# Vignette ecospat package

# Contents

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Miscellaneous methods and utilities for spatial ecology analysis, written by current and former members and collaborators of the ecospat group of Antoine Guisan, Department of Ecology and Evolution (DEE) & Institute of Earth Surface Dynamics (IDYST), University of Lausanne, Switzerland.

*ecospat* offers the possibility to perform Pre-modelling Analysis, such as Spatial autocorrelation analysis, MESS (Multivariate Environmental Similarity Surfaces) analyses, Phylogenetic diversity Measures, Biotic Interactions. It also provides functions to complement *biomod2* in preparing the data, calibrating and evaluating (e.g. boyce index) and projecting the models. Complementary analysis based on model predictions (e.g. co-occurrences analyses) are also provided.

In addition, the *ecospat* package includes Niche Quantification and Overlap functions that were used in Broennimann et al. 2012 and Petitpierre et al. 2012 to quantify climatic niche shifts between the native and invaded ranges of invasive species.

# 1 Load data

```
library(ecospat)
```

```
## Loading required package: ade4
```

```
## Loading required package: ape
```

```
## Loading required package: gbm
```

```
## Loading required package: survival
```

```
## Loading required package: lattice
```

```
## Loading required package: splines
```

```
## Loading required package: parallel
```

```
## Loaded gbm 2.1.1

## Loading required package: sp
```

```
citation("ecospat")
```

```
##
## To cite package 'ecospat' in publications use:
##
##    Olivier Broennimann, Valeria Di Cola and Antoine Guisan (2016).
##    ecospat: Spatial Ecology Miscellaneous Methods. R package
##    version 2.1.0.
##    http://www.unil.ch/ecospat/home/menuguid/ecospat-resources/tools.html
##
## A BibTeX entry for LaTeX users is
##
##    @Manual{,
##      title = {ecospat: Spatial Ecology Miscellaneous Methods},
##      author = {Olivier Broennimann and Valeria {Di Cola} and Antoine Guisan},
##      year = {2016},
##      note = {R package version 2.1.0},
##      url = {http://www.unil.ch/ecospat/home/menuguid/ecospat-resources/tools.html},
##    }
```

### 1.0.1   Test data for the ecospat library

*ecospat.testData()*

```
data(ecospat.testData)
names(ecospat.testData)
```

```
##  [1] "numplots"                "long"
##  [3] "lat"                     "ddeg"
##  [5] "mind"                    "srad"
##  [7] "slp"                     "topo"
##  [9] "Achillea_atrata"         "Achillea_millefolium"
## [11] "Acinos_alpinus"          "Adenostyles_glabra"
## [13] "Aposeris_foetida"        "Arnica_montana"
## [15] "Aster_bellidiastrum"     "Bartsia_alpina"
## [17] "Bellis_perennis"         "Campanula_rotundifolia"
## [19] "Centaurea_montana"       "Cerastium_latifolium"
## [21] "Cruciata_laevipes"       "Doronicum_grandiflorum"
## [23] "Galium_album"            "Galium_anisophyllon"
## [25] "Galium_megalospermum"    "Gentiana_bavarica"
## [27] "Gentiana_lutea"          "Gentiana_purpurea"
## [29] "Gentiana_verna"          "Globularia_cordifolia"
## [31] "Globularia_nudicaulis"   "Gypsophila_repens"
## [33] "Hieracium_lactucella"    "Homogyne_alpina"
## [35] "Hypochaeris_radicata"    "Leontodon_autumnalis"
## [37] "Leontodon_helveticus"    "Myosotis_alpestris"
## [39] "Myosotis_arvensis"       "Phyteuma_orbiculare"
## [41] "Phyteuma_spicatum"       "Plantago_alpina"
## [43] "Plantago_lanceolata"     "Polygonum_bistorta"
## [45] "Polygonum_viviparum"     "Prunella_grandiflora"
## [47] "Rhinanthus_alectorolophus" "Rumex_acetosa"
## [49] "Rumex_crispus"           "Vaccinium_gaultherioides"
## [51] "Veronica_alpina"         "Veronica_aphylla"
## [53] "Agrostis_capillaris"     "Bromus_erectus_sstr"
## [55] "Campanula_scheuchzeri"   "Carex_sempervirens"
```

```
## [57] "Cynosurus_cristatus"        "Dactylis_glomerata"
## [59] "Daucus_carota"              "Festuca_pratensis_sl"
## [61] "Geranium_sylvaticum"        "Leontodon_hispidus_sl"
## [63] "Potentilla_erecta"          "Pritzelago_alpina_sstr"
## [65] "Prunella_vulgaris"          "Ranunculus_acris_sl"
## [67] "Saxifraga_oppositifolia"    "Soldanella_alpina"
## [69] "Taraxacum_officinale_aggr"  "Trifolium_repens_sstr"
## [71] "Veronica_chamaedrys"        "Parnassia_palustris"
## [73] "glm_Agrostis_capillaris"    "glm_Leontodon_hispidus_sl"
## [75] "glm_Dactylis_glomerata"     "glm_Trifolium_repens_sstr"
## [77] "glm_Geranium_sylvaticum"    "glm_Ranunculus_acris_sl"
## [79] "glm_Prunella_vulgaris"      "glm_Veronica_chamaedrys"
## [81] "glm_Taraxacum_officinale_aggr" "glm_Plantago_lanceolata"
## [83] "glm_Potentilla_erecta"      "glm_Carex_sempervirens"
## [85] "glm_Soldanella_alpina"      "glm_Cynosurus_cristatus"
## [87] "glm_Campanula_scheuchzeri"  "glm_Festuca_pratensis_sl"
## [89] "glm_Bromus_erectus_sstr"    "glm_Saxifraga_oppositifolia"
## [91] "glm_Daucus_carota"          "glm_Pritzelago_alpina_sstr"
## [93] "gbm_Bromus_erectus_sstr"    "gbm_Saxifraga_oppositifolia"
## [95] "gbm_Daucus_carota"          "gbm_Pritzelago_alpina_sstr"
```

### 1.0.2   Test data for the Niche Overlap Analysis

*ecospat.testNiche.inv()*

```
data(ecospat.testNiche.inv)
names(ecospat.testNiche.inv)
```

```
##  [1] "x"           "y"           "aetpet"      "gdd"         "p"
##  [6] "pet"         "stdp"        "tmax"        "tmin"        "tmp"
## [11] "species_occ" "predictions"
```

ecospat.testNiche.nat()

```
data(ecospat.testNiche.nat)
names(ecospat.testNiche.nat)
```

```
##  [1] "x"           "y"           "aetpet"      "gdd"         "p"
##  [6] "pet"         "stdp"        "tmax"        "tmin"        "tmp"
## [11] "species_occ" "predictions"
```

### 1.0.3   Test tree for Phylogenetic Diversity Analysis

*ecospat.testTree()*

```
fpath <- system.file("extdata", "ecospat.testTree.tre", package="ecospat")
fpath
```

```
## [1] "/private/var/folders/tq/p13f4x0n75d94lvlkzzr4ylr0000gs/T/RtmpqZcYk9/Rinst12207675233bc/ecosp
```

```
tree<-read.tree(fpath)
tree$tip.label
```

```
##  [1] "Rumex_acetosa"            "Polygonum_bistorta"
##  [3] "Polygonum_viviparum"      "Rumex_crispus"
##  [5] "Cerastium_latifolium"     "Silene_acaulis"
##  [7] "Gypsophila_repens"        "Vaccinium_gaultherioides"
##  [9] "Soldanella_alpina"        "Cruciata_laevipes"
## [11] "Galium_album"             "Galium_anisophyllon"
## [13] "Galium_megalospermum"     "Gentiana_verna"
```

```
## [15] "Gentiana_bavarica"         "Gentiana_purpurea"
## [17] "Gentiana_lutea"            "Bartsia_alpina"
## [19] "Rhinanthus_alectorolophus" "Prunella_grandiflora"
## [21] "Acinos_alpinus"            "Plantago_alpina"
## [23] "Plantago_lanceolata"       "Veronica_officinalis"
## [25] "Veronica_aphylla"          "Veronica_alpina"
## [27] "Veronica_chamaedrys"       "Veronica_persica"
## [29] "Globularia_cordifolia"     "Globularia_nudicaulis"
## [31] "Myosotis_alpestris"        "Myosotis_arvensis"
## [33] "Aposeris_foetida"          "Centaurea_montana"
## [35] "Hieracium_lactucella"      "Leontodon_helveticus"
## [37] "Leontodon_autumnalis"      "Hypochaeris_radicata"
## [39] "Achillea_atrata"           "Achillea_millefolium"
## [41] "Homogyne_alpina"           "Senecio_doronicum"
## [43] "Adenostyles_glabra"        "Arnica_montana"
## [45] "Aster_bellidiastrum"       "Bellis_perennis"
## [47] "Doronicum_grandiflorum"    "Phyteuma_orbiculare"
## [49] "Phyteuma_spicatum"         "Campanula_rotundifolia"
```

Plot tree

```
plot(tree, cex=0.6)
```
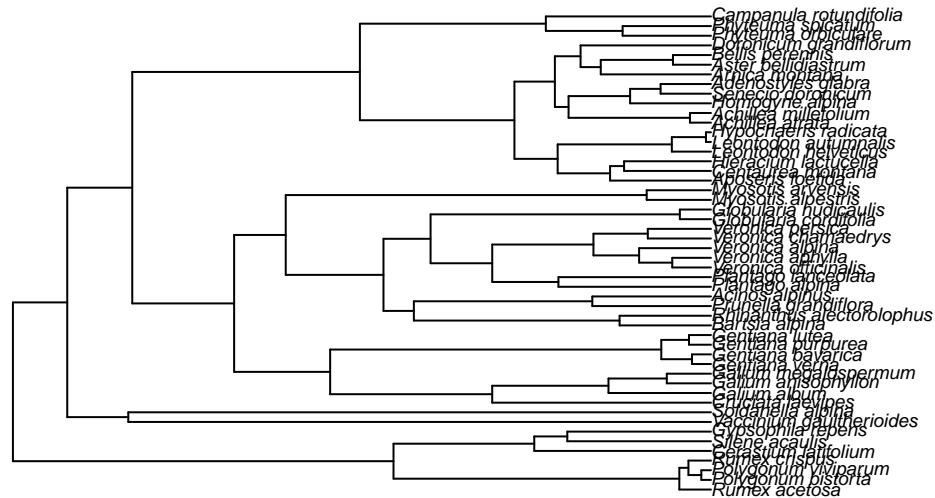


# 2 Pre-Modelling Analysis

## 2.1 Spatial Auto-correlation

### 2.1.1 Mantel Correlogram with *ecospat.mantel.correlogram()*

```
ecospat.mantel.correlogram(dfvar=ecospat.testData[c(2:16)],colxy=1:2, n=100,
                           colvar=3:7, max=1000, nclass=10, nperm=100)
```
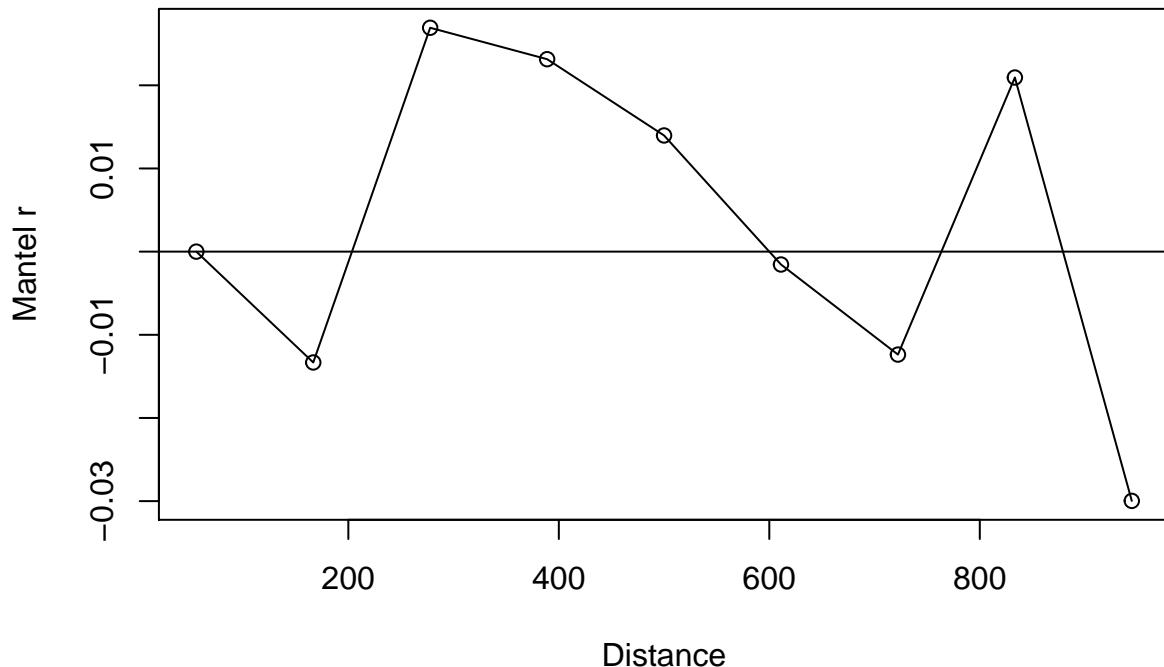
The graph indicates that spatial autocorrelation (SA) is minimal at a distance of 180 meters. Note however that SA is not significantly different than zero for several distances (open circles).

## 2.2 Predictor Variable Selection

### 2.2.1 Number of Predictors with Pearson Correlation *ecospat.npred()*

```
colvar <- ecospat.testData[c(4:8)]
x <- cor(colvar, method="pearson")
ecospat.npred (x, th=0.75)
```

```
## [1] 4
```

### 2.2.2 Number of Predictors with Spearman Correlation *ecospat.npred()*

```
x <- cor(colvar, method="spearman")
ecospat.npred (x, th=0.75)
```

```
## [1] 4
```

## 2.3 Extrapolation Detection Tools

### 2.3.1 Extrapolation Detection with *ecospat.exdet()*

```
x <- ecospat.testData[c(4:8)]
p<- x[1:90,] #A projection dataset.
ref<- x[91:300,] # A reference dataset
```

```
ecospat.exdet(ref,p)
```

```
##  [1]  0.185415746 -0.028290993 -0.032909931 -0.009237875 -0.034642032
##  [6] -0.209006928 -0.084295612 -0.103622863  0.355220600 -0.136258661
## [11] -0.087182448 -0.209006928 -0.143187067 -0.124711316 -0.114844720
## [16] -0.230596451  0.276046242  0.249093277 -0.125288684 -0.101226337
```

```
## [21] -0.113883908 -0.204653076 -0.001154734 -0.132217090 -0.100461894
## [26]  0.464738681 -0.416578541 -0.044457275 -0.018475751 -0.122225532
## [31] -0.137611720 -0.050808314  0.254605027 -0.062012319  0.238294633
## [36] -0.159141330 -0.147806005  0.277670365 -0.071593533 -0.019053118
## [41]  0.390781314  0.175132571  0.401892929  0.843703731  0.286155800
## [46]  0.321142114  0.668511130  0.252253209  0.440050672  0.177247206
## [51]  0.831525456  0.303710525  0.197182304  0.219273698  0.196637663
## [56]  0.195300816  0.142395786  0.176988160 -0.051991905  0.265163111
## [61] -0.020785219 -0.017898383  0.553965995  0.409635110  0.323633285
## [66]  0.468693064  0.124983005 -0.032909931  0.165642783  0.147046687
## [71]  0.202895471  0.341992334  0.225508458  0.133254065  0.485295264
## [76] -0.047344111 -0.012282931  0.165429659  0.134199992  0.216655251
## [81]  0.139419127  0.121254775  0.098782992  0.591393741  0.110866239
## [86]  0.146010655  0.095562156  0.093353356  0.081712342  0.160531262
```

### 2.3.2 Extrapolation detection, creating a MESS object with *ecospat.mess()*

```
x <- ecospat.testData[c(2,3,4:8)]
proj<- x[1:90,] #A projection dataset.
cal<- x[91:300,] #A calibration dataset
```

```
mess.object<-ecospat.mess (proj, cal, w="default")
```

#### 2.3.2.1 Plot MESS with *ecospat.plot.mess()*

```
ecospat.plot.mess (xy=proj[c(1:2)], mess.object, cex=1, pch=15)
```



**MESS**

min=−27 & max=24

**MESSw**

min=−6 & max=58

**#MESSneg**

min=0 & max=2
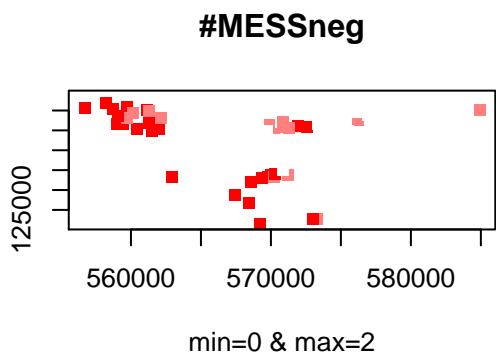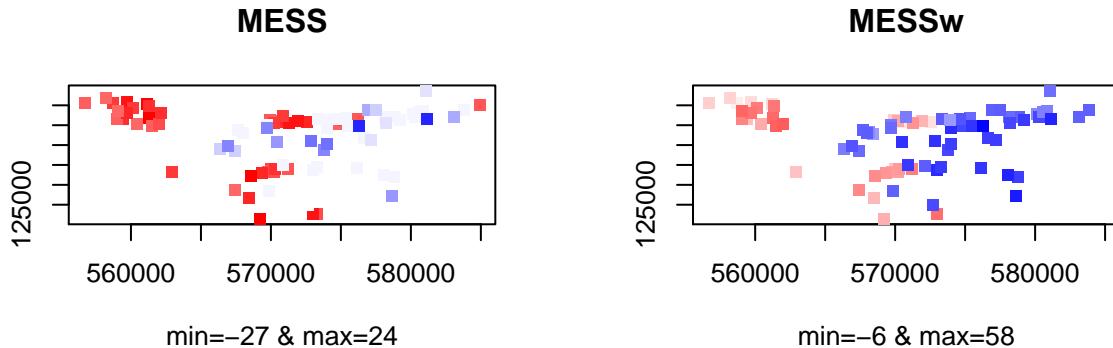
In the MESS plot pixels in red indicate sites where at least one environmental predictor has values outside of the range of that predictor in the calibration dataset. In the MESSw plot, same as previous plot but with weighted by the number of predictors.Finally, the MESSneg plot shows at each site how many predictors have values outside of their calibration range.

## 2.4 Phylogenetic Diversity Measures

```
fpath <- system.file("extdata", "ecospat.testTree.tre", package="ecospat")
tree <- read.tree(fpath)
data <- ecospat.testData[9:52]
```

### 2.4.1 Calculate Phylogenetic Diversity Measures *ecospat.calculate.pd*

```
pd<- ecospat.calculate.pd(tree, data, method = "spanning", type = "species", root = TRUE, average =
```

```
## Progress (. = 100 pixels calculated):
## ... [300]
## All 300 pixels done.
```

```
pd
```

```
##   [1]    6.9782188    6.7981743    4.9964700    4.9964700    4.9964700
##   [6]   29.8820547   58.7451752    6.5223035   30.6152478    1.5258335
##  [11]    0.0000000   44.3661803   38.4155607    6.5223035   24.0929443
##  [16]   78.1607950   38.4155607   29.0894143   29.0894143   89.9839758
##  [21]   27.4135569   40.2827035    1.5258335   56.7686202   18.9535475
##  [26]   34.8871800    0.0000000    1.5258335   39.9291325   48.5997861
##  [31]   82.8763723   29.0894143   24.0929443   24.0929443   35.0949481
##  [36]   85.1406422   54.7974724   41.2817284   32.4100269   30.0984781
##  [41]   46.8247511   42.8358475   35.6223697   91.5539224   72.7022527
##  [46]    0.0000000   21.1862293   29.7320308   10.1187868   30.6152478
##  [51]   27.4135569   59.0015345   78.1536692   42.6423378   24.0929443
##  [56]   46.8050070   49.3924266   29.0894143   38.5290848   43.3611373
##  [61]   63.6397674   49.6097169   34.6522309   37.1871282  109.8813371
##  [66]  106.6971561   52.2512132   80.6221671   68.3867818   49.1362998
##  [71]   56.6138690   41.9283257   29.0894143   33.2026673   16.1897593
##  [76]   79.1938213   42.8115427   25.6187778   34.6805724   96.9902366
##  [81]   75.2672695    7.5313673   31.4078882   50.5865673   13.9570775
##  [86]  104.4121025   43.0464918   36.6693230   52.8590823   24.8855847
##  [91]  107.2302322   33.9358604   54.0048319   30.6152478  102.0983385
##  [96]    8.3170826   52.3071062    8.3170826   61.8562896   58.1179346
## [101]   59.7939424    8.3170826   81.6495398   51.1054635   75.8701970
## [106]   77.6947419   56.7929250   70.3693202   81.3965205   29.9118877
## [111]  111.0790432   75.7518798  112.5482496   32.9763735   42.5644761
## [116]   40.4507005   83.8955419   36.6693230    2.3184739   57.5978451
## [121]   91.3453370   33.3983912   50.1351419    7.7084002   63.9227817
## [126]    0.7926404   67.2813325   91.2965996   90.9578739  105.9024741
## [131]   74.6128871   46.1321553   15.2479619   24.0929443   70.4802708
## [136]   68.8949899  118.6657550  101.3545260  119.8539056   23.6602184
## [141]  105.8968281   15.9336325  138.4059855   39.6674173   51.7391372
## [146]   58.4119283   81.1388699   96.6048825   72.2156025   56.3601992
## [151]  112.9489963   63.3258805   50.1594468   23.0021994   87.1886965
## [156]   12.7714946   33.7421666   23.2537702   14.3226164    6.9752071
## [161]    0.7926404   13.5641350   36.2007616   63.9227817   40.3310946
## [166]   52.8264129   67.9956878   29.5843437    0.0000000  191.7818606
## [171]  133.6077875   83.3977825  118.6711630   51.1512871   69.3838811
## [176]   87.7066616   35.8005270   93.7797077   85.8984840   23.4933413
## [181]  149.7094684   52.4451847  112.1873673   53.4479612   51.4341108
## [186]  106.6959500   14.4361405   41.6547546   89.4018733   59.1068292
## [191]    3.0516670   60.7852739   28.1850877   52.1002690  114.3651475
## [196]   86.2640717   83.7092232   39.8499777   55.3514065  116.1795597
## [201]   21.2346203   75.4593878  197.8157358  140.3806968   93.2192350
```

```
## [206]   36.5337815 146.3370747 214.5450205   64.2439145   83.3740177
## [211]   57.0440643 149.5697614 196.9415036   31.0984631   57.4769230
## [216]   28.4014469   42.3978747 194.5384819   60.5204195   73.0060715
## [221]   52.1628582   30.2801165   63.1752097   29.1789484   82.7662787
## [226]  196.8309769    3.4666557    0.0000000   31.5688084   60.5650008
## [231]   43.3334929   62.5952411   13.9570775   18.9495667   35.2646601
## [236]   32.6155790    0.0000000   14.6693623   24.2745827   73.9480832
## [241]   19.2825866    0.0000000   40.6115985   68.9862341    6.9782188
## [246]   11.5030881   27.9105497   72.4020225   39.6781995   35.4596364
## [251]   33.9160835   27.5735165   15.9619740   27.9105497   17.8628493
## [256]   36.0936777   87.0440848   27.9105497   66.6907987   21.6475811
## [261]   67.5969904    0.0000000    0.0000000    0.0000000   58.0542370
## [266]    0.0000000    0.0000000   27.9105497    0.0000000    0.0000000
## [271]   27.9105497   34.8887684   56.5556633   27.9105497   30.3097595
## [276]   88.4296666   37.8150727   54.2397810   31.6243116    7.5799087
## [281]   73.0136833   31.8638035   41.7172212  120.5228857   32.2001243
## [286]  151.4545228   10.1544492   70.8133537   59.3255687   25.7211220
## [291]   24.1115267   43.1500941  150.0299191   72.2758570   85.9498096
## [296]  159.7242106   66.8328159   24.0929443    0.0000000   27.9105497
```

