087752  50 -2.0292352 0.055941131 0.1353029395 0.0410943720  51 1.2435865 -0.894366840 0.6480862801 0.0168904297  52 0.8783633 -0.611628084 0.0584935170 0.0122282637  53 1.3838633 -0.660934308 0.5147241210 -0.0011290605  54 0.5793649 1.644417702 -0.0193979576 0.0808443073  56 0.5470329 0.544340327 -0.1712686062 -0.2196877854  57 0.8911050 -0.776261171 -0.1863385678 -0.0589711046  58 -0.3088020 1.779024861 -0.2896288156 -0.0164656965  59 1.0781369 -0.091531619 0.5547836921 -0.0417293721  61 0.0733722 2.523519689 0.0016240141 0.0283974925  62 0.5964639 0.033136065 -0.2403539900 0.0607661429  63 0.7324083 1.633697513 0.7206107452 0.0290908746  64 0.8723155 0.137930222 0.0236821160 -0.1524773678  66 1.0229359 -0.545346308 0.4694169331 0.0942022842  67 0.5058330 0.173280765 -0.5336890485 -0.1560475157  68 0.3208520 0.733603769 0.2562010169 -0.2038119977  69 1.3910226 1.475410820 0.4399300223 0.2227637404  70 0.3331967 1.220986530 0.1299044249 -0.0445664566  72 0.6355762 0.359121232 0.2296665967 0.1139863550  73 1.3914196 0.823394972 0.3213945295 -0.0076811690  74 0.7872397 0.358312378 0.2424110342 -0.2703895339  75 0.8562269 0.010100699 0.4083359437 0.0366745005  76 1.0241952 -0.297958095 0.4371953345 0.0931102661  77 1.4059383 -0.003165298 0.6852912171 0.0232970094  79 0.8196333 0.178891960 -0.1261278401 -0.0187297477  80 0.1283241 0.990835005 0.2829101670 0.0626315582  81 0.3021582 1.470015247 0.1075046178 -0.0010692123  83 0.4050997 0.715535430 0.1128506444 0.0298686322  84 1.2153774 0.556439883 -0.1550856409 -0.1608343909  85 0.3808166 0.269991572 -0.7096021713 -0.2114114301  86 0.5752172 -0.826946762 -0.4862996319 -0.0794283907  87 1.1942512 -0.560942493 0.3584545811 0.0326855498  88 1.2086219 1.251012457 0.6449673677 0.1239429156  89 0.2277981 0.201192127 -0.3314079274 -0.1221925716  90 0.4518298 1.246352083 -0.1308678832 0.0276644291  91 0.4428321 1.051431931 -0.1443930342 -0.2495336119  93 0.5011651 0.912927735 0.1587638158 0.0118693090  94 -0.1825263 1.929702267 -0.1459372914 0.0378061998  95 0.4513986 0.796650052 -0.1740248304 -0.0870120166  96 0.2481824 0.161870893 -0.1717761798 -0.2113509293  98 0.7312105 0.106811507 0.2324228209 -0.0186894139  101 1.9807727 -0.893659782 -1.0474946558 0.0116279586  102 1.3136261 0.621126669 -0.5754896967 0.0005548526  104 1.5856996 -0.016243814 -0.2147887950 -0.2094126039  106 2.8807823 -0.892325930 0.5302026928 -0.1052765648  107 0.5359569 1.485583292 -1.0337041196 -0.0723694153  108 2.4368666 -0.511281377 0.5960242788 -0.2447178682  109 2.1553983 0.583184802 0.3403337189 -0.0815035433  111 1.5067673 -0.723199878 -0.3199655587 0.1336299100  112 1.7532710 0.327713240 -0.0673939113 0.0774680711  116 1.7321199 -0.710149502 -0.6720566360 0.2335225860  117 1.6146505 -0.310346927 -0.0847888436 -0.1360493663  119 3.4440978 -0.170820954 0.6486397757 0.0394994671  120 1.4274956 1.563919108 0.2149079423 -0.0555464856  121 2.1738524 -0.958488536 -0.2715609949 0.1935753227  122 1.1346681 0.511411001 -0.8689911771 0.0800305763  124 1.4871496 0.393305332 -0.0345663292 0.1558921106  125 1.8362250 -1.039461191 -0.3402151251 -0.0328806360  126 2.0861621 -1.055102891 0.3703282033 -0.2184018557  130 2.0002581 -0.632406917 0.6644356672 -0.2205455581  131 2.5729683 -0.367997637 0.6778624082 -0.0290163946  132 2.4191489 -2.615698937 0.4493332350 -0.2180227341  133 2.0096621 0.091734898 -0.3970851815 0.1338635028  135 1.3542991 0.720264116 0.1024908813 -0.4740109114  136 2.9306445 -0.953828162 0.5042742561 0.2898538092  137 1.7133920 -1.075455903 -0.9824454751 0.0911440162  138 1.4883748 -0.461024333 -0.2284803678 -0.1903212626  140 1.9918829 -0.733184868 -0.0233667023 0.2094309436  143 1.3136261 0.621126669 -0.5754896967 0.0005548526  144 2.1759399 -0.913414140 -0.3791611392 0.0767148408  145 2.1339118 -1.082159885 -0.6662030358 0.2561235744  146 2.0148817 -0.455509590 -0.2868952348 0.4143375981  147 1.7214043 0.779055774 -0.0144151727 0.2367337791  148 1.6666003 -0.326774763 -0.2183174245 0.1422205259  149 1.5118663 -1.013144818 -0.9692614759 0.0803895310  150 1.1104099 -0.013652490 -0.5732410461 -0.1237840602 |
|  |
| |  | | --- | | tst<- predict(pr,testing)  tst<- data.frame(tst, testing[5])  library(nnet)  mymodel<- multinom(Species~PC1+PC2, data=trg)  weights: 12 (6 variable)  initial value 131.833475  iter 10 value 20.607042  iter 20 value 18.331120  iter 30 value 18.204474  iter 40 value 18.199783  iter 50 value 18.199009  iter 60 value 18.198506  final value 18.198269  converged  summary(mymodel)  Call:  multinom(formula = Species ~ PC1 + PC2, data = trg)  Coefficients:  (Intercept) PC1 PC2  versicolor 7.2345029 14.05161 3.167254  virginica -0.5757544 20.12094 3.625377  Std. Errors:  (Intercept) PC1 PC2  versicolor 187.5986 106.3766 127.8815  virginica 187.6093 106.3872 127.8829  Residual Deviance: 36.39654  AIC: 48.39654  p<- predict(mymodel,trg)  tab <-table(p,trg$Species)  tab  p setosa versicolor virginica  setosa 45 0 0  versicolor 0 35 3  virginica 0 5 32  p1<- predict(mymodel,tst)  tab1 <-table(p1,tst$Species)  tab1  p1 setosa versicolor virginica  setosa 5 0 0  versicolor 0 9 3  virginica 0 1 12 | |