#### 2.4.1.1 Plot the results (correlation of phylogenetic diversity with species richness)

```
plot(pd)
```
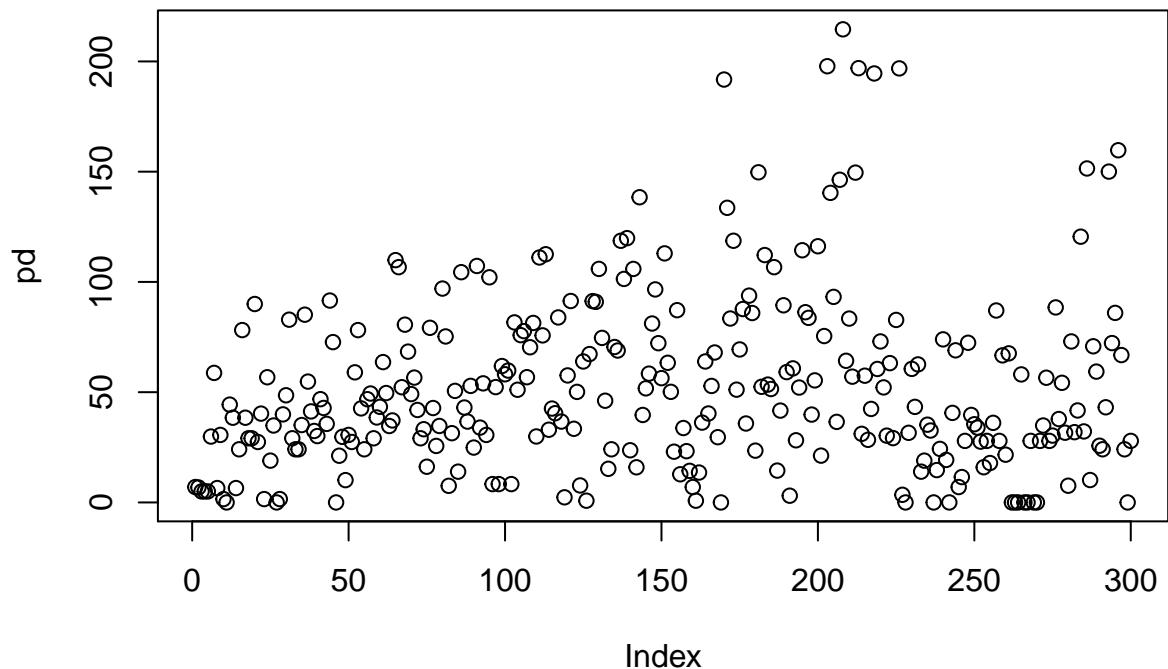


## 2.5 Niche Quantification and Comparison with Ordination techniques

Loading test data for the niche dynamics analysis in the invaded range

```
inv <- ecospat.testNiche.inv
```

Loading test data for the niche dynamics analysis in the native range

```
nat <- ecospat.testNiche.nat
```

### 2.5.1 PCA-ENVIRONMENT

#### 2.5.1.1 The PCA is calibrated on all the sites of the study area

Calibrating the PCA in the whole studay area, including both native and invaded ranges (same as PCAenv in Broenniman et al. 2012)

```
pca.env <- dudi.pca(rbind(nat,inv)[,3:10],scannf=F,nf=2)
```

#### 2.5.1.2 Plot Variables Contribution with *ecospat.plot.contrib()*

```
ecospat.plot.contrib(contrib=pca.env$co, eigen=pca.env$eig)
```
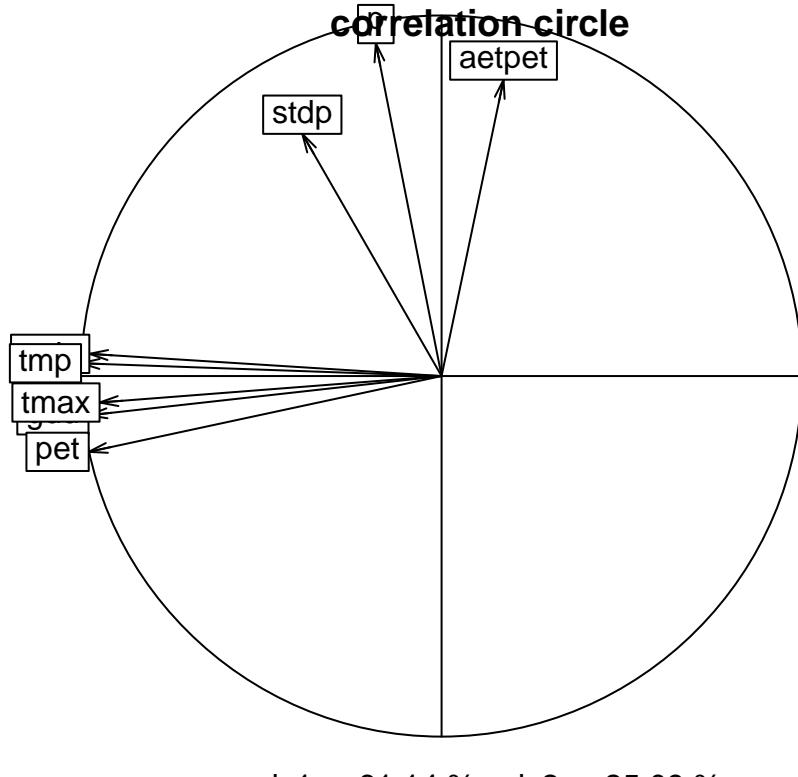


The correlation circle indicate the contribution of original predictors to the PCA axes.

#### 2.5.1.3 Predict the scores on the axes

```
# PCA scores for the whole study area
scores.globclim <- pca.env$li

# PCA scores for the species native distribution
scores.sp.nat <- suprow(pca.env,nat[which(nat[,11]==1),3:10])$li

# PCA scores for the species invasive distribution
scores.sp.inv <- suprow(pca.env,inv[which(inv[,11]==1),3:10])$li

# PCA scores for the whole native study area
scores.clim.nat <- suprow(pca.env,nat[,3:10])$li

# PCA scores for the whole invaded study area
scores.clim.inv <- suprow(pca.env,inv[,3:10])$li
```

### 2.5.2 Calculate the Occurrence Densities Grid with *ecospat.grid.clim.dyn()*

For a species in the native range (North America)

```
# gridding the native niche
grid.clim.nat <- ecospat.grid.clim.dyn(glob=scores.globclim,
                                        glob1=scores.clim.nat,
                                        sp=scores.sp.nat, R=100,
                                        th.sp=0)
```

For a species in the invaded range (Australia)

```
# gridding the invasive niche
grid.clim.inv <- ecospat.grid.clim.dyn(glob=scores.globclim,
                                        glob1=scores.clim.inv,
                                        sp=scores.sp.inv, R=100,
                                        th.sp=0)
```

### 2.5.3 Calculate Niche Overlap with *ecospat.niche.overlap()*

```
# Compute Schoener's D, index of niche overlap
D.overlap <- ecospat.niche.overlap (grid.clim.nat, grid.clim.inv, cor=T)$D
D.overlap
```

```
## [1] 0.2243085
```

The niche overlap between the native and the ivaded range is 22%.

### 2.5.4 Perform the Niche Equivalency Test with *ecospat.niche.equivalency.test()* according to Warren et al. (2008)

It is reccomended to use at least 1000 replications for the equivalency test. As an example we used rep = 10, to reduce the computational time.

```
eq.test <- ecospat.niche.equivalency.test(grid.clim.nat, grid.clim.inv,
                                          rep=10, alternative = "greater")
```

Niche equivalency test H1: Is the overlap between the native and invaded niche higher than two random niches?

### 2.5.5 Perform the Niche Similarity Test with *ecospat.niche.similarity.test()*

Shifting randomly the invasive niche in the invaded study area It is recomended to use at least 1000 replications for the similarity test. As an example we used rep = 10, to reduce the computational time.

```
sim.test <- ecospat.niche.similarity.test(grid.clim.nat, grid.clim.inv,
                                          rep=10, alternative = "greater",
                                          rand.type=2)
```

Niche similarity test H1: Is the overlap between the native and invaded higher than when the invasive niche is randomly introduced in the invaded study area?

#### 2.5.5.1 Plot Equivalency test

```
ecospat.plot.overlap.test(eq.test, "D", "Equivalency")
```

**Equivalency**

D
p.value = 0.81818
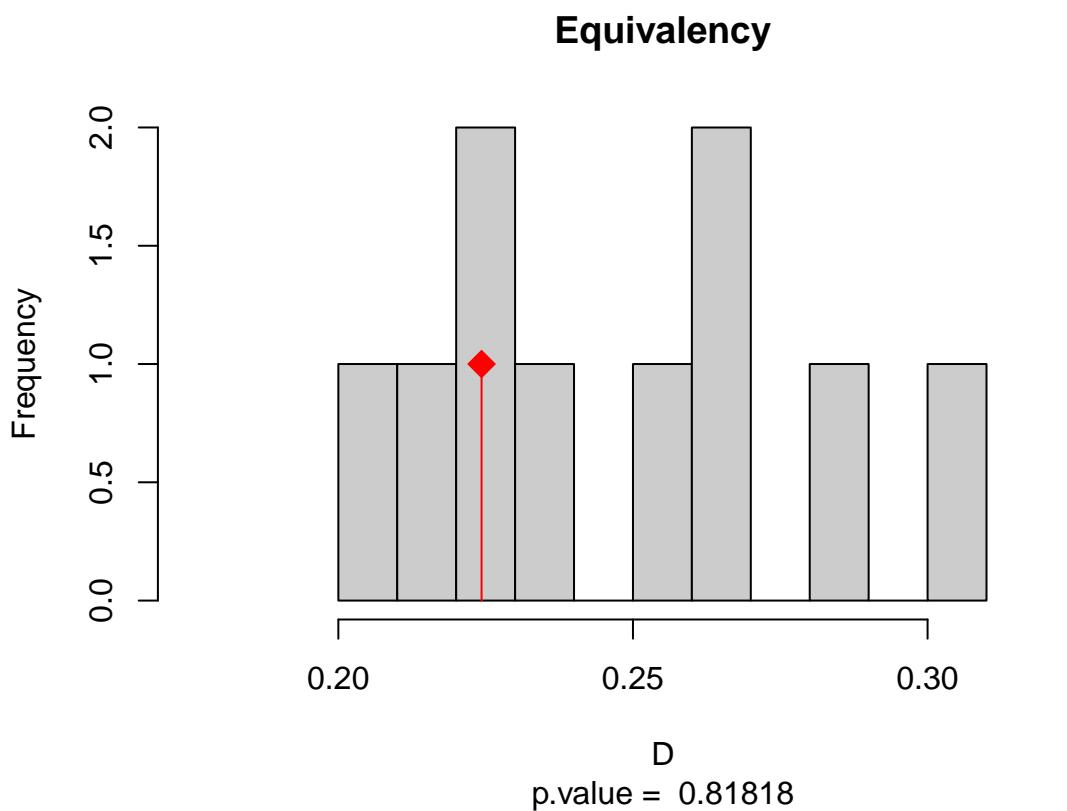
### 2.5.5.2 Plot Similarity test

```r
ecospat.plot.overlap.test(sim.test, "D", "Similarity")
```



**Similarity**

D
p.value = 0.18182
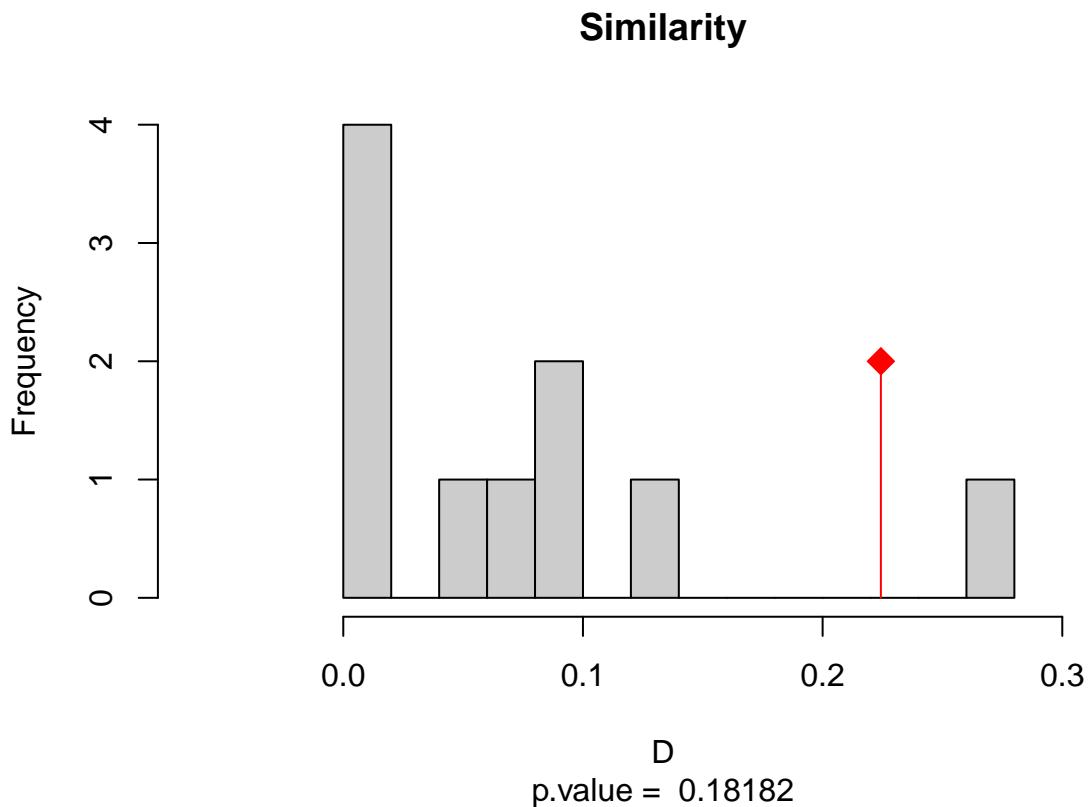
We see that the niche overlap D is 22% and this value is compared to the random distribution of the niche equivalency and niche similarity tests.

### 2.5.6 Delimiting niche categories and quantifying niche dynamics in analogue climates with *ecospat.niche.dyn.index()*

```
niche.dyn <- ecospat.niche.dyn.index (grid.clim.nat, grid.clim.inv, intersection = 0.1)
```

### 2.5.6.1 Visualizing niche categories, niche dynamics and climate analogy between ranges with *ecospat.plot.niche.dyn()*

Plot niche overlap

```
ecospat.plot.niche.dyn(grid.clim.nat, grid.clim.inv, quant=0.25, interest=2,
                       title= "Niche Overlap", name.axis1="PC1",
                       name.axis2="PC2")

ecospat.shift.centroids(scores.sp.nat, scores.sp.inv, scores.clim.nat, scores.clim.inv)
```

## Niche Overlap
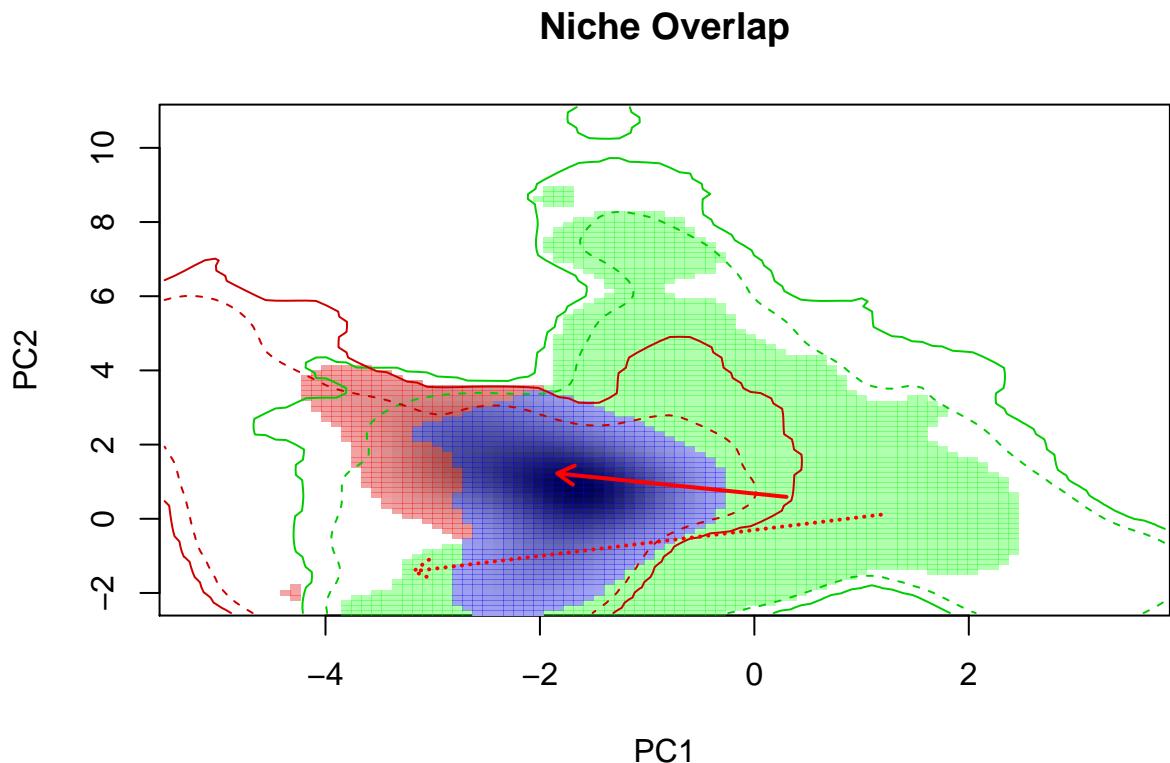


### 2.5.6.2 Plot the niche dynamics along one gradient (here temperature) with *ecospat.plot.niche.dyn()*

```
# gridding the native niche
grid.clim.t.nat <- ecospat.grid.clim.dyn(glob=as.data.frame(rbind(nat,inv)[,10]),
                                          glob1=as.data.frame(nat[,10]),
                                    sp=as.data.frame(nat[which(nat[,11]==1),10]),
                                    R=1000, th.sp=0)
# gridding the invaded niche
grid.clim.t.inv <- ecospat.grid.clim.dyn(glob=as.data.frame(rbind(nat,inv)[,10]),
                                          glob1=as.data.frame(inv[,10]),
                                    sp=as.data.frame(inv[which(inv[,11]==1),10]),
                                    R=1000, th.sp=0)
t.dyn<-ecospat.niche.dyn.index (grid.clim.t.nat, grid.clim.t.inv,
                                intersection=0.1)
ecospat.plot.niche.dyn(grid.clim.t.nat, grid.clim.t.inv, quant=0,
```

```
                    interest=2, title= "Niche Overlap",
                    name.axis1="Average temperature")
```
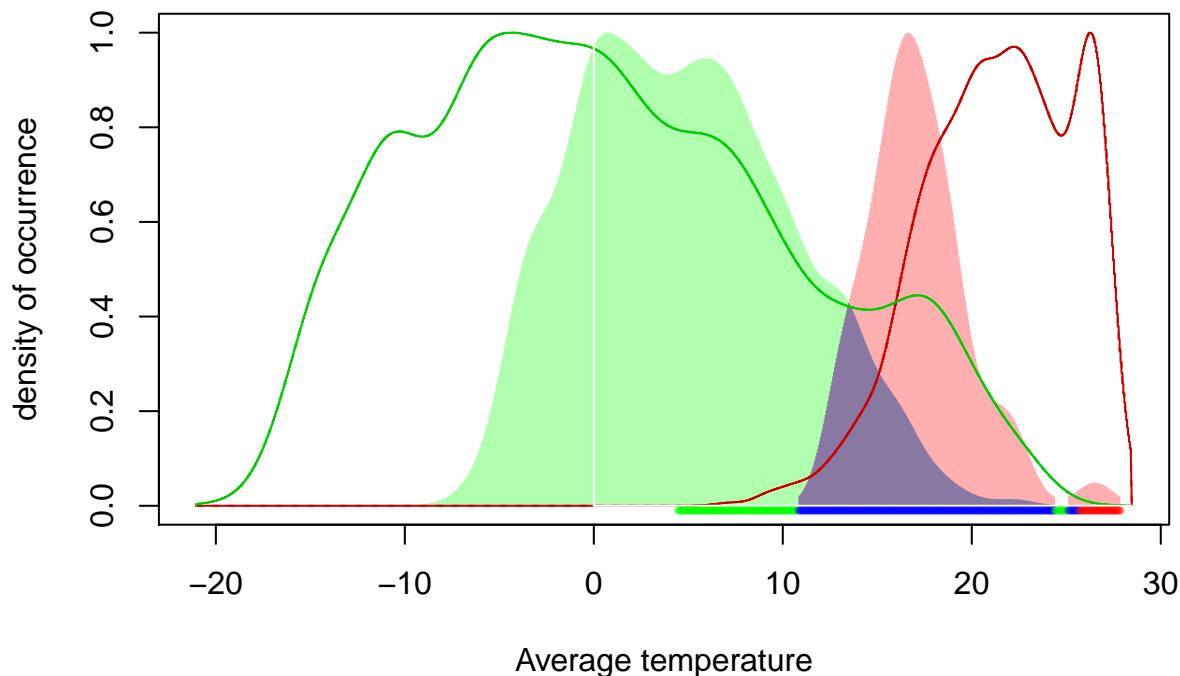


## 2.6    Biotic Interactions

### 2.6.1    Species Co-occurrences Analysis with a Presence-absence matrix using the function *ecospat.co__occurrences()*

```
data <- ecospat.testData[c(9:16,54:57)]
```

For each pair of species (sp1, sp2), the number (N) of plots where both species were present is divided by the number of plots where the rarest of the two species is present. This index ranges from 0 (no co-occurrence) to 1 (always in co-occurrence) as given in eq. 1.

where N(S1 intersects S2) is the number of times species S1 and S2 co-occur, while Min(NS1, NS2) is the number of times species S1 and S2 co-occur, while is the occurrence frequency of the rarest of the two species.

```
ecospat.co_occurrences (data)
```
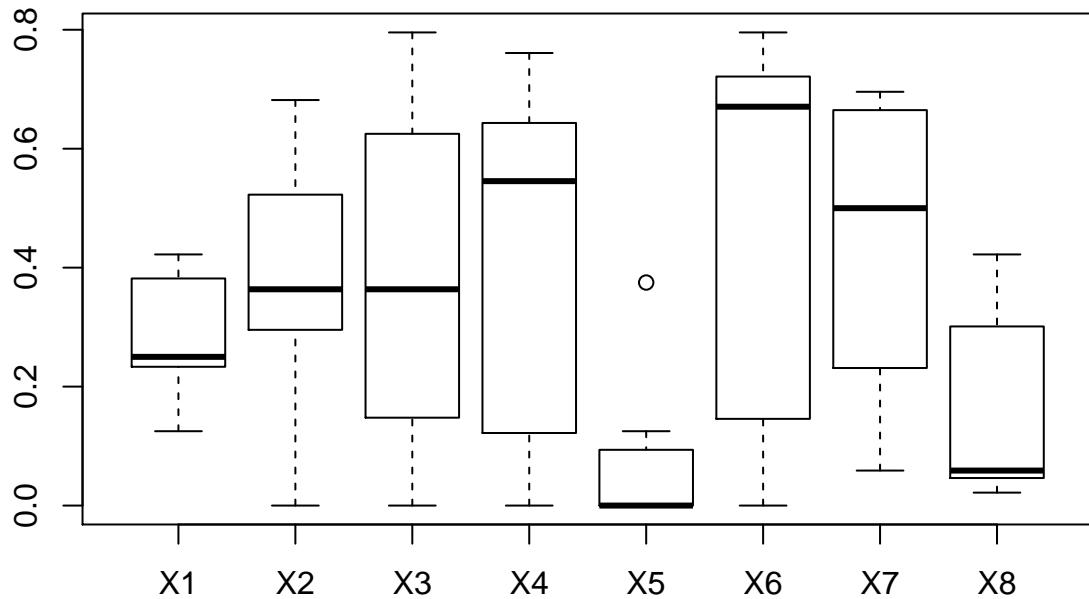
```
##                      Aposeris_foetida Arnica_montana Aster_bellidiastrum
## Aposeris_foetida            1.0000000      0.3636364          0.25000000
## Arnica_montana              0.3636364      1.0000000          0.36363636
## Aster_bellidiastrum         0.2500000      0.3636364          1.00000000
## Bartsia_alpina              0.2222222      0.5454545          0.59090909
## Bromus_erectus_sstr         0.1250000      0.0000000          0.00000000
## Campanula_scheuchzeri       0.2444444      0.6818182          0.79545455
## Carex_sempervirens          0.4000000      0.5000000          0.65909091
## Cynosurus_cristatus         0.4222222      0.2272727          0.04545455
##                      Bartsia_alpina Bromus_erectus_sstr
## Aposeris_foetida         0.22222222              0.1250
## Arnica_montana           0.54545455              0.0000
## Aster_bellidiastrum      0.59090909              0.0000
## Bartsia_alpina           1.00000000              0.0000
## Bromus_erectus_sstr      0.00000000              1.0000
## Campanula_scheuchzeri    0.76086957              0.0000
## Carex_sempervirens       0.69565217              0.0625
## Cynosurus_cristatus      0.02173913              0.3750
##                      Campanula_scheuchzeri Carex_sempervirens
## Aposeris_foetida                0.24444444         0.40000000
## Arnica_montana                  0.68181818         0.50000000
## Aster_bellidiastrum             0.79545455         0.65909091
## Bartsia_alpina                  0.76086957         0.69565217
## Bromus_erectus_sstr             0.00000000         0.06250000
## Campanula_scheuchzeri           1.00000000         0.67058824
## Carex_sempervirens              0.67058824         1.00000000
## Cynosurus_cristatus             0.04705882         0.05882353
##                      Cynosurus_cristatus
## Aposeris_foetida              0.42222222
## Arnica_montana               0.22727273
## Aster_bellidiastrum          0.04545455
## Bartsia_alpina               0.02173913
## Bromus_erectus_sstr          0.37500000
## Campanula_scheuchzeri        0.04705882
## Carex_sempervirens           0.05882353
## Cynosurus_cristatus          1.00000000
```

### 2.6.2 Pairwise co-occurrence Analysis with calculation of the C-score index using the function *ecospat.Cscore()*

This function allows to apply a pairwise null model analysis to a presence-absence community matrix to determine which species associations are significant across the study area. The strength of associations is quantified by the C-score index and a 'fixed-equiprobable' null model algorithm is applied.

It is recomended to use at least 10000 permutatiobns for the test. As an example we used nperm = 100, to reduce the computational time.

```
data<- ecospat.testData[c(53,62,58,70,61,66,65,71,69,43,63,56,68,57,55,60,54,67,59,64)]
nperm <- 100
outpath <- getwd()
ecospat.Cscore(data, nperm, outpath)
```

```
## Computing observed co-occurence matrix
## .............
## .............
## .............
## Computing permutations
## .............
## 100  permutations to go
## .............
## 50  permutations to go
## .............
## Computing P-values
## .............
## Exporting dataset
## .............
## .............
## .............
```

## Histogram of standardized effect size
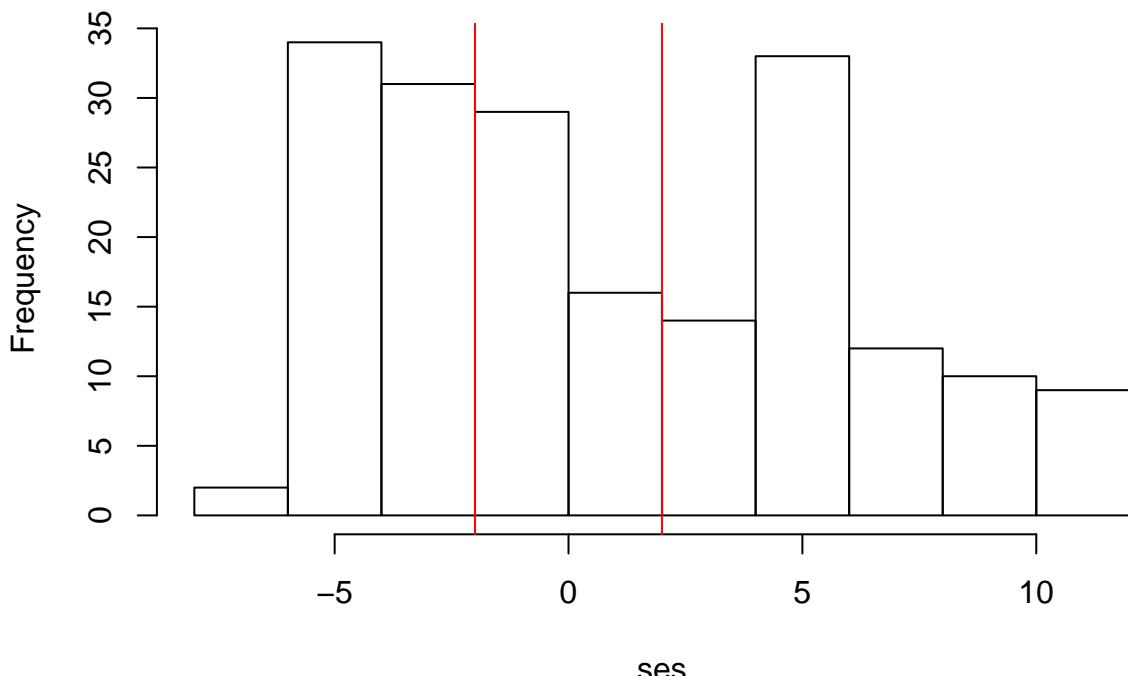


```
## $ObsCscoreTot
## [1] 2675.468
##
## $SimCscoreTot
```

```
## [1] 2467.515
##
## $PVal.less
## [1] 1
##
## $PVal.greater
## [1] 0.00990099
##
## $SES.Tot
## [1] 54.7644
```

The function returns the C-score index for the observed community (ObsCscoreTot), p.value (PValTot)
and standardized effect size (SES.Tot). It saves also a table in the working directory where the same
metrics are calculated for each species pair (only the table with species pairs with significant p-values is
saved in this version)

## 2.7 Data Preparation

### 2.7.1 Correlation Plot of Variables with *ecospat.cor.plot()*

```
data <- ecospat.testData[,4:8]
ecospat.cor.plot(data)
```
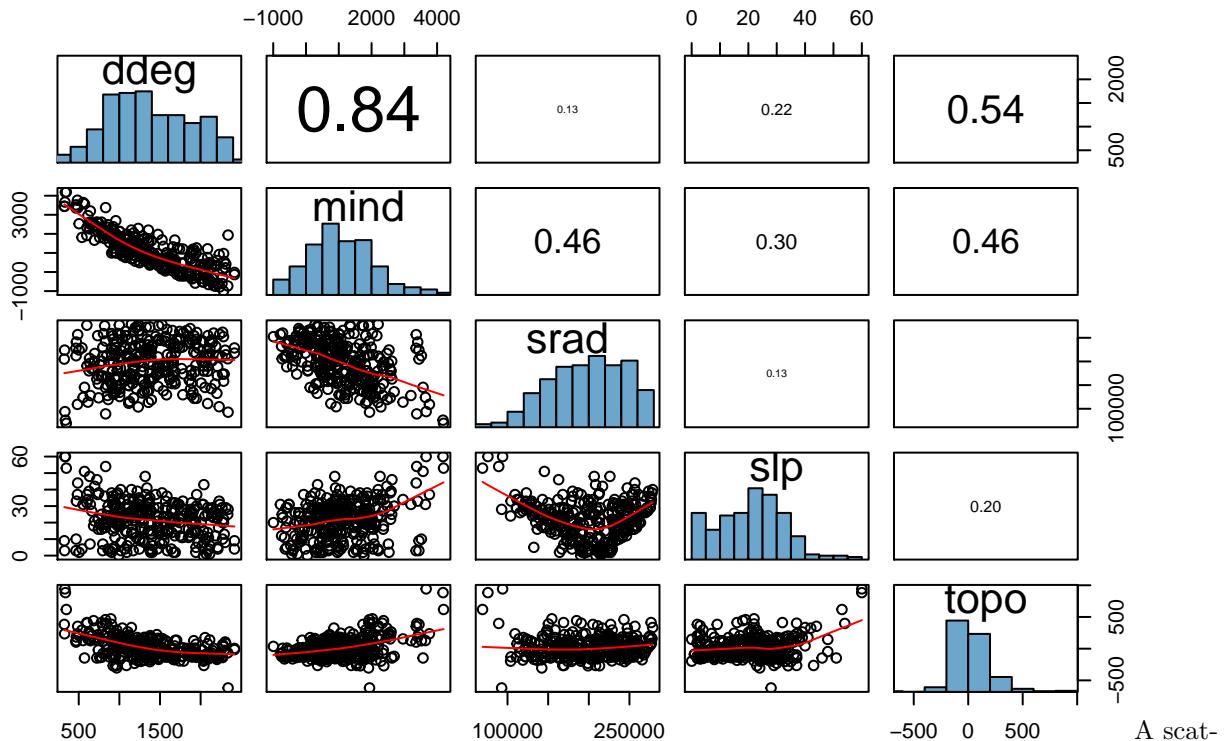


A scatter plot of matrices, with bivariate scatter plots below the diagonal, histograms on the diagonal, and the
Pearson correlation above the diagonal. Useful for descriptive statistics of small data sets (better with
less than 10 variables).

### 2.7.2 Calibration And Evaluation Dataset

```
data <- ecospat.testData
caleval <- ecospat.caleval (data = ecospat.testData[53], xy = data[2:3],
                            row.num = 1:nrow(data), nrep = 2, ratio = 0.7,
                            disaggregate = 0.2, pseudoabs = 100, npres = 10,
```

```
                                    replace = FALSE)
caleval
```

```
## $eval
##     yeval yeval
## 1     NA     NA
## 2    197     73
## 3    172     NA
## 4    150    290
## 5    189    293
## 6    145     75
## 7     56    186
## 8     43    113
## 9     27    256
## 10   259    235
## 11   262     16
## 12    21    296
## 13   297    204
## 14   206    261
## 15   139    243
## 16   225    182
## 17    36    169
## 18   192     45
## 19    79    211
## 20   266      5
## 21   300    251
## 22   252    201
## 23   123    288
## 24   140     49
## 25   294     17
## 26   286      3
## 27   234    114
## 28     3    229
## 29   238     71
## 30   214     51
## 31   289    289
## 32   239    264
## 33    67     44
##
## $cal
##     ycal ycal
## 1    101    91
## 2      1    NA
## 3     NA    NA
## 4     19    38
## 5     81    NA
## 6     NA    NA
## 7     NA   122
## 8     11   241
## 9    223   233
## 10   203     8
## 11   168   258
## 12   272   240
## 13   229   273
## 14   270   266
## 15   271   177
## 16    18    22
## 17   220   168
```

```
## 18    166     67
## 19    295    224
## 20    181    278
## 21    171     15
## 22    134    291
## 23    253    121
## 24    264    198
## 25     23    181
## 26    231    199
## 27    177    123
## 28     95      4
## 29    180    230
## 30    279    295
## 31    188     21
## 32    273    225
## 33    193    116
## 34    232    180
## 35    115    154
## 36    185    184
## 37     84    221
## 38     85    210
## 39    110    267
## 40    222     24
## 41    217     95
## 42    265     55
## 43    199    214
## 44    247    106
## 45    248     36
## 46    275    263
## 47    100    244
## 48    254    269
## 49     57    292
## 50    258    283
## 51    233    147
## 52    157    249
## 53     53    110
## 54     71    178
## 55    156     34
## 56     94    246
## 57    255    236
## 58    268     30
## 59     33    245
## 60    228    150
## 61    269    297
## 62    200    276
## 63     44     20
## 64    120     31
## 65    267    242
## 66    133      2
## 67    147    274
## 68    152    196
## 69     51     37
## 70    205    115
## 71    114    250
## 72    281    260
## 73    299     14
## 74    155    212
## 75    263    300
```

```
## 76  219  171
## 77   15  237
```

We obtained an evaluation and calibration dataset with a desired ratio of disaggregation.

# 3 Core Niche Modelling

## 3.1 Model Evaluation

### 3.1.1 Presence-only Evaluation Indices- Boyce Index

The argument fit is a vector containing the predicted suitability values

```
fit <- ecospat.testData$glm_Saxifraga_oppositifolia
```

The argument obs is a vector containing the predicted suitability values of the validation points (presence records)

```
obs<-ecospat.testData$glm_Saxifraga_oppositifolia[which(ecospat.testData$Saxifraga_oppositifolia==1)
```

Calculate and plot Boyce Index with *ecospat.boyce*

```
ecospat.boyce (fit, obs, nclass = 0, window.w = "default", res = 100,
               PEplot = TRUE)$Spearman.cor
```
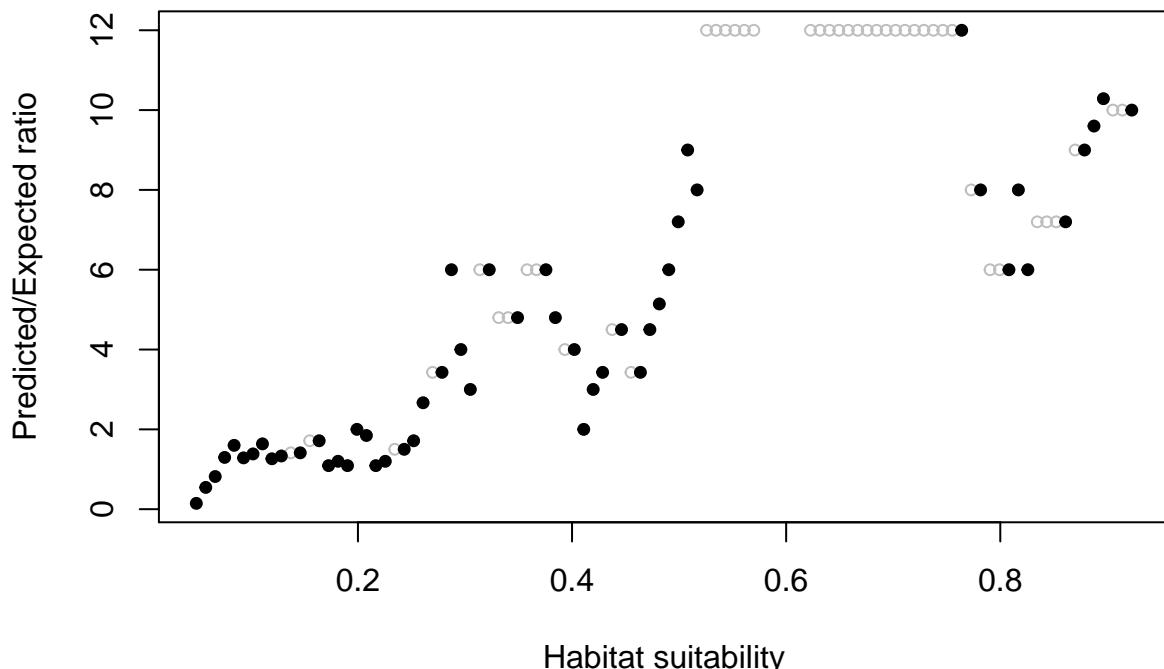


```
## [1] 0.91
```

Here the boyce index is 0.91. If the rank of predicted expected ratio would be completely ordered along habitat suitability axis then boyce index would be 1.

### 3.1.2 Accuracy of Community Prediction

Indices of accuracy of community predictions *ecospat.CommunityEval()*

```
eval<-ecospat.testData[c(53,62,58,70,61,66,65,71,69,43,63,56,68,57,55,60,54,67,59,64)]
pred<-ecospat.testData[c(73:92)]
```

```
ecospat.CommunityEval (eval, pred, proba=T, ntir=5)
```

```
## trial 1 on 5
## trial 2 on 5
## trial 3 on 5
## trial 4 on 5
## trial 5 on 5

## $deviation.rich.pred
##       1  2   3   4  5
## 1     0  2  -1  -2  0
## 2    -6 -6  -5 -10 -7
## 3    -8 -6  -5  -4 -8
## 4    -4 -4  -6  -6 -4
## 5    -9 -6  -7  -9 -9
## 6    -1  1   1  -2 -2
## 7    -5 -6  -4  -2 -4
## 8    -7 -6  -7  -5 -7
## 9     4  2   6   6  2
## 10   -4 -6  -3  -4 -4
## 11   -7 -8 -13 -11 -9
## 12   -2 -2  -1   1  1
## 13   -3  0   1   0  0
## 14   -4 -3  -2  -4 -4
## 15    2  0   1   1  2
## 16   -3 -3  -2  -3 -1
## 17   -4 -5  -5  -7 -2
## 18   -1  0  -1  -1 -2
## 19    8  5   5   4  5
## 20   -6 -5  -3  -5 -3
## 21   -2 -4  -3  -5 -3
## 22   -3 -3  -4  -5 -5
## 23   -2 -5  -7  -4 -6
## 24    1  3   2   1  1
## 25   -6 -5  -4  -1 -2
## 26   -1 -2   4  -2 -1
## 27   -5 -7  -6  -8 -7
## 28   -5 -3  -5  -3 -2
## 29   -2  2   0   2  1
## 30   -7 -2  -5  -6 -6
## 31   -1 -4   1  -1 -3
## 32    2  0   0   2  3
## 33    1 -3  -5  -4 -1
## 34   -3 -2  -5  -5 -4
## 35    0 -1   2   3  1
## 36   -6 -6  -2  -5 -4
## 37    6  5   2   2  3
## 38   -3 -5  -3  -6 -3
## 39    0  2   3   1  0
## 40   -2  0  -1   0 -1
## 41    1  6   2   3  3
## 42    2  1   0   3  3
## 43   -2  1  -1  -2  1
## 44   -1  1   1   3  2
## 45    2 -1   0   0 -1
## 46   -3  0   0  -1  1
## 47    2 -1  -4   0  1
## 48    0  2   2   4  1
```

```
## 49  -2 -1   1  -1 -1
## 50   3  4   1   7  5
## 51   6  3   4   5  4
## 52  -2 -3  -3  -4 -2
## 53   5  2   2  -1  2
## 54   2  1   2   3  1
## 55  -4 -5  -4  -6 -6
## 56  -8 -6  -5  -4 -4
## 57  -1 -1  -2  -2  0
## 58  -3  1  -3  -3 -2
## 59   0  2   1  -1 -3
## 60  -1 -2  -1   0 -2
## 61   1  3   3   1  2
## 62   1  2   1   1  2
## 63   2  1   4   1  2
## 64   2  1   4   3  0
## 65   6  4   4   5  3
## 66   7  3   7   7  2
## 67   2  3   6   2  4
## 68   0  1   0   2  1
## 69   1  0   1   3 -2
## 70   6  6   7   8  4
## 71  -4 -4  -6  -5 -2
## 72   0 -2  -1   2  1
## 73   1  1   0   1  0
## 74   0  1   3   2  1
## 75  -8 -9 -11  -6 -8
## 76   5  7   4   6  4
## 77   1  4  -1   1  1
## 78   2  7   2   4  2
## 79  -5 -2  -2  -8 -6
## 80  -2 -3  -1   2 -1
## 81   7  3   5   4  4
## 82   2  2  -3   1  2
## 83   2  4   6   3  6
## 84  -5 -5  -4  -3 -2
## 85  -6  0  -4  -7 -3
## 86   4  3   4   5  3
## 87   2  6   1   4  2
## 88   4  4   1   5  6
## 89   0 -1   1   2  2
## 90   3  1   7   2  3
## 91   3  4   5   3  6
## 92   4  0   3   1  5
## 93   4  3   3   4  2
## 94  -3  1  -4  -2 -1
## 95   2  5   2   6  4
## 96   7  4   6   3  3
## 97  -3 -3  -1   2 -1
## 98   3  4   6   2  4
## 99   9  7   4   4  7
## 100  2  3   4   0  3
## 101 -4 -1   1   2 -2
## 102  1  2   4   3  3
## 103  1 -2   0   2 -1
## 104  3  5   5   3  6
## 105  5  1   1   4  2
## 106  4  2   4   4  0
```

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```
## 107   2   0    3    4   1
## 108   0   0    4    4   5
## 109   4   5    4    8   5
## 110  -7  -8   -5   -6  -9
## 111   2   1    1    3   1
## 112   6   6    4    4   6
## 113   4   3    6   -1   3
## 114  -8  -3   -3   -5  -3
## 115   2   0    0    3   4
## 116  -2  -5   -2   -4  -6
## 117   7   6    5    4   7
## 118   5   7    7    4   8
## 119  -2  -4   -1   -4  -2
## 120  -2  -3   -4   -5   0
## 121   1   2   -1   -1   1
## 122   4   4    6    4   2
## 123   7   2    6    4   6
## 124   1   5    3    2   2
## 125  -4  -1   -6   -3  -2
## 126   2   3    2    5  -1
## 127   7   8    8   10   9
## 128   7   5    5    3   5
## 129   2   8    6    5   7
## 130   2   4    3    3   2
## 131   3   2    9    5   5
## 132   3   6    5    3   5
## 133   0  -4    0   -1   0
## 134  -2  -6   -1   -7  -4
## 135   9   5    9    7   5
## 136   5   5    3    4   4
## 137   1   3    3    3   2
## 138   1   3    1    2  -2
## 139  -5  -3   -4   -1  -2
## 140  -3   0    1    0  -1
## 141   3   5    6    5   2
## 142   7   5    4    5   1
## 143  -5  -2   -2   -1   2
## 144   7   7    8    8  10
## 145   0  -1   -4   -5  -2
## 146  -2   2    1    1   0
## 147   0  -1    1    0  -1
## 148   4   5    3    0   5
## 149   6   5    2    6   7
## 150  -2  -5   -1   -5  -1
## 151   0   2   -1   -3   2
## 152  -3  -1   -1    0  -1
## 153   5   4    2    4   8
## 154  -4  -1    0   -3  -1
## 155  -1  -2    0    1   2
## 156  -5  -5   -4   -8  -2
## 157  -2  -3   -5   -9  -5
## 158   3   4    4    1   5
## 159   5   2    8    5   5
## 160  -3   0   -8    1  -2
## 161  -2  -3   -1   -1  -4
## 162   3  -1   -1    3   4
## 163   1   2    1    3   2
## 164  -1   3    0   -2  -3
```

```
## 165   0   0    2    1   0
## 166  -5  -5   -1   -5  -4
## 167   1   5    3   -1   3
## 168  -2  -5   -4   -4  -2
## 169  -2  -4   -2   -1  -4
## 170   4   4    5    2   6
## 171  -3  -2   -4    0  -1
## 172   0   0   -1    1  -3
## 173   3   7    4    5   2
## 174  -2  -3   -2    0  -2
## 175   2   1    4    5   1
## 176   2   0    0    4   2
## 177  -3   1    0   -1   1
## 178   2   3    4    4   7
## 179   4   1    3    2   5
## 180  -3  -1   -2   -3  -4
## 181  -3  -1   -3   -2  -5
## 182   4   2    2    0   4
## 183   3  -3    2    4   0
## 184  -2   3    2    1  -1
## 185   0   1    1   -4   0
## 186   0  -5   -3   -2  -1
## 187   1  -1   -2   -1  -1
## 188   0  -5   -1    0   1
## 189   0   2    4    2   3
## 190   2   5    2    3   2
## 191   1   3    1   -1   1
## 192  -2  -3    0   -3   0
## 193  -3  -2   -2   -5  -1
## 194   4   6    1    2   2
## 195   1   2    2    3   5
## 196  -3  -1   -1   -6  -2
## 197   3   2    2    3   3
## 198  -2  -1   -2   -2   0
## 199  -5  -1   -2   -4  -4
## 200  -2  -4   -4   -2  -2
## 201   0  -3   -3   -4  -3
## 202   3   4    3    2   2
## 203  -1   0   -1    2  -1
## 204   1   0    0    2   0
## 205  -1   0    0   -1   0
## 206   1  -3   -1    0  -2
## 207   0  -1    2    4   2
## 208   1   0    5    2   2
## 209   6   0    2   -2   2
## 210  -4  -3   -4   -1  -3
## 211  -3  -4   -1    0  -2
## 212  -4   2    3    1   1
## 213   2   2    3    3   1
## 214  -4   0   -1    1  -1
## 215   1   0    4    0   0
## 216  -2   2    0    2   1
## 217   1  -1   -1    0  -2
## 218   2   3    3    1   0
## 219   0  -1    2    4   1
## 220   2   4    0    2   2
## 221   2  -1   -3   -2  -2
## 222  -1  -2   -2   -1  -1
```

```
## 223 -4 -2  -3  -4  0
## 224 -1  3   1   0  2
## 225  0  0   0   0 -3
## 226  2  1   3   3  1
## 227  4  3   3   4  1
## 228 -4 -3  -2  -1 -5
## 229 -2 -4  -2  -4 -3
## 230  1  0   1   1  2
## 231  4  2   3   4  3
## 232  0 -1   4   1  3
## 233  3  3   1   0  2
## 234 -1 -1   1   2 -2
## 235 -1 -2  -2  -6 -2
## 236 -3 -2  -1  -3 -2
## 237 -2 -1  -2  -2 -2
## 238 -2  0   0  -2 -2
## 239 -1 -1  -1   1  1
## 240 -2 -3  -1  -2 -4
## 241 -3 -3  -4  -4 -3
## 242 -3 -4  -3  -5 -1
## 243  1 -1   2   1  2
## 244 -1  0   0  -3  3
## 245 -3 -3  -5  -2 -2
## 246 -1 -1  -3  -4  0
## 247 -1 -1   1  -2 -2
## 248 -1 -1   0  -1  1
## 249  1  2   1   2  0
## 250 -2  1   0  -2  0
## 251 -3  0  -1  -1  0
## 252 -3 -3  -2  -3 -2
## 253 -2 -1  -2  -5 -2
## 254 -2 -2  -1  -3  0
## 255 -2  0  -1   1 -1
## 256 -3 -1  -1  -6  0
## 257  0  2   0   4  1
## 258 -4 -2  -2  -4 -1
## 259 -1 -3  -3   0  0
## 260  0  2  -1  -3 -2
## 261 -1 -2   0  -3 -1
## 262 -1 -4  -6  -2 -3
## 263 -1 -2  -1  -2 -1
## 264 -5 -3  -2  -4 -4
## 265 -2 -1  -1  -2  1
## 266 -3 -2  -4  -3 -4
## 267 -3  0  -2  -1 -2
## 268 -1  0  -3  -2 -4
## 269 -2 -3  -3   0 -1
## 270 -1 -2  -1  -2 -4
## 271 -2 -3  -2  -3 -2
## 272 -2 -3  -2  -1 -2
## 273 -1 -1   0  -4 -3
## 274 -5 -2  -5  -3 -3
## 275 -2 -3   1  -3 -1
## 276  1 -5  -4  -1 -3
## 277  5 -2   0   2  1
## 278 -5 -3   2  -5 -3
## 279  4  0   0   0  0
## 280  9  6   6   9  7
```

```
## 281   0 -1  -1  -1 -1
## 282   3  1   1   4  0
## 283  -3 -2  -3   1 -1
## 284   2  3  -1   0  2
## 285   1 -2   2  -2 -1
## 286  -1  0   3  -1  0
## 287  -1  3  -2   1  2
## 288   1 -1  -1   0  1
## 289  -2  0   2   0  1
## 290  -2 -3  -3  -1  0
## 291   0  0   1   0 -2
## 292   2 -1   1  -1  0
## 293  -1  0   1  -2 -3
## 294   0  0   3   0  0
## 295   2  1   3   0  1
## 296  -3  0   1   0  1
## 297  -3 -2  -1  -3  2
## 298   0  1  -1  -2 -2
## 299  -2 -1  -1  -2  0
## 300   1  0   0   0  0
##
## $overprediction
##                 1          2          3          4          5
## 1     0.17647059 0.00000000 0.23529412 0.17647059 0.11764706
## 2     0.43750000 0.37500000 0.37500000 0.62500000 0.43750000
## 3     0.60000000 0.40000000 0.33333333 0.33333333 0.53333333
## 4     0.40000000 0.33333333 0.40000000 0.46666667 0.26666667
## 5     0.50000000 0.44444444 0.38888889 0.50000000 0.50000000
## 6     0.40000000 0.00000000 0.20000000 0.30000000 0.30000000
## 7     0.40000000 0.46666667 0.26666667 0.33333333 0.33333333
## 8     0.46666667 0.46666667 0.46666667 0.33333333 0.46666667
## 9     0.20000000 0.10000000 0.10000000 0.00000000 0.10000000
## 10    0.40000000 0.40000000 0.26666667 0.40000000 0.26666667
## 11    0.35000000 0.40000000 0.65000000 0.55000000 0.45000000
## 12    0.25000000 0.37500000 0.25000000 0.25000000 0.00000000
## 13    0.30000000 0.40000000 0.10000000 0.20000000 0.20000000
## 14    0.30769231 0.46153846 0.23076923 0.38461538 0.46153846
## 15    0.33333333 0.44444444 0.33333333 0.22222222 0.33333333
## 16    0.40000000 0.40000000 0.30000000 0.40000000 0.30000000
## 17    0.28571429 0.50000000 0.50000000 0.57142857 0.21428571
## 18    0.30769231 0.15384615 0.23076923 0.23076923 0.23076923
## 19    0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 20    0.46153846 0.38461538 0.46153846 0.38461538 0.30769231
## 21    0.33333333 0.50000000 0.50000000 0.50000000 0.33333333
## 22    0.46153846 0.46153846 0.53846154 0.46153846 0.46153846
## 23    0.25000000 0.37500000 0.43750000 0.31250000 0.37500000
## 24    0.20000000 0.10000000 0.40000000 0.30000000 0.30000000
## 25    0.37500000 0.31250000 0.31250000 0.12500000 0.31250000
## 26    0.28571429 0.21428571 0.00000000 0.14285714 0.21428571
## 27    0.25000000 0.35000000 0.30000000 0.40000000 0.35000000
## 28    0.53846154 0.30769231 0.46153846 0.46153846 0.30769231
## 29    0.33333333 0.16666667 0.25000000 0.16666667 0.08333333
## 30    0.50000000 0.28571429 0.50000000 0.57142857 0.42857143
## 31    0.40000000 0.50000000 0.20000000 0.40000000 0.40000000
## 32    0.11111111 0.33333333 0.22222222 0.22222222 0.22222222
## 33    0.00000000 0.38461538 0.38461538 0.30769231 0.46153846
## 34    0.30769231 0.30769231 0.46153846 0.46153846 0.46153846
## 35    0.30000000 0.30000000 0.10000000 0.30000000 0.20000000
```

```
## 36    0.58333333 0.58333333 0.25000000 0.58333333 0.58333333
## 37    0.00000000 0.00000000 0.14285714 0.28571429 0.28571429
## 38    0.46153846 0.53846154 0.46153846 0.46153846 0.46153846
## 39    0.30000000 0.20000000 0.20000000 0.20000000 0.30000000
## 40    0.40000000 0.10000000 0.20000000 0.30000000 0.10000000
## 41    0.22222222 0.11111111 0.11111111 0.11111111 0.11111111
## 42    0.20000000 0.30000000 0.30000000 0.30000000 0.20000000
## 43    0.33333333 0.33333333 0.25000000 0.33333333 0.16666667
## 44    0.30000000 0.30000000 0.20000000 0.00000000 0.20000000
## 45    0.30000000 0.20000000 0.30000000 0.20000000 0.40000000
## 46    0.50000000 0.33333333 0.25000000 0.25000000 0.08333333
## 47    0.14285714 0.28571429 0.35714286 0.21428571 0.21428571
## 48    0.16666667 0.33333333 0.25000000 0.08333333 0.08333333
## 49    0.41666667 0.16666667 0.16666667 0.33333333 0.33333333
## 50    0.00000000 0.00000000 0.25000000 0.00000000 0.00000000
## 51    0.22222222 0.22222222 0.11111111 0.22222222 0.22222222
## 52    0.40000000 0.33333333 0.26666667 0.33333333 0.33333333
## 53    0.00000000 0.27272727 0.09090909 0.27272727 0.18181818
## 54    0.00000000 0.25000000 0.25000000 0.25000000 0.25000000
## 55    0.40000000 0.40000000 0.26666667 0.46666667 0.46666667
## 56    0.56250000 0.37500000 0.31250000 0.31250000 0.31250000
## 57    0.45454545 0.18181818 0.45454545 0.45454545 0.45454545
## 58    0.33333333 0.08333333 0.41666667 0.25000000 0.41666667
## 59    0.33333333 0.11111111 0.22222222 0.22222222 0.33333333
## 60    0.35714286 0.28571429 0.28571429 0.21428571 0.21428571
## 61    0.40000000 0.30000000 0.20000000 0.20000000 0.20000000
## 62    0.09090909 0.09090909 0.18181818 0.18181818 0.18181818
## 63    0.09090909 0.27272727 0.09090909 0.27272727 0.09090909
## 64    0.07142857 0.14285714 0.00000000 0.14285714 0.14285714
## 65    0.20000000 0.30000000 0.10000000 0.20000000 0.10000000
## 66    0.11111111 0.33333333 0.00000000 0.22222222 0.33333333
## 67    0.33333333 0.22222222 0.00000000 0.33333333 0.22222222
## 68    0.22222222 0.22222222 0.33333333 0.22222222 0.11111111
## 69    0.27272727 0.18181818 0.27272727 0.00000000 0.45454545
## 70    0.25000000 0.12500000 0.12500000 0.25000000 0.00000000
## 71    0.42857143 0.42857143 0.64285714 0.50000000 0.28571429
## 72    0.40000000 0.40000000 0.30000000 0.30000000 0.20000000
## 73    0.33333333 0.33333333 0.44444444 0.22222222 0.22222222
## 74    0.36363636 0.36363636 0.36363636 0.27272727 0.27272727
## 75    0.40000000 0.45000000 0.55000000 0.30000000 0.40000000
## 76    0.00000000 0.16666667 0.16666667 0.00000000 0.16666667
## 77    0.37500000 0.12500000 0.50000000 0.25000000 0.25000000
## 78    0.22222222 0.00000000 0.11111111 0.11111111 0.33333333
## 79    0.33333333 0.16666667 0.16666667 0.50000000 0.38888889
## 80    0.23076923 0.38461538 0.30769231 0.23076923 0.30769231
## 81    0.12500000 0.25000000 0.00000000 0.25000000 0.25000000
## 82    0.08333333 0.25000000 0.33333333 0.16666667 0.16666667
## 83    0.25000000 0.12500000 0.00000000 0.25000000 0.12500000
## 84    0.27777778 0.33333333 0.27777778 0.27777778 0.22222222
## 85    0.35294118 0.11764706 0.29411765 0.41176471 0.23529412
## 86    0.10000000 0.10000000 0.10000000 0.20000000 0.30000000
## 87    0.44444444 0.11111111 0.22222222 0.22222222 0.22222222
## 88    0.20000000 0.00000000 0.10000000 0.20000000 0.00000000
## 89    0.33333333 0.33333333 0.25000000 0.33333333 0.33333333
## 90    0.00000000 0.18181818 0.09090909 0.18181818 0.18181818
## 91    0.10000000 0.10000000 0.20000000 0.40000000 0.20000000
## 92    0.22222222 0.22222222 0.11111111 0.22222222 0.22222222
## 93    0.25000000 0.12500000 0.25000000 0.25000000 0.25000000
```

```
## 94  0.28571429 0.14285714 0.35714286 0.21428571 0.21428571
## 95  0.25000000 0.00000000 0.37500000 0.25000000 0.12500000
## 96  0.00000000 0.10000000 0.00000000 0.20000000 0.10000000
## 97  0.38461538 0.46153846 0.53846154 0.15384615 0.46153846
## 98  0.36363636 0.09090909 0.00000000 0.27272727 0.27272727
## 99  0.00000000 0.33333333 0.44444444 0.33333333 0.11111111
## 100 0.25000000 0.33333333 0.16666667 0.41666667 0.16666667
## 101 0.46153846 0.30769231 0.23076923 0.15384615 0.38461538
## 102 0.16666667 0.16666667 0.16666667 0.16666667 0.25000000
## 103 0.25000000 0.33333333 0.33333333 0.25000000 0.25000000
## 104 0.37500000 0.12500000 0.25000000 0.25000000 0.25000000
## 105 0.07692308 0.15384615 0.15384615 0.15384615 0.23076923
## 106 0.07692308 0.23076923 0.07692308 0.15384615 0.23076923
## 107 0.14285714 0.21428571 0.07142857 0.14285714 0.28571429
## 108 0.30000000 0.30000000 0.00000000 0.20000000 0.20000000
## 109 0.22222222 0.11111111 0.22222222 0.00000000 0.22222222
## 110 0.35000000 0.40000000 0.25000000 0.30000000 0.45000000
## 111 0.16666667 0.33333333 0.16666667 0.08333333 0.08333333
## 112 0.00000000 0.20000000 0.10000000 0.10000000 0.10000000
## 113 0.08333333 0.08333333 0.00000000 0.33333333 0.25000000
## 114 0.58823529 0.35294118 0.17647059 0.35294118 0.29411765
## 115 0.16666667 0.33333333 0.33333333 0.33333333 0.08333333
## 116 0.10526316 0.26315789 0.15789474 0.21052632 0.31578947
## 117 0.00000000 0.11111111 0.11111111 0.11111111 0.22222222
## 118 0.00000000 0.14285714 0.14285714 0.28571429 0.28571429
## 119 0.23529412 0.35294118 0.17647059 0.29411765 0.23529412
## 120 0.23529412 0.29411765 0.41176471 0.47058824 0.11764706
## 121 0.14285714 0.14285714 0.28571429 0.42857143 0.21428571
## 122 0.11111111 0.00000000 0.11111111 0.11111111 0.22222222
## 123 0.09090909 0.27272727 0.27272727 0.27272727 0.00000000
## 124 0.14285714 0.07142857 0.00000000 0.14285714 0.07142857
## 125 0.27777778 0.11111111 0.38888889 0.16666667 0.16666667
## 126 0.25000000 0.25000000 0.41666667 0.08333333 0.33333333
## 127 0.11111111 0.22222222 0.11111111 0.00000000 0.00000000
## 128 0.00000000 0.33333333 0.22222222 0.44444444 0.00000000
## 129 0.30000000 0.00000000 0.10000000 0.20000000 0.10000000
## 130 0.20000000 0.20000000 0.30000000 0.30000000 0.30000000
## 131 0.20000000 0.30000000 0.00000000 0.20000000 0.10000000
## 132 0.20000000 0.00000000 0.10000000 0.20000000 0.20000000
## 133 0.26666667 0.33333333 0.26666667 0.26666667 0.20000000
## 134 0.26666667 0.46666667 0.26666667 0.60000000 0.33333333
## 135 0.11111111 0.11111111 0.11111111 0.11111111 0.22222222
## 136 0.08333333 0.16666667 0.16666667 0.08333333 0.08333333
## 137 0.27272727 0.18181818 0.27272727 0.27272727 0.36363636
## 138 0.38461538 0.15384615 0.15384615 0.30769231 0.30769231
## 139 0.43750000 0.37500000 0.37500000 0.31250000 0.31250000
## 140 0.29411765 0.17647059 0.11764706 0.11764706 0.17647059
## 141 0.16666667 0.08333333 0.08333333 0.08333333 0.33333333
## 142 0.00000000 0.16666667 0.08333333 0.08333333 0.33333333
## 143 0.43750000 0.31250000 0.37500000 0.18750000 0.06250000
## 144 0.10000000 0.00000000 0.10000000 0.00000000 0.00000000
## 145 0.20000000 0.26666667 0.46666667 0.40000000 0.33333333
## 146 0.33333333 0.06666667 0.20000000 0.13333333 0.26666667
## 147 0.18750000 0.18750000 0.12500000 0.12500000 0.18750000
## 148 0.08333333 0.16666667 0.08333333 0.16666667 0.00000000
## 149 0.10000000 0.20000000 0.40000000 0.00000000 0.10000000
## 150 0.16666667 0.33333333 0.11111111 0.27777778 0.11111111
## 151 0.14285714 0.07142857 0.28571429 0.35714286 0.14285714
```

```
## 152 0.31250000 0.25000000 0.18750000 0.25000000 0.25000000
## 153 0.09090909 0.09090909 0.09090909 0.27272727 0.09090909
## 154 0.29411765 0.23529412 0.11764706 0.17647059 0.17647059
## 155 0.33333333 0.20000000 0.20000000 0.20000000 0.06666667
## 156 0.25000000 0.25000000 0.20000000 0.40000000 0.10000000
## 157 0.10000000 0.15000000 0.25000000 0.45000000 0.25000000
## 158 0.18181818 0.00000000 0.09090909 0.27272727 0.09090909
## 159 0.09090909 0.09090909 0.09090909 0.18181818 0.00000000
## 160 0.23529412 0.17647059 0.52941176 0.11764706 0.23529412
## 161 0.31250000 0.31250000 0.25000000 0.25000000 0.37500000
## 162 0.06666667 0.40000000 0.26666667 0.00000000 0.00000000
## 163 0.06666667 0.06666667 0.13333333 0.06666667 0.00000000
## 164 0.25000000 0.06250000 0.25000000 0.25000000 0.31250000
## 165 0.12500000 0.12500000 0.12500000 0.12500000 0.12500000
## 166 0.38888889 0.38888889 0.16666667 0.38888889 0.27777778
## 167 0.23076923 0.00000000 0.15384615 0.53846154 0.07692308
## 168 0.16666667 0.33333333 0.22222222 0.27777778 0.16666667
## 169 0.15789474 0.26315789 0.10526316 0.10526316 0.26315789
## 170 0.15384615 0.15384615 0.00000000 0.23076923 0.07692308
## 171 0.25000000 0.31250000 0.37500000 0.12500000 0.25000000
## 172 0.20000000 0.20000000 0.20000000 0.20000000 0.46666667
## 173 0.20000000 0.10000000 0.30000000 0.00000000 0.40000000
## 174 0.16666667 0.27777778 0.22222222 0.11111111 0.22222222
## 175 0.25000000 0.33333333 0.25000000 0.08333333 0.33333333
## 176 0.14285714 0.21428571 0.35714286 0.14285714 0.14285714
## 177 0.23529412 0.05882353 0.11764706 0.17647059 0.05882353
## 178 0.27272727 0.27272727 0.27272727 0.09090909 0.00000000
## 179 0.00000000 0.16666667 0.08333333 0.33333333 0.00000000
## 180 0.23529412 0.17647059 0.17647059 0.23529412 0.23529412
## 181 0.15000000 0.05000000 0.15000000 0.10000000 0.25000000
## 182 0.07142857 0.21428571 0.28571429 0.21428571 0.07142857
## 183 0.00000000 0.40000000 0.13333333 0.00000000 0.20000000
## 184 0.20000000 0.06666667 0.06666667 0.06666667 0.20000000
## 185 0.13333333 0.13333333 0.20000000 0.33333333 0.20000000
## 186 0.00000000 0.26315789 0.15789474 0.10526316 0.05263158
## 187 0.06666667 0.20000000 0.13333333 0.26666667 0.33333333
## 188 0.11764706 0.41176471 0.17647059 0.11764706 0.05882353
## 189 0.20000000 0.20000000 0.06666667 0.06666667 0.13333333
## 190 0.25000000 0.00000000 0.25000000 0.16666667 0.33333333
## 191 0.20000000 0.00000000 0.13333333 0.26666667 0.13333333
## 192 0.23529412 0.29411765 0.11764706 0.23529412 0.11764706
## 193 0.15789474 0.15789474 0.15789474 0.26315789 0.10526316
## 194 0.07142857 0.00000000 0.28571429 0.07142857 0.00000000
## 195 0.15384615 0.07692308 0.15384615 0.07692308 0.07692308
## 196 0.15789474 0.10526316 0.10526316 0.31578947 0.15789474
## 197 0.08333333 0.33333333 0.16666667 0.08333333 0.08333333
## 198 0.16666667 0.16666667 0.22222222 0.11111111 0.11111111
## 199 0.33333333 0.16666667 0.16666667 0.27777778 0.27777778
## 200 0.16666667 0.22222222 0.33333333 0.16666667 0.16666667
## 201 0.11111111 0.22222222 0.22222222 0.27777778 0.27777778
## 202 0.08333333 0.16666667 0.08333333 0.25000000 0.16666667
## 203 0.25000000 0.18750000 0.25000000 0.12500000 0.18750000
## 204 0.06250000 0.18750000 0.12500000 0.00000000 0.12500000
## 205 0.17647059 0.17647059 0.00000000 0.17647059 0.00000000
## 206 0.05555556 0.22222222 0.11111111 0.05555556 0.16666667
## 207 0.14285714 0.28571429 0.14285714 0.00000000 0.07142857
## 208 0.20000000 0.26666667 0.00000000 0.20000000 0.13333333
## 209 0.00000000 0.35714286 0.28571429 0.35714286 0.07142857
```

```
## 210 0.26315789 0.21052632 0.21052632 0.10526316 0.21052632
## 211 0.22222222 0.27777778 0.16666667 0.05555556 0.16666667
## 212 0.37500000 0.06250000 0.00000000 0.06250000 0.06250000
## 213 0.20000000 0.13333333 0.06666667 0.06666667 0.06666667
## 214 0.29411765 0.05882353 0.17647059 0.05882353 0.23529412
## 215 0.20000000 0.26666667 0.06666667 0.26666667 0.26666667
## 216 0.25000000 0.06250000 0.25000000 0.12500000 0.12500000
## 217 0.12500000 0.18750000 0.31250000 0.18750000 0.18750000
## 218 0.20000000 0.06666667 0.06666667 0.26666667 0.13333333
## 219 0.20000000 0.13333333 0.06666667 0.06666667 0.13333333
## 220 0.13333333 0.00000000 0.20000000 0.06666667 0.00000000
## 221 0.00000000 0.11764706 0.17647059 0.11764706 0.17647059
## 222 0.11764706 0.17647059 0.11764706 0.11764706 0.05882353
## 223 0.21052632 0.15789474 0.21052632 0.26315789 0.05263158
## 224 0.18750000 0.00000000 0.12500000 0.12500000 0.00000000
## 225 0.06250000 0.12500000 0.06250000 0.12500000 0.25000000
## 226 0.07142857 0.00000000 0.07142857 0.00000000 0.07142857
## 227 0.00000000 0.21428571 0.07142857 0.00000000 0.28571429
## 228 0.21052632 0.21052632 0.15789474 0.10526316 0.26315789
## 229 0.10526316 0.21052632 0.10526316 0.21052632 0.15789474
## 230 0.12500000 0.12500000 0.06250000 0.12500000 0.06250000
## 231 0.00000000 0.13333333 0.06666667 0.06666667 0.13333333
## 232 0.13333333 0.06666667 0.00000000 0.06666667 0.00000000
## 233 0.06250000 0.06250000 0.12500000 0.12500000 0.00000000
## 234 0.05882353 0.17647059 0.05882353 0.05882353 0.17647059
## 235 0.10526316 0.10526316 0.15789474 0.31578947 0.10526316
## 236 0.23529412 0.23529412 0.17647059 0.29411765 0.23529412
## 237 0.22222222 0.16666667 0.16666667 0.22222222 0.22222222
## 238 0.10526316 0.05263158 0.00000000 0.10526316 0.15789474
## 239 0.17647059 0.11764706 0.11764706 0.05882353 0.11764706
## 240 0.11111111 0.22222222 0.11111111 0.11111111 0.27777778
## 241 0.21052632 0.21052632 0.21052632 0.26315789 0.15789474
## 242 0.21052632 0.26315789 0.21052632 0.26315789 0.10526316
## 243 0.00000000 0.11764706 0.05882353 0.05882353 0.00000000
## 244 0.11764706 0.05882353 0.11764706 0.23529412 0.00000000
## 245 0.15000000 0.15000000 0.25000000 0.10000000 0.10000000
## 246 0.05263158 0.10526316 0.21052632 0.21052632 0.05263158
## 247 0.05263158 0.10526316 0.00000000 0.10526316 0.15789474
## 248 0.05882353 0.23529412 0.11764706 0.11764706 0.05882353
## 249 0.00000000 0.06250000 0.06250000 0.06250000 0.18750000
## 250 0.11764706 0.05882353 0.00000000 0.11764706 0.05882353
## 251 0.23529412 0.05882353 0.11764706 0.17647059 0.11764706
## 252 0.15000000 0.15000000 0.10000000 0.15000000 0.10000000
## 253 0.10526316 0.10526316 0.15789474 0.31578947 0.15789474
## 254 0.10526316 0.10526316 0.10526316 0.15789474 0.05263158
## 255 0.16666667 0.11111111 0.16666667 0.00000000 0.11111111
## 256 0.16666667 0.11111111 0.05555556 0.33333333 0.11111111
## 257 0.06250000 0.00000000 0.18750000 0.00000000 0.12500000
## 258 0.22222222 0.22222222 0.11111111 0.27777778 0.11111111
## 259 0.11111111 0.22222222 0.22222222 0.05555556 0.11111111
## 260 0.05555556 0.00000000 0.11111111 0.16666667 0.16666667
## 261 0.11111111 0.22222222 0.11111111 0.22222222 0.11111111
## 262 0.05000000 0.20000000 0.30000000 0.10000000 0.15000000
## 263 0.05000000 0.10000000 0.05000000 0.10000000 0.05000000
## 264 0.26315789 0.15789474 0.10526316 0.21052632 0.21052632
## 265 0.17647059 0.11764706 0.23529412 0.11764706 0.05882353
## 266 0.15789474 0.10526316 0.21052632 0.15789474 0.21052632
## 267 0.16666667 0.00000000 0.16666667 0.05555556 0.11111111
```

```
## 268 0.11111111 0.05555556 0.16666667 0.11111111 0.27777778
## 269 0.10526316 0.15789474 0.15789474 0.00000000 0.05263158
## 270 0.05263158 0.10526316 0.05263158 0.10526316 0.21052632
## 271 0.10526316 0.15789474 0.10526316 0.15789474 0.10526316
## 272 0.15789474 0.15789474 0.10526316 0.05263158 0.15789474
## 273 0.11111111 0.11111111 0.11111111 0.27777778 0.27777778
## 274 0.26315789 0.10526316 0.26315789 0.15789474 0.15789474
## 275 0.11111111 0.16666667 0.00000000 0.16666667 0.11111111
## 276 0.21428571 0.35714286 0.35714286 0.35714286 0.35714286
## 277 0.08333333 0.41666667 0.33333333 0.25000000 0.41666667
## 278 0.53846154 0.46153846 0.07692308 0.38461538 0.30769231
## 279 0.15384615 0.23076923 0.30769231 0.30769231 0.38461538
## 280 0.00000000 0.22222222 0.11111111 0.11111111 0.11111111
## 281 0.05263158 0.10526316 0.10526316 0.05263158 0.10526316
## 282 0.15384615 0.30769231 0.15384615 0.15384615 0.23076923
## 283 0.22222222 0.11111111 0.22222222 0.05555556 0.11111111
## 284 0.21428571 0.14285714 0.42857143 0.28571429 0.14285714
## 285 0.05882353 0.23529412 0.05882353 0.23529412 0.11764706
## 286 0.23529412 0.11764706 0.00000000 0.17647059 0.17647059
## 287 0.13333333 0.06666667 0.20000000 0.13333333 0.13333333
## 288 0.05882353 0.23529412 0.23529412 0.17647059 0.05882353
## 289 0.25000000 0.06250000 0.06250000 0.06250000 0.00000000
## 290 0.11111111 0.22222222 0.22222222 0.05555556 0.05555556
## 291 0.11764706 0.11764706 0.05882353 0.17647059 0.29411765
## 292 0.00000000 0.17647059 0.05882353 0.11764706 0.11764706
## 293 0.12500000 0.00000000 0.06250000 0.18750000 0.25000000
## 294 0.12500000 0.12500000 0.06250000 0.12500000 0.12500000
## 295 0.00000000 0.06250000 0.06250000 0.12500000 0.06250000
## 296 0.17647059 0.11764706 0.00000000 0.17647059 0.00000000
## 297 0.23529412 0.17647059 0.23529412 0.23529412 0.00000000
## 298 0.30000000 0.20000000 0.20000000 0.50000000 0.30000000
## 299 0.16666667 0.05555556 0.11111111 0.11111111 0.00000000
## 300 0.00000000 0.05555556 0.05555556 0.05555556 0.05555556
##
## $underprediction
##             1          2          3          4          5
## 1   1.0000000 0.66666667 1.00000000 0.33333333 0.66666667
## 2   0.2500000 0.00000000 0.25000000 0.00000000 0.00000000
## 3   0.2000000 0.00000000 0.00000000 0.20000000 0.00000000
## 4   0.4000000 0.20000000 0.00000000 0.20000000 0.00000000
## 5   0.0000000 1.00000000 0.00000000 0.00000000 0.00000000
## 6   0.3000000 0.10000000 0.30000000 0.10000000 0.10000000
## 7   0.2000000 0.20000000 0.00000000 0.60000000 0.20000000
## 8   0.0000000 0.20000000 0.00000000 0.00000000 0.00000000
## 9   0.6000000 0.30000000 0.70000000 0.60000000 0.30000000
## 10  0.4000000 0.00000000 0.20000000 0.40000000 0.00000000
## 11        NaN        NaN        NaN        NaN        NaN
## 12  0.0000000 0.08333333 0.08333333 0.25000000 0.08333333
## 13  0.0000000 0.40000000 0.20000000 0.20000000 0.20000000
## 14  0.0000000 0.42857143 0.14285714 0.14285714 0.28571429
## 15  0.4545455 0.36363636 0.36363636 0.27272727 0.45454545
## 16  0.1000000 0.10000000 0.10000000 0.10000000 0.20000000
## 17  0.0000000 0.33333333 0.33333333 0.16666667 0.16666667
## 18  0.4285714 0.28571429 0.28571429 0.28571429 0.14285714
## 19  0.5333333 0.33333333 0.33333333 0.26666667 0.33333333
## 20  0.0000000 0.00000000 0.42857143 0.00000000 0.14285714
## 21  0.2500000 0.25000000 0.37500000 0.12500000 0.12500000
## 22  0.4285714 0.42857143 0.42857143 0.14285714 0.14285714
```

```
## 23   0.5000000 0.25000000 0.00000000 0.25000000 0.00000000
## 24   0.3000000 0.40000000 0.60000000 0.40000000 0.40000000
## 25   0.0000000 0.00000000 0.25000000 0.25000000 0.75000000
## 26   0.5000000 0.16666667 0.66666667 0.00000000 0.33333333
## 27         NaN        NaN        NaN        NaN        NaN
## 28   0.2857143 0.14285714 0.14285714 0.42857143 0.28571429
## 29   0.2500000 0.50000000 0.37500000 0.50000000 0.25000000
## 30   0.0000000 0.33333333 0.33333333 0.33333333 0.00000000
## 31   0.3000000 0.10000000 0.30000000 0.30000000 0.10000000
## 32   0.2727273 0.27272727 0.18181818 0.36363636 0.45454545
## 33   0.1428571 0.28571429 0.00000000 0.00000000 0.71428571
## 34   0.1428571 0.28571429 0.14285714 0.14285714 0.28571429
## 35   0.3000000 0.20000000 0.30000000 0.60000000 0.30000000
## 36   0.1250000 0.12500000 0.12500000 0.25000000 0.37500000
## 37   0.4615385 0.38461538 0.23076923 0.30769231 0.38461538
## 38   0.4285714 0.28571429 0.42857143 0.00000000 0.42857143
## 39   0.3000000 0.40000000 0.50000000 0.30000000 0.30000000
## 40   0.2000000 0.10000000 0.10000000 0.30000000 0.00000000
## 41   0.2727273 0.63636364 0.27272727 0.36363636 0.36363636
## 42   0.4000000 0.40000000 0.30000000 0.60000000 0.50000000
## 43   0.2500000 0.62500000 0.25000000 0.25000000 0.37500000
## 44   0.2000000 0.40000000 0.30000000 0.30000000 0.40000000
## 45   0.5000000 0.10000000 0.30000000 0.20000000 0.30000000
## 46   0.3750000 0.50000000 0.37500000 0.25000000 0.25000000
## 47   0.6666667 0.50000000 0.16666667 0.50000000 0.66666667
## 48   0.2500000 0.75000000 0.62500000 0.62500000 0.25000000
## 49   0.3750000 0.12500000 0.37500000 0.37500000 0.37500000
## 50   0.2500000 0.33333333 0.25000000 0.58333333 0.41666667
## 51   0.7272727 0.45454545 0.45454545 0.63636364 0.54545455
## 52   0.8000000 0.40000000 0.20000000 0.20000000 0.60000000
## 53   0.5555556 0.55555556 0.33333333 0.22222222 0.44444444
## 54   0.1666667 0.25000000 0.33333333 0.41666667 0.25000000
## 55   0.4000000 0.20000000 0.00000000 0.20000000 0.20000000
## 56   0.2500000 0.00000000 0.00000000 0.25000000 0.25000000
## 57   0.4444444 0.11111111 0.33333333 0.33333333 0.55555556
## 58   0.1250000 0.25000000 0.25000000 0.00000000 0.37500000
## 59   0.2727273 0.27272727 0.27272727 0.09090909 0.00000000
## 60   0.6666667 0.33333333 0.50000000 0.50000000 0.16666667
## 61   0.5000000 0.60000000 0.50000000 0.30000000 0.40000000
## 62   0.2222222 0.33333333 0.33333333 0.33333333 0.44444444
## 63   0.3333333 0.44444444 0.55555556 0.44444444 0.33333333
## 64   0.5000000 0.50000000 0.66666667 0.83333333 0.33333333
## 65   0.8000000 0.70000000 0.50000000 0.70000000 0.40000000
## 66   0.7272727 0.54545455 0.63636364 0.81818182 0.45454545
## 67   0.4545455 0.45454545 0.54545455 0.45454545 0.54545455
## 68   0.1818182 0.27272727 0.27272727 0.36363636 0.18181818
## 69   0.4444444 0.22222222 0.44444444 0.33333333 0.33333333
## 70   0.6666667 0.58333333 0.66666667 0.83333333 0.33333333
## 71   0.3333333 0.33333333 0.50000000 0.33333333 0.33333333
## 72   0.4000000 0.20000000 0.20000000 0.50000000 0.30000000
## 73   0.3636364 0.36363636 0.36363636 0.27272727 0.18181818
## 74   0.4444444 0.55555556 0.77777778 0.55555556 0.44444444
## 75         NaN        NaN        NaN        NaN        NaN
## 76   0.3571429 0.57142857 0.35714286 0.42857143 0.35714286
## 77   0.3333333 0.41666667 0.25000000 0.25000000 0.25000000
## 78   0.3636364 0.63636364 0.27272727 0.45454545 0.45454545
## 79   0.5000000 0.50000000 0.50000000 0.50000000 0.50000000
## 80   0.1428571 0.28571429 0.42857143 0.71428571 0.42857143
```

```
## 81  0.6666667 0.41666667 0.41666667 0.50000000 0.50000000
## 82  0.3750000 0.62500000 0.12500000 0.37500000 0.50000000
## 83  0.3333333 0.41666667 0.50000000 0.41666667 0.58333333
## 84  0.0000000 0.50000000 0.50000000 1.00000000 1.00000000
## 85  0.0000000 0.66666667 0.33333333 0.00000000 0.33333333
## 86  0.5000000 0.40000000 0.50000000 0.70000000 0.60000000
## 87  0.5454545 0.63636364 0.27272727 0.54545455 0.36363636
## 88  0.6000000 0.40000000 0.20000000 0.70000000 0.60000000
## 89  0.5000000 0.37500000 0.50000000 0.75000000 0.75000000
## 90  0.3333333 0.33333333 0.88888889 0.44444444 0.55555556
## 91  0.4000000 0.50000000 0.70000000 0.70000000 0.80000000
## 92  0.5454545 0.18181818 0.36363636 0.27272727 0.63636364
## 93  0.5000000 0.33333333 0.41666667 0.50000000 0.33333333
## 94  0.1666667 0.50000000 0.16666667 0.16666667 0.33333333
## 95  0.3333333 0.41666667 0.41666667 0.66666667 0.41666667
## 96  0.7000000 0.50000000 0.60000000 0.50000000 0.40000000
## 97  0.2857143 0.42857143 0.85714286 0.57142857 0.71428571
## 98  0.7777778 0.55555556 0.66666667 0.55555556 0.77777778
## 99  0.8181818 0.90909091 0.72727273 0.63636364 0.72727273
## 100 0.6250000 0.87500000 0.75000000 0.62500000 0.62500000
## 101 0.2857143 0.42857143 0.57142857 0.57142857 0.42857143
## 102 0.3750000 0.50000000 0.75000000 0.62500000 0.75000000
## 103 0.5000000 0.25000000 0.50000000 0.62500000 0.25000000
## 104 0.5000000 0.50000000 0.58333333 0.41666667 0.66666667
## 105 0.8571429 0.42857143 0.42857143 0.85714286 0.71428571
## 106 0.7142857 0.71428571 0.71428571 0.85714286 0.42857143
## 107 0.6666667 0.50000000 0.66666667 1.00000000 0.83333333
## 108 0.3000000 0.30000000 0.40000000 0.60000000 0.70000000
## 109 0.5454545 0.54545455 0.54545455 0.72727273 0.63636364
## 110       NaN        NaN        NaN        NaN        NaN
## 111 0.5000000 0.62500000 0.37500000 0.50000000 0.25000000
## 112 0.6000000 0.80000000 0.50000000 0.50000000 0.70000000
## 113 0.6250000 0.50000000 0.75000000 0.37500000 0.75000000
## 114 0.6666667 1.00000000 0.00000000 0.33333333 0.66666667
## 115 0.5000000 0.50000000 0.50000000 0.87500000 0.62500000
## 116 0.0000000 0.00000000 1.00000000 0.00000000 0.00000000
## 117 0.6363636 0.63636364 0.54545455 0.45454545 0.81818182
## 118 0.3846154 0.61538462 0.61538462 0.46153846 0.76923077
## 119 0.6666667 0.66666667 0.66666667 0.33333333 0.66666667
## 120 0.6666667 0.66666667 1.00000000 1.00000000 0.66666667
## 121 0.5000000 0.66666667 0.50000000 0.83333333 0.66666667
## 122 0.4545455 0.36363636 0.63636364 0.45454545 0.36363636
## 123 0.8888889 0.55555556 1.00000000 0.77777778 0.66666667
## 124 0.5000000 1.00000000 0.50000000 0.66666667 0.50000000
## 125 0.5000000 0.50000000 0.50000000 0.00000000 0.50000000
## 126 0.6250000 0.75000000 0.87500000 0.75000000 0.37500000
## 127 0.7272727 0.90909091 0.81818182 0.90909091 0.81818182
## 128 0.6363636 0.72727273 0.63636364 0.63636364 0.45454545
## 129 0.5000000 0.80000000 0.70000000 0.70000000 0.80000000
## 130 0.4000000 0.60000000 0.60000000 0.60000000 0.50000000
## 131 0.5000000 0.50000000 0.90000000 0.70000000 0.60000000
## 132 0.5000000 0.60000000 0.60000000 0.50000000 0.70000000
## 133 0.8000000 0.20000000 0.80000000 0.60000000 0.60000000
## 134 0.4000000 0.20000000 0.60000000 0.40000000 0.20000000
## 135 0.9090909 0.54545455 0.90909091 0.72727273 0.63636364
## 136 0.7500000 0.87500000 0.62500000 0.62500000 0.62500000
## 137 0.4444444 0.55555556 0.66666667 0.66666667 0.66666667
## 138 0.8571429 0.71428571 0.42857143 0.85714286 0.28571429
```

```
## 139 0.5000000 0.75000000 0.50000000 1.00000000 0.75000000
## 140 0.6666667 1.00000000 1.00000000 0.66666667 0.66666667
## 141 0.6250000 0.75000000 0.87500000 0.75000000 0.75000000
## 142 0.8750000 0.87500000 0.62500000 0.75000000 0.62500000
## 143 0.5000000 0.75000000 1.00000000 0.50000000 0.75000000
## 144 0.8000000 0.70000000 0.90000000 0.80000000 1.00000000
## 145 0.6000000 0.60000000 0.60000000 0.20000000 0.60000000
## 146 0.6000000 0.60000000 0.80000000 0.60000000 0.80000000
## 147 0.7500000 0.50000000 0.75000000 0.50000000 0.50000000
## 148 0.6250000 0.87500000 0.50000000 0.25000000 0.62500000
## 149 0.7000000 0.70000000 0.60000000 0.60000000 0.80000000
## 150 0.5000000 0.50000000 0.50000000 0.00000000 0.50000000
## 151 0.3333333 0.50000000 0.50000000 0.33333333 0.66666667
## 152 0.5000000 0.75000000 0.50000000 1.00000000 0.75000000
## 153 0.6666667 0.55555556 0.33333333 0.77777778 1.00000000
## 154 0.3333333 1.00000000 0.66666667 0.00000000 0.66666667
## 155 0.8000000 0.20000000 0.60000000 0.80000000 0.60000000
## 156       NaN       NaN       NaN       NaN       NaN
## 157       NaN       NaN       NaN       NaN       NaN
## 158 0.5555556 0.44444444 0.55555556 0.44444444 0.66666667
## 159 0.6666667 0.33333333 1.00000000 0.77777778 0.55555556
## 160 0.3333333 1.00000000 0.33333333 1.00000000 0.66666667
## 161 0.7500000 0.50000000 0.75000000 0.75000000 0.50000000
## 162 0.8000000 1.00000000 0.60000000 0.60000000 0.80000000
## 163 0.4000000 0.60000000 0.60000000 0.80000000 0.40000000
## 164 0.7500000 1.00000000 1.00000000 0.50000000 0.50000000
## 165 0.5000000 0.50000000 1.00000000 0.75000000 0.50000000
## 166 1.0000000 1.00000000 1.00000000 1.00000000 0.50000000
## 167 0.5714286 0.71428571 0.71428571 0.85714286 0.57142857
## 168 0.5000000 0.50000000 0.00000000 0.50000000 0.50000000
## 169 1.0000000 1.00000000 0.00000000 1.00000000 1.00000000
## 170 0.8571429 0.85714286 0.71428571 0.71428571 1.00000000
## 171 0.2500000 0.75000000 0.50000000 0.50000000 0.75000000
## 172 0.6000000 0.60000000 0.40000000 0.80000000 0.80000000
## 173 0.5000000 0.80000000 0.70000000 0.50000000 0.60000000
## 174 0.5000000 1.00000000 1.00000000 1.00000000 1.00000000
## 175 0.6250000 0.62500000 0.87500000 0.75000000 0.62500000
## 176 0.6666667 0.50000000 0.83333333 1.00000000 0.66666667
## 177 0.3333333 0.66666667 0.66666667 0.66666667 0.66666667
## 178 0.5555556 0.66666667 0.77777778 0.55555556 0.77777778
## 179 0.5000000 0.37500000 0.50000000 0.75000000 0.62500000
## 180 0.3333333 0.66666667 0.33333333 0.33333333 0.00000000
## 181       NaN       NaN       NaN       NaN       NaN
## 182 0.8333333 0.83333333 1.00000000 0.50000000 0.83333333
## 183 0.6000000 0.60000000 0.80000000 0.80000000 0.60000000
## 184 0.2000000 0.80000000 0.60000000 0.40000000 0.40000000
## 185 0.4000000 0.60000000 0.80000000 0.20000000 0.60000000
## 186 0.0000000 0.00000000 0.00000000 0.00000000 0.00000000
## 187 0.4000000 0.40000000 0.00000000 0.60000000 0.80000000
## 188 0.6666667 0.66666667 0.66666667 0.66666667 0.66666667
## 189 0.6000000 1.00000000 1.00000000 0.60000000 1.00000000
## 190 0.6250000 0.62500000 0.62500000 0.62500000 0.75000000
## 191 0.8000000 0.60000000 0.60000000 0.60000000 0.60000000
## 192 0.6666667 0.66666667 0.66666667 0.33333333 0.66666667
## 193 0.0000000 1.00000000 1.00000000 0.00000000 1.00000000
## 194 0.8333333 1.00000000 0.83333333 0.50000000 0.33333333
## 195 0.4285714 0.42857143 0.57142857 0.57142857 0.85714286
## 196 0.0000000 1.00000000 1.00000000 0.00000000 1.00000000
```

```
## 197 0.5000000 0.75000000 0.50000000 0.50000000 0.50000000
## 198 0.5000000 1.00000000 1.00000000 0.00000000 1.00000000
## 199 0.5000000 1.00000000 0.50000000 0.50000000 0.50000000
## 200 0.5000000 0.00000000 1.00000000 0.50000000 0.50000000
## 201 1.0000000 0.50000000 0.50000000 0.50000000 1.00000000
## 202 0.5000000 0.75000000 0.50000000 0.62500000 0.50000000
## 203 0.7500000 0.75000000 0.75000000 1.00000000 0.50000000
## 204 0.5000000 0.75000000 0.50000000 0.50000000 0.50000000
## 205 0.6666667 1.00000000 0.00000000 0.66666667 0.00000000
## 206 1.0000000 0.50000000 0.50000000 0.50000000 0.50000000
## 207 0.3333333 0.50000000 0.66666667 0.66666667 0.50000000
## 208 0.8000000 0.80000000 1.00000000 1.00000000 0.80000000
## 209 1.0000000 0.83333333 1.00000000 0.50000000 0.50000000
## 210 1.0000000 1.00000000 0.00000000 1.00000000 1.00000000
## 211 0.5000000 0.50000000 1.00000000 0.50000000 0.50000000
## 212 0.5000000 0.75000000 0.75000000 0.50000000 0.50000000
## 213 1.0000000 0.80000000 0.80000000 0.80000000 0.40000000
## 214 0.3333333 0.33333333 0.66666667 0.66666667 1.00000000
## 215 0.8000000 0.80000000 1.00000000 0.80000000 0.80000000
## 216 0.5000000 0.75000000 1.00000000 1.00000000 0.75000000
## 217 0.7500000 0.50000000 1.00000000 0.75000000 0.25000000
## 218 1.0000000 0.80000000 0.80000000 1.00000000 0.40000000
## 219 0.6000000 0.20000000 0.60000000 1.00000000 0.60000000
## 220 0.8000000 0.80000000 0.60000000 0.60000000 0.40000000
## 221 0.6666667 0.33333333 0.00000000 0.00000000 0.33333333
## 222 0.3333333 0.33333333 0.00000000 0.33333333 0.00000000
## 223 0.0000000 1.00000000 1.00000000 1.00000000 1.00000000
## 224 0.5000000 0.75000000 0.75000000 0.50000000 0.50000000
## 225 0.2500000 0.50000000 0.25000000 0.50000000 0.25000000
## 226 0.5000000 0.16666667 0.66666667 0.50000000 0.33333333
## 227 0.6666667 1.00000000 0.66666667 0.66666667 0.83333333
## 228 0.0000000 1.00000000 1.00000000 1.00000000 0.00000000
## 229 0.0000000 0.00000000 0.00000000 0.00000000 0.00000000
## 230 0.7500000 0.50000000 0.50000000 0.75000000 0.75000000
## 231 0.8000000 0.80000000 0.80000000 1.00000000 1.00000000
## 232 0.4000000 0.00000000 0.80000000 0.40000000 0.60000000
## 233 1.0000000 1.00000000 0.75000000 0.50000000 0.50000000
## 234 0.0000000 0.66666667 0.66666667 1.00000000 0.33333333
## 235 1.0000000 0.00000000 1.00000000 0.00000000 0.00000000
## 236 0.3333333 0.66666667 0.66666667 0.66666667 0.66666667
## 237 1.0000000 1.00000000 0.50000000 1.00000000 1.00000000
## 238 0.0000000 1.00000000 0.00000000 0.00000000 1.00000000
## 239 0.6666667 0.33333333 0.33333333 0.66666667 1.00000000
## 240 0.0000000 0.50000000 0.50000000 0.00000000 0.50000000
## 241 1.0000000 1.00000000 0.00000000 1.00000000 0.00000000
## 242 1.0000000 1.00000000 1.00000000 0.00000000 1.00000000
## 243 0.3333333 0.33333333 1.00000000 0.66666667 0.66666667
## 244 0.3333333 0.33333333 0.66666667 0.33333333 1.00000000
## 245       NaN        NaN        NaN        NaN        NaN
## 246 0.0000000 1.00000000 1.00000000 0.00000000 1.00000000
## 247 0.0000000 1.00000000 1.00000000 0.00000000 1.00000000
## 248 0.0000000 1.00000000 0.66666667 0.33333333 0.66666667
## 249 0.2500000 0.75000000 0.50000000 0.75000000 0.75000000
## 250 0.0000000 0.66666667 0.00000000 0.00000000 0.33333333
## 251 0.3333333 0.33333333 0.33333333 0.66666667 0.66666667
## 252       NaN        NaN        NaN        NaN        NaN
## 253 0.0000000 1.00000000 1.00000000 1.00000000 1.00000000
## 254 0.0000000 0.00000000 1.00000000 0.00000000 1.00000000
```

```
## 255 0.5000000 1.00000000 1.00000000 0.50000000 0.50000000
## 256 0.0000000 0.50000000 0.00000000 0.00000000 1.00000000
## 257 0.2500000 0.50000000 0.75000000 1.00000000 0.75000000
## 258 0.0000000 1.00000000 0.00000000 0.50000000 0.50000000
## 259 0.5000000 0.50000000 0.50000000 0.50000000 1.00000000
## 260 0.5000000 1.00000000 0.50000000 0.00000000 0.50000000
## 261 0.5000000 1.00000000 1.00000000 0.50000000 0.50000000
## 262       NaN       NaN       NaN       NaN       NaN
## 263       NaN       NaN       NaN       NaN       NaN
## 264 0.0000000 0.00000000 0.00000000 0.00000000 0.00000000
## 265 0.3333333 0.33333333 1.00000000 0.00000000 0.66666667
## 266 0.0000000 0.00000000 0.00000000 0.00000000 0.00000000
## 267 0.0000000 0.00000000 0.50000000 0.00000000 0.00000000
## 268 0.5000000 0.50000000 0.00000000 0.00000000 0.50000000
## 269 0.0000000 0.00000000 0.00000000 0.00000000 0.00000000
## 270 0.0000000 0.00000000 0.00000000 0.00000000 0.00000000
## 271 0.0000000 0.00000000 0.00000000 0.00000000 0.00000000
## 272 1.0000000 0.00000000 0.00000000 0.00000000 1.00000000
## 273 0.5000000 0.50000000 1.00000000 0.50000000 1.00000000
## 274 0.0000000 0.00000000 0.00000000 0.00000000 0.00000000
## 275 0.0000000 0.00000000 0.50000000 0.00000000 0.50000000
## 276 0.6666667 0.00000000 0.16666667 0.66666667 0.33333333
## 277 0.7500000 0.37500000 0.50000000 0.62500000 0.75000000
## 278 0.2857143 0.42857143 0.42857143 0.00000000 0.14285714
## 279 0.8571429 0.42857143 0.57142857 0.57142857 0.71428571
## 280 0.8181818 0.72727273 0.63636364 0.90909091 0.72727273
## 281 1.0000000 1.00000000 1.00000000 0.00000000 1.00000000
## 282 0.7142857 0.71428571 0.42857143 0.85714286 0.42857143
## 283 0.5000000 0.00000000 0.50000000 1.00000000 0.50000000
## 284 0.8333333 0.83333333 0.83333333 0.66666667 0.66666667
## 285 0.6666667 0.66666667 1.00000000 0.66666667 0.33333333
## 286 1.0000000 0.66666667 1.00000000 0.66666667 1.00000000
## 287 0.2000000 0.80000000 0.20000000 0.60000000 0.80000000
## 288 0.6666667 1.00000000 1.00000000 1.00000000 0.66666667
## 289 0.5000000 0.25000000 0.75000000 0.25000000 0.25000000
## 290 0.0000000 0.50000000 0.50000000 0.00000000 0.50000000
## 291 0.6666667 0.66666667 0.66666667 1.00000000 1.00000000
## 292 0.6666667 0.66666667 0.66666667 0.33333333 0.66666667
## 293 0.2500000 0.00000000 0.50000000 0.25000000 0.25000000
## 294 0.5000000 0.50000000 1.00000000 0.50000000 0.50000000
## 295 0.5000000 0.50000000 1.00000000 0.50000000 0.50000000
## 296 0.0000000 0.66666667 0.33333333 1.00000000 0.33333333
## 297 0.3333333 0.33333333 1.00000000 0.33333333 0.66666667
## 298 0.3000000 0.30000000 0.10000000 0.30000000 0.10000000
## 299 0.5000000 0.00000000 0.50000000 0.00000000 0.00000000
## 300 0.5000000 0.50000000 0.50000000 0.50000000 0.50000000
##
## $prediction.success
##      1    2    3    4    5
## 1  0.70 0.90 0.65 0.80 0.80
## 2  0.60 0.70 0.65 0.50 0.65
## 3  0.50 0.70 0.75 0.70 0.60
## 4  0.60 0.70 0.70 0.60 0.80
## 5  0.55 0.50 0.65 0.55 0.55
## 6  0.65 0.95 0.75 0.80 0.80
## 7  0.65 0.60 0.80 0.60 0.70
## 8  0.65 0.60 0.65 0.75 0.65
## 9  0.60 0.80 0.60 0.70 0.80
```

```
## 10    0.60 0.70 0.75 0.60 0.80
## 11    0.65 0.60 0.35 0.45 0.55
## 12    0.90 0.80 0.85 0.75 0.95
## 13    0.85 0.60 0.85 0.80 0.80
## 14    0.80 0.55 0.80 0.70 0.60
## 15    0.60 0.60 0.65 0.75 0.60
## 16    0.75 0.75 0.80 0.75 0.75
## 17    0.80 0.55 0.55 0.55 0.80
## 18    0.65 0.80 0.75 0.75 0.80
## 19    0.60 0.75 0.75 0.80 0.75
## 20    0.70 0.75 0.55 0.75 0.75
## 21    0.70 0.60 0.55 0.65 0.75
## 22    0.55 0.55 0.50 0.65 0.65
## 23    0.70 0.65 0.65 0.70 0.70
## 24    0.75 0.75 0.50 0.65 0.65
## 25    0.70 0.75 0.70 0.85 0.60
## 26    0.65 0.80 0.80 0.90 0.75
## 27    0.75 0.65 0.70 0.60 0.65
## 28    0.55 0.75 0.65 0.55 0.70
## 29    0.70 0.70 0.70 0.70 0.85
## 30    0.65 0.70 0.55 0.50 0.70
## 31    0.65 0.70 0.75 0.65 0.75
## 32    0.80 0.70 0.80 0.70 0.65
## 33    0.95 0.65 0.75 0.80 0.45
## 34    0.75 0.70 0.65 0.65 0.60
## 35    0.70 0.75 0.80 0.55 0.75
## 36    0.60 0.60 0.80 0.55 0.50
## 37    0.70 0.75 0.80 0.70 0.65
## 38    0.55 0.55 0.55 0.70 0.55
## 39    0.70 0.70 0.65 0.75 0.70
## 40    0.70 0.90 0.85 0.70 0.95
## 41    0.75 0.60 0.80 0.75 0.75
## 42    0.70 0.65 0.70 0.55 0.65
## 43    0.70 0.55 0.75 0.70 0.75
## 44    0.75 0.65 0.75 0.85 0.70
## 45    0.60 0.85 0.70 0.80 0.65
## 46    0.55 0.60 0.70 0.75 0.85
## 47    0.70 0.65 0.70 0.70 0.65
## 48    0.80 0.50 0.60 0.70 0.85
## 49    0.60 0.85 0.75 0.65 0.65
## 50    0.85 0.80 0.75 0.65 0.75
## 51    0.50 0.65 0.70 0.55 0.60
## 52    0.50 0.65 0.75 0.70 0.60
## 53    0.75 0.60 0.80 0.75 0.70
## 54    0.90 0.75 0.70 0.65 0.75
## 55    0.60 0.65 0.80 0.60 0.60
## 56    0.50 0.70 0.75 0.70 0.70
## 57    0.55 0.85 0.60 0.60 0.50
## 58    0.75 0.85 0.65 0.85 0.60
## 59    0.70 0.80 0.75 0.85 0.85
## 60    0.55 0.70 0.65 0.70 0.80
## 61    0.55 0.55 0.65 0.75 0.70
## 62    0.85 0.80 0.75 0.75 0.70
## 63    0.80 0.65 0.70 0.65 0.80
## 64    0.80 0.75 0.80 0.65 0.80
## 65    0.50 0.50 0.70 0.55 0.75
## 66    0.55 0.55 0.65 0.45 0.60
## 67    0.60 0.65 0.70 0.60 0.60
```

```
## 68   0.80 0.75 0.70 0.70 0.85
## 69   0.65 0.80 0.65 0.85 0.60
## 70   0.50 0.60 0.55 0.40 0.80
## 71   0.60 0.60 0.40 0.55 0.70
## 72   0.60 0.70 0.75 0.60 0.75
## 73   0.65 0.65 0.60 0.75 0.80
## 74   0.60 0.55 0.45 0.60 0.65
## 75   0.60 0.55 0.45 0.70 0.60
## 76   0.75 0.55 0.70 0.70 0.70
## 77   0.65 0.70 0.65 0.75 0.75
## 78   0.70 0.65 0.80 0.70 0.60
## 79   0.65 0.80 0.80 0.50 0.60
## 80   0.80 0.65 0.65 0.60 0.65
## 81   0.55 0.65 0.75 0.60 0.60
## 82   0.80 0.60 0.75 0.75 0.70
## 83   0.70 0.70 0.70 0.65 0.60
## 84   0.75 0.65 0.70 0.65 0.70
## 85   0.70 0.80 0.70 0.65 0.75
## 86   0.70 0.75 0.70 0.55 0.55
## 87   0.50 0.60 0.75 0.60 0.70
## 88   0.60 0.80 0.85 0.55 0.70
## 89   0.60 0.65 0.65 0.50 0.50
## 90   0.85 0.75 0.55 0.70 0.65
## 91   0.75 0.70 0.55 0.45 0.50
## 92   0.60 0.80 0.75 0.75 0.55
## 93   0.60 0.75 0.65 0.60 0.70
## 94   0.75 0.75 0.70 0.80 0.75
## 95   0.70 0.75 0.60 0.50 0.70
## 96   0.65 0.70 0.70 0.65 0.75
## 97   0.65 0.55 0.35 0.70 0.45
## 98   0.45 0.70 0.70 0.60 0.50
## 99   0.55 0.35 0.40 0.50 0.55
## 100 0.60 0.45 0.60 0.50 0.65
## 101 0.60 0.65 0.65 0.70 0.60
## 102 0.75 0.70 0.60 0.65 0.55
## 103 0.65 0.70 0.60 0.60 0.75
## 104 0.55 0.65 0.55 0.65 0.50
## 105 0.65 0.75 0.75 0.60 0.60
## 106 0.70 0.60 0.70 0.60 0.70
## 107 0.70 0.70 0.75 0.60 0.55
## 108 0.70 0.70 0.80 0.60 0.55
## 109 0.60 0.65 0.60 0.60 0.55
## 110 0.65 0.60 0.75 0.70 0.55
## 111 0.70 0.55 0.75 0.75 0.85
## 112 0.70 0.50 0.70 0.70 0.60
## 113 0.70 0.75 0.70 0.65 0.55
## 114 0.40 0.55 0.85 0.65 0.65
## 115 0.70 0.60 0.60 0.45 0.70
## 116 0.90 0.75 0.80 0.80 0.70
## 117 0.65 0.60 0.65 0.70 0.45
## 118 0.75 0.55 0.55 0.60 0.40
## 119 0.70 0.60 0.75 0.70 0.70
## 120 0.70 0.65 0.50 0.45 0.80
## 121 0.75 0.70 0.65 0.45 0.65
## 122 0.70 0.80 0.60 0.70 0.70
## 123 0.55 0.60 0.40 0.50 0.70
## 124 0.75 0.65 0.85 0.70 0.80
## 125 0.70 0.85 0.60 0.85 0.80
```

```
## 126 0.60 0.55 0.40 0.65 0.65
## 127 0.55 0.40 0.50 0.50 0.55
## 128 0.65 0.45 0.55 0.45 0.75
## 129 0.60 0.60 0.60 0.55 0.55
## 130 0.70 0.60 0.55 0.55 0.60
## 131 0.65 0.60 0.55 0.55 0.65
## 132 0.65 0.70 0.65 0.65 0.55
## 133 0.60 0.70 0.60 0.65 0.70
## 134 0.70 0.60 0.65 0.45 0.70
## 135 0.45 0.65 0.45 0.55 0.55
## 136 0.65 0.55 0.65 0.70 0.70
## 137 0.65 0.65 0.55 0.55 0.50
## 138 0.45 0.65 0.75 0.50 0.70
## 139 0.55 0.55 0.60 0.55 0.60
## 140 0.65 0.70 0.75 0.80 0.75
## 141 0.65 0.65 0.60 0.65 0.50
## 142 0.65 0.55 0.70 0.65 0.55
## 143 0.55 0.60 0.50 0.75 0.80
## 144 0.55 0.65 0.50 0.60 0.50
## 145 0.70 0.65 0.50 0.65 0.60
## 146 0.60 0.80 0.65 0.75 0.60
## 147 0.70 0.75 0.75 0.80 0.75
## 148 0.70 0.55 0.75 0.80 0.75
## 149 0.60 0.55 0.50 0.70 0.55
## 150 0.80 0.65 0.85 0.75 0.85
## 151 0.80 0.80 0.65 0.65 0.70
## 152 0.65 0.65 0.75 0.60 0.65
## 153 0.65 0.70 0.80 0.50 0.50
## 154 0.70 0.65 0.80 0.85 0.75
## 155 0.55 0.80 0.70 0.65 0.80
## 156 0.75 0.75 0.80 0.60 0.90
## 157 0.90 0.85 0.75 0.55 0.75
## 158 0.65 0.80 0.70 0.65 0.65
## 159 0.65 0.80 0.50 0.55 0.75
## 160 0.75 0.70 0.50 0.75 0.70
## 161 0.60 0.65 0.65 0.65 0.60
## 162 0.75 0.45 0.65 0.85 0.80
## 163 0.85 0.80 0.75 0.75 0.90
## 164 0.65 0.75 0.60 0.70 0.65
## 165 0.80 0.80 0.70 0.75 0.80
## 166 0.55 0.55 0.75 0.55 0.70
## 167 0.65 0.75 0.65 0.35 0.75
## 168 0.80 0.65 0.80 0.70 0.80
## 169 0.80 0.70 0.90 0.85 0.70
## 170 0.60 0.60 0.75 0.60 0.60
## 171 0.75 0.60 0.60 0.80 0.65
## 172 0.70 0.70 0.75 0.65 0.45
## 173 0.65 0.55 0.50 0.75 0.50
## 174 0.80 0.65 0.70 0.80 0.70
## 175 0.60 0.55 0.50 0.65 0.55
## 176 0.70 0.70 0.50 0.60 0.70
## 177 0.75 0.85 0.80 0.75 0.85
## 178 0.60 0.55 0.50 0.70 0.65
## 179 0.80 0.75 0.75 0.50 0.75
## 180 0.75 0.75 0.80 0.75 0.80
## 181 0.85 0.95 0.85 0.90 0.75
## 182 0.70 0.60 0.50 0.70 0.70
## 183 0.85 0.55 0.70 0.80 0.70
```

```
## 184 0.80 0.75 0.80 0.85 0.75
## 185 0.80 0.75 0.65 0.70 0.70
## 186 1.00 0.75 0.85 0.90 0.95
## 187 0.85 0.75 0.90 0.65 0.55
## 188 0.80 0.55 0.75 0.80 0.85
## 189 0.70 0.60 0.70 0.80 0.65
## 190 0.60 0.75 0.60 0.65 0.50
## 191 0.65 0.85 0.75 0.65 0.75
## 192 0.70 0.65 0.80 0.75 0.80
## 193 0.85 0.80 0.80 0.75 0.85
## 194 0.70 0.70 0.55 0.80 0.90
## 195 0.75 0.80 0.70 0.75 0.65
## 196 0.85 0.85 0.85 0.70 0.80
## 197 0.75 0.50 0.70 0.75 0.75
## 198 0.80 0.75 0.70 0.90 0.80
## 199 0.65 0.75 0.80 0.70 0.70
## 200 0.80 0.80 0.60 0.80 0.80
## 201 0.80 0.75 0.75 0.70 0.65
## 202 0.75 0.60 0.75 0.60 0.70
## 203 0.65 0.70 0.65 0.70 0.75
## 204 0.85 0.70 0.80 0.90 0.80
## 205 0.75 0.70 1.00 0.75 1.00
## 206 0.85 0.75 0.85 0.90 0.80
## 207 0.80 0.65 0.70 0.80 0.80
## 208 0.65 0.60 0.75 0.60 0.70
## 209 0.70 0.50 0.50 0.60 0.80
## 210 0.70 0.75 0.80 0.85 0.75
## 211 0.75 0.70 0.75 0.90 0.80
## 212 0.60 0.80 0.85 0.85 0.85
## 213 0.60 0.70 0.75 0.75 0.85
## 214 0.70 0.90 0.75 0.85 0.65
## 215 0.65 0.60 0.70 0.60 0.60
## 216 0.70 0.80 0.60 0.70 0.75
## 217 0.75 0.75 0.55 0.70 0.80
## 218 0.60 0.75 0.75 0.55 0.80
## 219 0.70 0.85 0.80 0.70 0.75
## 220 0.70 0.80 0.70 0.80 0.90
## 221 0.90 0.85 0.85 0.90 0.80
## 222 0.85 0.80 0.90 0.85 0.95
## 223 0.80 0.80 0.75 0.70 0.90
## 224 0.75 0.85 0.75 0.80 0.90
## 225 0.90 0.80 0.90 0.80 0.75
## 226 0.80 0.95 0.75 0.85 0.85
## 227 0.80 0.55 0.75 0.80 0.55
## 228 0.80 0.75 0.80 0.85 0.75
## 229 0.90 0.80 0.90 0.80 0.85
## 230 0.75 0.80 0.85 0.75 0.80
## 231 0.80 0.70 0.75 0.70 0.65
## 232 0.80 0.95 0.80 0.85 0.85
## 233 0.75 0.75 0.75 0.80 0.90
## 234 0.95 0.75 0.85 0.80 0.80
## 235 0.85 0.90 0.80 0.70 0.90
## 236 0.75 0.70 0.75 0.65 0.70
## 237 0.70 0.75 0.80 0.70 0.70
## 238 0.90 0.90 1.00 0.90 0.80
## 239 0.75 0.85 0.85 0.85 0.75
## 240 0.90 0.75 0.85 0.90 0.70
## 241 0.75 0.75 0.80 0.70 0.85
```

```
## 242 0.75 0.70 0.75 0.75 0.85
## 243 0.95 0.85 0.80 0.85 0.90
## 244 0.85 0.90 0.80 0.75 0.85
## 245 0.85 0.85 0.75 0.90 0.90
## 246 0.95 0.85 0.75 0.80 0.90
## 247 0.95 0.85 0.95 0.90 0.80
## 248 0.95 0.65 0.80 0.85 0.85
## 249 0.95 0.80 0.85 0.80 0.70
## 250 0.90 0.85 1.00 0.90 0.90
## 251 0.75 0.90 0.85 0.75 0.80
## 252 0.85 0.85 0.90 0.85 0.90
## 253 0.90 0.85 0.80 0.65 0.80
## 254 0.90 0.90 0.85 0.85 0.90
## 255 0.80 0.80 0.75 0.95 0.85
## 256 0.85 0.85 0.95 0.70 0.80
## 257 0.90 0.90 0.70 0.80 0.75
## 258 0.80 0.70 0.90 0.70 0.85
## 259 0.85 0.75 0.75 0.90 0.80
## 260 0.90 0.90 0.85 0.85 0.80
## 261 0.85 0.70 0.80 0.75 0.85
## 262 0.95 0.80 0.70 0.90 0.85
## 263 0.95 0.90 0.95 0.90 0.95
## 264 0.75 0.85 0.90 0.80 0.80
## 265 0.80 0.85 0.65 0.90 0.85
## 266 0.85 0.90 0.80 0.85 0.80
## 267 0.85 1.00 0.80 0.95 0.90
## 268 0.85 0.90 0.85 0.90 0.70
## 269 0.90 0.85 0.85 1.00 0.95
## 270 0.95 0.90 0.95 0.90 0.80
## 271 0.90 0.85 0.90 0.85 0.90
## 272 0.80 0.85 0.90 0.95 0.80
## 273 0.85 0.85 0.80 0.70 0.65
## 274 0.75 0.90 0.75 0.85 0.85
## 275 0.90 0.85 0.95 0.85 0.85
## 276 0.65 0.75 0.70 0.55 0.65
## 277 0.65 0.60 0.60 0.60 0.45
## 278 0.55 0.55 0.80 0.75 0.75
## 279 0.60 0.70 0.60 0.60 0.50
## 280 0.55 0.50 0.60 0.45 0.55
## 281 0.90 0.85 0.85 0.95 0.85
## 282 0.65 0.55 0.75 0.60 0.70
## 283 0.75 0.90 0.75 0.85 0.85
## 284 0.60 0.65 0.45 0.60 0.70
## 285 0.85 0.70 0.80 0.70 0.85
## 286 0.65 0.80 0.85 0.75 0.70
## 287 0.85 0.75 0.80 0.75 0.70
## 288 0.85 0.65 0.65 0.70 0.85
## 289 0.70 0.90 0.80 0.90 0.95
## 290 0.90 0.75 0.75 0.95 0.90
## 291 0.80 0.80 0.85 0.70 0.60
## 292 0.90 0.75 0.85 0.85 0.80
## 293 0.85 1.00 0.85 0.80 0.75
## 294 0.80 0.80 0.75 0.80 0.80
## 295 0.90 0.85 0.75 0.80 0.85
## 296 0.85 0.80 0.95 0.70 0.95
## 297 0.75 0.80 0.65 0.75 0.90
## 298 0.70 0.75 0.85 0.60 0.80
## 299 0.80 0.95 0.85 0.90 1.00
```

```
## 300 0.95 0.90 0.90 0.90 0.90
##
## $sensitivity
##              1           2          3          4          5
## 1    0.00000000 1.0000000 0.0000000 0.4000000 0.3333333
## 2    0.30000000 0.4000000 0.3333333 0.2857143 0.3636364
## 3    0.30769231 0.4545455 0.5000000 0.4444444 0.3846154
## 4    0.33333333 0.4444444 0.4545455 0.3636364 0.5555556
## 5    0.18181818 0.0000000 0.2222222 0.1818182 0.1818182
## 6    0.63636364 1.0000000 0.7777778 0.7500000 0.7500000
## 7    0.40000000 0.3636364 0.5555556 0.2857143 0.4444444
## 8    0.41666667 0.3636364 0.4166667 0.5000000 0.4166667
## 9    0.66666667 0.8750000 0.7500000 1.0000000 0.8750000
## 10   0.33333333 0.4545455 0.5000000 0.3333333 0.5555556
## 11   0.00000000 0.0000000 0.0000000 0.0000000 0.0000000
## 12   0.85714286 0.7857143 0.8461538 0.8181818 1.0000000
## 13   0.76923077 0.6000000 0.8888889 0.8000000 0.8000000
## 14   0.63636364 0.4000000 0.6666667 0.5454545 0.4545455
## 15   0.66666667 0.6363636 0.7000000 0.8000000 0.6666667
## 16   0.69230769 0.6923077 0.7500000 0.6923077 0.7272727
## 17   0.60000000 0.3636364 0.3636364 0.3846154 0.6250000
## 18   0.50000000 0.7142857 0.6250000 0.6250000 0.6666667
## 19   1.00000000 1.0000000 1.0000000 1.0000000 1.0000000
## 20   0.53846154 0.5833333 0.4000000 0.5833333 0.6000000
## 21   0.60000000 0.5000000 0.4545455 0.5384615 0.6363636
## 22   0.40000000 0.4000000 0.3636364 0.5000000 0.5000000
## 23   0.33333333 0.3333333 0.3636364 0.3750000 0.4000000
## 24   0.77777778 0.8571429 0.5000000 0.6666667 0.6666667
## 25   0.40000000 0.4444444 0.3750000 0.6000000 0.1666667
## 26   0.42857143 0.6250000 1.0000000 0.7500000 0.5714286
## 27   0.00000000 0.0000000 0.0000000 0.0000000 0.0000000
## 28   0.41666667 0.6000000 0.5000000 0.4000000 0.5555556
## 29   0.60000000 0.6666667 0.6250000 0.6666667 0.8571429
## 30   0.46153846 0.5000000 0.3636364 0.3333333 0.5000000
## 31   0.63636364 0.6428571 0.7777778 0.6363636 0.6923077
## 32   0.88888889 0.7272727 0.8181818 0.7777778 0.7500000
## 33   1.00000000 0.5000000 0.5833333 0.6363636 0.2500000
## 34   0.60000000 0.5555556 0.5000000 0.5000000 0.4545455
## 35   0.70000000 0.7272727 0.8750000 0.5714286 0.7777778
## 36   0.50000000 0.5000000 0.7000000 0.4615385 0.4166667
## 37   1.00000000 1.0000000 0.9090909 0.8181818 0.8000000
## 38   0.40000000 0.4166667 0.4000000 0.5384615 0.4000000
## 39   0.70000000 0.7500000 0.7142857 0.7777778 0.7000000
## 40   0.66666667 0.9000000 0.8181818 0.7000000 0.9090909
## 41   0.80000000 0.8000000 0.8888889 0.8750000 0.8750000
## 42   0.75000000 0.6666667 0.7000000 0.5714286 0.7142857
## 43   0.60000000 0.4285714 0.6666667 0.6000000 0.7142857
## 44   0.72727273 0.6666667 0.7777778 1.0000000 0.7500000
## 45   0.62500000 0.8181818 0.7000000 0.8000000 0.6363636
## 46   0.45454545 0.5000000 0.6250000 0.6666667 0.8571429
## 47   0.50000000 0.4285714 0.5000000 0.5000000 0.4000000
## 48   0.75000000 0.3333333 0.5000000 0.7500000 0.8571429
## 49   0.50000000 0.7777778 0.7142857 0.5555556 0.5555556
## 50   1.00000000 1.0000000 0.8181818 1.0000000 1.0000000
## 51   0.60000000 0.7500000 0.8571429 0.6666667 0.7142857
## 52   0.14285714 0.3750000 0.5000000 0.4444444 0.2857143
## 53   1.00000000 0.5714286 0.8571429 0.7000000 0.7142857
## 54   1.00000000 0.8181818 0.8000000 0.7777778 0.8181818
```

```
## 55   0.33333333 0.4000000 0.5555556 0.3636364 0.3636364
## 56   0.25000000 0.4000000 0.4444444 0.3750000 0.3750000
## 57   0.50000000 0.8000000 0.5454545 0.5454545 0.4444444
## 58   0.63636364 0.8571429 0.5454545 0.7272727 0.5000000
## 59   0.72727273 0.8888889 0.8000000 0.8333333 0.7857143
## 60   0.28571429 0.5000000 0.4285714 0.5000000 0.6250000
## 61   0.55555556 0.5714286 0.7142857 0.7777778 0.7500000
## 62   0.87500000 0.8571429 0.7500000 0.7500000 0.7142857
## 63   0.85714286 0.6250000 0.8000000 0.6250000 0.8571429
## 64   0.75000000 0.6000000 1.0000000 0.3333333 0.6666667
## 65   0.50000000 0.5000000 0.8333333 0.6000000 0.8571429
## 66   0.75000000 0.6250000 1.0000000 0.5000000 0.6666667
## 67   0.66666667 0.7500000 1.0000000 0.6666667 0.7142857
## 68   0.81818182 0.8000000 0.7272727 0.7777778 0.9000000
## 69   0.62500000 0.7777778 0.6250000 1.0000000 0.5454545
## 70   0.66666667 0.8333333 0.8000000 0.5000000 1.0000000
## 71   0.40000000 0.4000000 0.2500000 0.3636364 0.5000000
## 72   0.60000000 0.6666667 0.7272727 0.6250000 0.7777778
## 73   0.70000000 0.7000000 0.6363636 0.8000000 0.8181818
## 74   0.55555556 0.5000000 0.3333333 0.5714286 0.6250000
## 75   0.00000000 0.0000000 0.0000000 0.0000000 0.0000000
## 76   1.00000000 0.8571429 0.9000000 1.0000000 0.9000000
## 77   0.72727273 0.8750000 0.6923077 0.8181818 0.8181818
## 78   0.77777778 1.0000000 0.8888889 0.8571429 0.6666667
## 79   0.14285714 0.2500000 0.2500000 0.1000000 0.1250000
## 80   0.66666667 0.5000000 0.5000000 0.4000000 0.5000000
## 81   0.80000000 0.7777778 1.0000000 0.7500000 0.7500000
## 82   0.83333333 0.5000000 0.6363636 0.7142857 0.6666667
## 83   0.80000000 0.8750000 1.0000000 0.7777778 0.8333333
## 84   0.28571429 0.1428571 0.1666667 0.0000000 0.0000000
## 85   0.33333333 0.3333333 0.2857143 0.3000000 0.3333333
## 86   0.83333333 0.8571429 0.8333333 0.6000000 0.5714286
## 87   0.55555556 0.8000000 0.8000000 0.7142857 0.7777778
## 88   0.66666667 1.0000000 0.8888889 0.6000000 1.0000000
## 89   0.50000000 0.5555556 0.5714286 0.3333333 0.3333333
## 90   1.00000000 0.7500000 0.5000000 0.7142857 0.6666667
## 91   0.85714286 0.8333333 0.6000000 0.4285714 0.5000000
## 92   0.71428571 0.8181818 0.8750000 0.8000000 0.6666667
## 93   0.75000000 0.8888889 0.7777778 0.7500000 0.8000000
## 94   0.55555556 0.6000000 0.5000000 0.6250000 0.5714286
## 95   0.80000000 1.0000000 0.7000000 0.6666667 0.8750000
## 96   1.00000000 0.8333333 1.0000000 0.7142857 0.8571429
## 97   0.50000000 0.4000000 0.1250000 0.6000000 0.2500000
## 98   0.33333333 0.8000000 1.0000000 0.5714286 0.4000000
## 99   1.00000000 0.2500000 0.4285714 0.5714286 0.7500000
## 100  0.50000000 0.2000000 0.5000000 0.3750000 0.6000000
## 101  0.45454545 0.5000000 0.5000000 0.6000000 0.4444444
## 102  0.71428571 0.6666667 0.5000000 0.6000000 0.4000000
## 103  0.57142857 0.6000000 0.5000000 0.5000000 0.6666667
## 104  0.66666667 0.8571429 0.7142857 0.7777778 0.6666667
## 105  0.50000000 0.6666667 0.6666667 0.3333333 0.4000000
## 106  0.66666667 0.4000000 0.6666667 0.3333333 0.5714286
## 107  0.50000000 0.5000000 0.6666667 0.0000000 0.2000000
## 108  0.70000000 0.7000000 1.0000000 0.6666667 0.6000000
## 109  0.71428571 0.8333333 0.7142857 1.0000000 0.6666667
## 110  0.00000000 0.0000000 0.0000000 0.0000000 0.0000000
## 111  0.66666667 0.4285714 0.7142857 0.8000000 0.8571429
## 112  1.00000000 0.5000000 0.8333333 0.8333333 0.7500000
```

```
## 113 0.75000000 0.8000000 1.0000000 0.5555556 0.4000000
## 114 0.09090909 0.0000000 0.5000000 0.2500000 0.1666667
## 115 0.66666667 0.5000000 0.5000000 0.2000000 0.7500000
## 116 0.33333333 0.1666667 0.0000000 0.2000000 0.1428571
## 117 1.00000000 0.8000000 0.8333333 0.8571429 0.5000000
## 118 1.00000000 0.8333333 0.8333333 0.7777778 0.6000000
## 119 0.20000000 0.1428571 0.2500000 0.2857143 0.2000000
## 120 0.20000000 0.1666667 0.0000000 0.0000000 0.3333333
## 121 0.60000000 0.5000000 0.4285714 0.1428571 0.4000000
## 122 0.85714286 1.0000000 0.8000000 0.8571429 0.7777778
## 123 0.50000000 0.5714286 0.0000000 0.4000000 1.0000000
## 124 0.60000000 0.0000000 1.0000000 0.5000000 0.7500000
## 125 0.16666667 0.3333333 0.1250000 0.4000000 0.2500000
## 126 0.50000000 0.4000000 0.1666667 0.6666667 0.5555556
## 127 0.75000000 0.3333333 0.6666667 1.0000000 1.0000000
## 128 1.00000000 0.5000000 0.6666667 0.5000000 1.0000000
## 129 0.62500000 1.0000000 0.7500000 0.6000000 0.6666667
## 130 0.75000000 0.6666667 0.5714286 0.5714286 0.6250000
## 131 0.71428571 0.6250000 1.0000000 0.6000000 0.8000000
## 132 0.71428571 1.0000000 0.8000000 0.7142857 0.6000000
## 133 0.20000000 0.4444444 0.2000000 0.3333333 0.4000000
## 134 0.42857143 0.3636364 0.3333333 0.2500000 0.4444444
## 135 0.50000000 0.8333333 0.5000000 0.7500000 0.6666667
## 136 0.66666667 0.3333333 0.6000000 0.7500000 0.7500000
## 137 0.62500000 0.6666667 0.5000000 0.5000000 0.4285714
## 138 0.16666667 0.5000000 0.6666667 0.2000000 0.5555556
## 139 0.22222222 0.1428571 0.2500000 0.0000000 0.1666667
## 140 0.16666667 0.0000000 0.0000000 0.3333333 0.2500000
## 141 0.60000000 0.6666667 0.5000000 0.6666667 0.3333333
## 142 1.00000000 0.3333333 0.7500000 0.6666667 0.4285714
## 143 0.22222222 0.1666667 0.0000000 0.4000000 0.5000000
## 144 0.66666667 1.0000000 0.5000000 1.0000000       NaN
## 145 0.40000000 0.3333333 0.2222222 0.4000000 0.2857143
## 146 0.28571429 0.6666667 0.2500000 0.5000000 0.2000000
## 147 0.25000000 0.4000000 0.3333333 0.5000000 0.4000000
## 148 0.75000000 0.3333333 0.8000000 0.7500000 1.0000000
## 149 0.75000000 0.6000000 0.5000000 1.0000000 0.6666667
## 150 0.25000000 0.1428571 0.3333333 0.2857143 0.3333333
## 151 0.66666667 0.7500000 0.4285714 0.4444444 0.5000000
## 152 0.28571429 0.2000000 0.4000000 0.0000000 0.2000000
## 153 0.75000000 0.8000000 0.8571429 0.4000000 0.0000000
## 154 0.28571429 0.0000000 0.3333333 0.5000000 0.2500000
## 155 0.16666667 0.5714286 0.4000000 0.2500000 0.6666667
## 156 0.00000000 0.0000000 0.0000000 0.0000000 0.0000000
## 157 0.00000000 0.0000000 0.0000000 0.0000000 0.0000000
## 158 0.66666667 1.0000000 0.8000000 0.6250000 0.7500000
## 159 0.75000000 0.8571429 0.0000000 0.5000000 1.0000000
## 160 0.33333333 0.0000000 0.1818182 0.0000000 0.2000000
## 161 0.16666667 0.2857143 0.2000000 0.2000000 0.2500000
## 162 0.50000000 0.0000000 0.3333333 1.0000000 1.0000000
## 163 0.75000000 0.6666667 0.5000000 0.5000000 1.0000000
## 164 0.20000000 0.0000000 0.0000000 0.3333333 0.2857143
## 165 0.50000000 0.5000000 0.0000000 0.3333333 0.5000000
## 166 0.00000000 0.0000000 0.0000000 0.0000000 0.1666667
## 167 0.50000000 1.0000000 0.5000000 0.1250000 0.7500000
## 168 0.25000000 0.1428571 0.3333333 0.1666667 0.2500000
## 169 0.00000000 0.0000000 0.3333333 0.0000000 0.0000000
## 170 0.33333333 0.3333333 1.0000000 0.4000000 0.0000000
```

```
## 171 0.42857143 0.1666667 0.2500000 0.5000000 0.2000000
## 172 0.40000000 0.4000000 0.5000000 0.2500000 0.1250000
## 173 0.71428571 0.6666667 0.5000000 1.0000000 0.5000000
## 174 0.25000000 0.0000000 0.0000000 0.0000000 0.0000000
## 175 0.50000000 0.4285714 0.2500000 0.6666667 0.4285714
## 176 0.50000000 0.5000000 0.1666667 0.0000000 0.5000000
## 177 0.33333333 0.5000000 0.3333333 0.2500000 0.5000000
## 178 0.57142857 0.5000000 0.4000000 0.8000000 1.0000000
## 179 1.00000000 0.7142857 0.8000000 0.3333333 1.0000000
## 180 0.33333333 0.2500000 0.4000000 0.3333333 0.4285714
## 181 0.00000000 0.0000000 0.0000000 0.0000000 0.0000000
## 182 0.50000000 0.2500000 0.0000000 0.5000000 0.5000000
## 183 1.00000000 0.2500000 0.3333333 1.0000000 0.4000000
## 184 0.57142857 0.5000000 0.6666667 0.7500000 0.5000000
## 185 0.60000000 0.5000000 0.2500000 0.4444444 0.4000000
## 186 1.00000000 0.1666667 0.2500000 0.3333333 0.5000000
## 187 0.75000000 0.5000000 0.7142857 0.3333333 0.1666667
## 188 0.33333333 0.1250000 0.2500000 0.3333333 0.5000000
## 189 0.40000000 0.0000000 0.0000000 0.6666667 0.0000000
## 190 0.50000000 1.0000000 0.5000000 0.6000000 0.3333333
## 191 0.25000000 1.0000000 0.5000000 0.3333333 0.5000000
## 192 0.20000000 0.1666667 0.3333333 0.3333333 0.3333333
## 193 0.25000000 0.0000000 0.0000000 0.1666667 0.0000000
## 194 0.50000000       NaN 0.2000000 0.7500000 1.0000000
## 195 0.66666667 0.8000000 0.6000000 0.7500000 0.5000000
## 196 0.25000000 0.0000000 0.0000000 0.1428571 0.0000000
## 197 0.80000000 0.3333333 0.6666667 0.8000000 0.8000000
## 198 0.25000000 0.0000000 0.0000000 0.5000000 0.0000000
## 199 0.14285714 0.0000000 0.2500000 0.1666667 0.1666667
## 200 0.25000000 0.3333333 0.0000000 0.2500000 0.2500000
## 201 0.00000000 0.2000000 0.2000000 0.1666667 0.0000000
## 202 0.80000000 0.5000000 0.8000000 0.5000000 0.6666667
## 203 0.20000000 0.2500000 0.2000000 0.0000000 0.4000000
## 204 0.66666667 0.2500000 0.5000000 1.0000000 0.5000000
## 205 0.25000000 0.0000000 1.0000000 0.2500000 1.0000000
## 206 0.00000000 0.2000000 0.3333333 0.5000000 0.2500000
## 207 0.66666667 0.4285714 0.5000000 1.0000000 0.7500000
## 208 0.25000000 0.2000000       NaN 0.0000000 0.3333333
## 209       NaN 0.1666667 0.0000000 0.3750000 0.7500000
## 210 0.00000000 0.0000000 0.2000000 0.0000000 0.0000000
## 211 0.20000000 0.1666667 0.0000000 0.5000000 0.2500000
## 212 0.25000000 0.5000000 1.0000000 0.6666667 0.6666667
## 213 0.00000000 0.3333333 0.5000000 0.5000000 0.7500000
## 214 0.28571429 0.6666667 0.2500000 0.5000000 0.0000000
## 215 0.25000000 0.2000000 0.0000000 0.2000000 0.2000000
## 216 0.33333333 0.5000000 0.0000000 0.0000000 0.3333333
## 217 0.33333333 0.4000000 0.0000000 0.2500000 0.5000000
## 218 0.00000000 0.5000000 0.5000000 0.0000000 0.6000000
## 219 0.40000000 0.6666667 0.6666667 0.0000000 0.5000000
## 220 0.33333333 1.0000000 0.4000000 0.6666667 1.0000000
## 221 1.00000000 0.5000000 0.5000000 0.6000000 0.4000000
## 222 0.50000000 0.4000000 0.6000000 0.5000000 0.7500000
## 223 0.20000000 0.0000000 0.0000000 0.0000000 0.0000000
## 224 0.40000000 1.0000000 0.3333333 0.5000000 1.0000000
## 225 0.75000000 0.5000000 0.7500000 0.5000000 0.4285714
## 226 0.75000000 1.0000000 0.6666667 1.0000000 0.8000000
## 227 1.00000000 0.0000000 0.6666667 1.0000000 0.2000000
## 228 0.20000000 0.0000000 0.0000000 0.0000000 0.1666667
```

```
## 229 0.33333333 0.2000000 0.3333333 0.2000000 0.2500000
## 230 0.33333333 0.5000000 0.6666667 0.3333333 0.5000000
## 231 1.00000000 0.3333333 0.5000000 0.0000000 0.0000000
## 232 0.60000000 0.8333333 1.0000000 0.7500000 1.0000000
## 233 0.00000000 0.0000000 0.3333333 0.5000000 1.0000000
## 234 0.75000000 0.2500000 0.5000000 0.0000000 0.4000000
## 235 0.00000000 0.3333333 0.0000000 0.1428571 0.3333333
## 236 0.33333333 0.2000000 0.2500000 0.1666667 0.2000000
## 237 0.00000000 0.0000000 0.2500000 0.0000000 0.0000000
## 238 0.33333333 0.0000000 1.0000000 0.3333333 0.0000000
## 239 0.25000000 0.5000000 0.5000000 0.5000000 0.0000000
## 240 0.50000000 0.2000000 0.3333333 0.5000000 0.1666667
## 241 0.00000000 0.0000000 0.2000000 0.0000000 0.2500000
## 242 0.00000000 0.0000000 0.0000000 0.1666667 0.0000000
## 243 1.00000000 0.5000000 0.0000000 0.5000000 1.0000000
## 244 0.50000000 0.6666667 0.3333333 0.3333333       NaN
## 245 0.00000000 0.0000000 0.0000000 0.0000000 0.0000000
## 246 0.50000000 0.0000000 0.0000000 0.2000000 0.0000000
## 247 0.50000000 0.0000000       NaN 0.3333333 0.0000000
## 248 0.75000000 0.0000000 0.3333333 0.5000000 0.5000000
## 249 1.00000000 0.5000000 0.6666667 0.5000000 0.2500000
## 250 0.60000000 0.5000000 1.0000000 0.6000000 0.6666667
## 251 0.33333333 0.6666667 0.5000000 0.2500000 0.3333333
## 252 0.00000000 0.0000000 0.0000000 0.0000000 0.0000000
## 253 0.33333333 0.0000000 0.0000000 0.0000000 0.0000000
## 254 0.33333333 0.3333333 0.0000000 0.2500000 0.0000000
## 255 0.25000000 0.0000000 0.0000000 1.0000000 0.3333333
## 256 0.40000000 0.3333333 0.6666667 0.2500000 0.0000000
## 257 0.75000000 1.0000000 0.2500000       NaN 0.3333333
## 258 0.33333333 0.0000000 0.5000000 0.1666667 0.3333333
## 259 0.33333333 0.2000000 0.2000000 0.5000000 0.0000000
## 260 0.50000000       NaN 0.3333333 0.4000000 0.2500000
## 261 0.33333333 0.0000000 0.0000000 0.2000000 0.3333333
## 262 0.00000000 0.0000000 0.0000000 0.0000000 0.0000000
## 263 0.00000000 0.0000000 0.0000000 0.0000000 0.0000000
## 264 0.16666667 0.2500000 0.3333333 0.2000000 0.2000000
## 265 0.40000000 0.5000000 0.0000000 0.6000000 0.5000000
## 266 0.25000000 0.3333333 0.2000000 0.2500000 0.2000000
## 267 0.40000000 1.0000000 0.2500000 0.6666667 0.5000000
## 268 0.33333333 0.5000000 0.4000000 0.5000000 0.1666667
## 269 0.33333333 0.2500000 0.2500000 1.0000000 0.5000000
## 270 0.50000000 0.3333333 0.5000000 0.3333333 0.2000000
## 271 0.33333333 0.2500000 0.3333333 0.2500000 0.3333333
## 272 0.00000000 0.2500000 0.3333333 0.5000000 0.0000000
## 273 0.33333333 0.3333333 0.0000000 0.1666667 0.0000000
## 274 0.16666667 0.3333333 0.1666667 0.2500000 0.2500000
## 275 0.50000000 0.4000000 1.0000000 0.4000000 0.3333333
## 276 0.40000000 0.5454545 0.5000000 0.2857143 0.4444444
## 277 0.66666667 0.5000000 0.5000000 0.5000000 0.2857143
## 278 0.41666667 0.4000000 0.8000000 0.5833333 0.6000000
## 279 0.33333333 0.5714286 0.4285714 0.4285714 0.2857143
## 280 1.00000000 0.6000000 0.8000000 0.5000000 0.7500000
## 281 0.00000000 0.0000000 0.0000000 0.5000000 0.0000000
## 282 0.50000000 0.3333333 0.6666667 0.3333333 0.5714286
## 283 0.20000000 0.5000000 0.2000000 0.0000000 0.3333333
## 284 0.25000000 0.3333333 0.1428571 0.3333333 0.5000000
## 285 0.50000000 0.2000000 0.0000000 0.2000000 0.5000000
## 286 0.00000000 0.3333333       NaN 0.2500000 0.0000000
```

```
## 287 0.66666667 0.5000000 0.5714286 0.5000000 0.3333333
## 288 0.50000000 0.0000000 0.0000000 0.0000000 0.5000000
## 289 0.33333333 0.7500000 0.5000000 0.7500000 1.0000000
## 290 0.50000000 0.2000000 0.2000000 0.6666667 0.5000000
## 291 0.33333333 0.3333333 0.5000000 0.0000000 0.0000000
## 292 1.00000000 0.2500000 0.5000000 0.5000000 0.3333333
## 293 0.60000000 1.0000000 0.6666667 0.5000000 0.4285714
## 294 0.50000000 0.5000000 0.0000000 0.5000000 0.5000000
## 295 1.00000000 0.6666667 0.0000000 0.5000000 0.6666667
## 296 0.50000000 0.3333333 1.0000000 0.0000000 1.0000000
## 297 0.33333333 0.4000000 0.0000000 0.3333333 1.0000000
## 298 0.70000000 0.7777778 0.8181818 0.5833333 0.7500000
## 299 0.25000000 0.6666667 0.3333333 0.5000000 1.0000000
## 300 1.00000000 0.5000000 0.5000000 0.5000000 0.5000000
##
## $specificity
##              1         2         3         4         5
## 1   0.8235294 0.8947368 0.8125000 0.9333333 0.8823529
## 2   0.9000000 1.0000000 0.9090909 1.0000000 1.0000000
## 3   0.8571429 1.0000000 1.0000000 0.9090909 1.0000000
## 4   0.8181818 0.9090909 1.0000000 0.8888889 1.0000000
## 5   1.0000000 0.8333333 1.0000000 1.0000000 1.0000000
## 6   0.6666667 0.9090909 0.7272727 0.8750000 0.8750000
## 7   0.9000000 0.8888889 1.0000000 0.7692308 0.9090909
## 8   1.0000000 0.8888889 1.0000000 1.0000000 1.0000000
## 9   0.5714286 0.7500000 0.5625000 0.6250000 0.7500000
## 10  0.8181818 1.0000000 0.9166667 0.8181818 1.0000000
## 11  1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 12  1.0000000 0.8333333 0.8571429 0.6666667 0.8888889
## 13  1.0000000 0.6000000 0.8181818 0.8000000 0.8000000
## 14  1.0000000 0.7000000 0.9090909 0.8888889 0.7777778
## 15  0.5454545 0.5555556 0.6000000 0.7000000 0.5454545
## 16  0.8571429 0.8571429 0.8750000 0.8571429 0.7777778
## 17  1.0000000 0.7777778 0.7777778 0.8571429 0.9166667
## 18  0.7500000 0.8461538 0.8333333 0.8333333 0.9090909
## 19  0.3846154 0.5000000 0.5000000 0.5555556 0.5000000
## 20  1.0000000 1.0000000 0.7000000 1.0000000 0.9000000
## 21  0.8000000 0.7500000 0.6666667 0.8571429 0.8888889
## 22  0.7000000 0.7000000 0.6666667 0.8750000 0.8750000
## 23  0.8571429 0.9090909 1.0000000 0.9166667 1.0000000
## 24  0.7272727 0.6923077 0.5000000 0.6363636 0.6363636
## 25  1.0000000 1.0000000 0.9166667 0.9333333 0.7857143
## 26  0.7692308 0.9166667 0.7777778 1.0000000 0.8461538
## 27  1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 28  0.7500000 0.9000000 0.8750000 0.7000000 0.8181818
## 29  0.8000000 0.7142857 0.7500000 0.7142857 0.8461538
## 30  1.0000000 0.8333333 0.7777778 0.7500000 1.0000000
## 31  0.6666667 0.8333333 0.7272727 0.6666667 0.8571429
## 32  0.7272727 0.6666667 0.7777778 0.6363636 0.5833333
## 33  0.9285714 0.8000000 1.0000000 1.0000000 0.5833333
## 34  0.9000000 0.8181818 0.8750000 0.8750000 0.7777778
## 35  0.7000000 0.7777778 0.7500000 0.5384615 0.7272727
## 36  0.8333333 0.8333333 0.9000000 0.7142857 0.6250000
## 37  0.5384615 0.5833333 0.6666667 0.5555556 0.5000000
## 38  0.7000000 0.7500000 0.7000000 1.0000000 0.7000000
## 39  0.7000000 0.6666667 0.6153846 0.7272727 0.7000000
## 40  0.7500000 0.9000000 0.8888889 0.7000000 1.0000000
## 41  0.7000000 0.5333333 0.7272727 0.6666667 0.6666667
```

```
## 42    0.6666667 0.6363636 0.7000000 0.5384615 0.6153846
## 43    0.8000000 0.6153846 0.8181818 0.8000000 0.7692308
## 44    0.7777778 0.6363636 0.7272727 0.7692308 0.6666667
## 45    0.5833333 0.8888889 0.7000000 0.8000000 0.6666667
## 46    0.6666667 0.6666667 0.7500000 0.8181818 0.8461538
## 47    0.7500000 0.7692308 0.9000000 0.7857143 0.7333333
## 48    0.8333333 0.5714286 0.6428571 0.6875000 0.8461538
## 49    0.7000000 0.9090909 0.7692308 0.7272727 0.7272727
## 50    0.7272727 0.6666667 0.6666667 0.5333333 0.6153846
## 51    0.4666667 0.5833333 0.6153846 0.5000000 0.5384615
## 52    0.6923077 0.8333333 0.9166667 0.9090909 0.7692308
## 53    0.6875000 0.6153846 0.7692308 0.8000000 0.6923077
## 54    0.8000000 0.6666667 0.6000000 0.5454545 0.6666667
## 55    0.8181818 0.9000000 1.0000000 0.8888889 0.8888889
## 56    0.8750000 1.0000000 1.0000000 0.9166667 0.9166667
## 57    0.6000000 0.9000000 0.6666667 0.6666667 0.5454545
## 58    0.8888889 0.8461538 0.7777778 1.0000000 0.7000000
## 59    0.6666667 0.7272727 0.7000000 0.8750000 1.0000000
## 60    0.6923077 0.8333333 0.7692308 0.7857143 0.9166667
## 61    0.5454545 0.5384615 0.6153846 0.7272727 0.6666667
## 62    0.8333333 0.7692308 0.7500000 0.7500000 0.6923077
## 63    0.7692308 0.6666667 0.6666667 0.6666667 0.7692308
## 64    0.8125000 0.8000000 0.7777778 0.7058824 0.8571429
## 65    0.5000000 0.5000000 0.6428571 0.5333333 0.6923077
## 66    0.5000000 0.5000000 0.5625000 0.4375000 0.5454545
## 67    0.5454545 0.5833333 0.6000000 0.5454545 0.5384615
## 68    0.7777778 0.7000000 0.6666667 0.6363636 0.8000000
## 69    0.6666667 0.8181818 0.6666667 0.7857143 0.6666667
## 70    0.4285714 0.5000000 0.4666667 0.3750000 0.6666667
## 71    0.8000000 0.8000000 0.6250000 0.7777778 0.8333333
## 72    0.6000000 0.7500000 0.7777778 0.5833333 0.7272727
## 73    0.6000000 0.6000000 0.5555556 0.7000000 0.7777778
## 74    0.6363636 0.5833333 0.5000000 0.6153846 0.6666667
## 75    1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 76    0.5454545 0.3846154 0.5000000 0.5000000 0.5000000
## 77    0.5555556 0.5833333 0.5714286 0.6666667 0.6666667
## 78    0.6363636 0.5625000 0.7272727 0.6153846 0.5454545
## 79    0.9230769 0.9375000 0.9375000 0.9000000 0.9166667
## 80    0.9090909 0.8000000 0.7500000 0.6666667 0.7500000
## 81    0.4666667 0.5454545 0.6153846 0.5000000 0.5000000
## 82    0.7857143 0.6428571 0.8888889 0.7692308 0.7142857
## 83    0.6000000 0.5833333 0.5714286 0.5454545 0.5000000
## 84    1.0000000 0.9230769 0.9285714 0.8666667 0.8750000
## 85    1.0000000 0.8823529 0.9230769 1.0000000 0.9285714
## 86    0.6428571 0.6923077 0.6428571 0.5333333 0.5384615
## 87    0.4545455 0.5333333 0.7000000 0.5384615 0.6363636
## 88    0.5714286 0.7142857 0.8181818 0.5333333 0.6250000
## 89    0.6666667 0.7272727 0.6923077 0.5714286 0.5714286
## 90    0.7857143 0.7500000 0.5555556 0.6923077 0.6428571
## 91    0.6923077 0.6428571 0.5333333 0.4615385 0.5000000
## 92    0.5384615 0.7777778 0.6666667 0.7000000 0.5000000
## 93    0.5000000 0.6363636 0.5454545 0.5000000 0.6000000
## 94    0.9090909 0.8000000 0.9000000 0.9166667 0.8461538
## 95    0.6000000 0.6153846 0.5000000 0.4285714 0.5833333
## 96    0.5882353 0.6428571 0.6250000 0.6153846 0.6923077
## 97    0.8000000 0.7000000 0.5000000 0.7333333 0.5833333
## 98    0.5000000 0.6666667 0.6470588 0.6153846 0.5333333
## 99    0.5000000 0.3750000 0.3846154 0.4615385 0.5000000
```

```
## 100 0.6428571 0.5333333 0.6250000 0.5833333 0.6666667
## 101 0.7777778 0.7500000 0.7142857 0.7333333 0.7272727
## 102 0.7692308 0.7142857 0.6250000 0.6666667 0.6000000
## 103 0.6923077 0.8000000 0.6666667 0.6428571 0.8181818
## 104 0.4545455 0.5384615 0.4615385 0.5454545 0.4285714
## 105 0.6666667 0.7857143 0.7857143 0.6470588 0.6666667
## 106 0.7058824 0.6666667 0.7058824 0.6470588 0.7692308
## 107 0.7500000 0.7857143 0.7647059 0.6666667 0.6666667
## 108 0.7000000 0.7000000 0.7142857 0.5714286 0.5333333
## 109 0.5384615 0.5714286 0.5384615 0.5294118 0.5000000
## 110 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 111 0.7142857 0.6153846 0.7692308 0.7333333 0.8461538
## 112 0.6250000 0.5000000 0.6428571 0.6428571 0.5625000
## 113 0.6875000 0.7333333 0.6666667 0.7272727 0.6000000
## 114 0.7777778 0.7857143 1.0000000 0.9166667 0.8571429
## 115 0.7142857 0.6666667 0.6666667 0.5333333 0.6875000
## 116 1.0000000 1.0000000 0.9411765 1.0000000 1.0000000
## 117 0.5625000 0.5333333 0.5714286 0.6153846 0.4375000
## 118 0.5833333 0.4285714 0.4285714 0.4545455 0.3333333
## 119 0.8666667 0.8461538 0.8750000 0.9230769 0.8666667
## 120 0.8666667 0.8571429 0.7692308 0.7500000 0.8823529
## 121 0.8000000 0.7500000 0.7692308 0.6153846 0.7333333
## 122 0.6153846 0.6923077 0.5333333 0.6153846 0.6363636
## 123 0.5555556 0.6153846 0.4705882 0.5333333 0.6470588
## 124 0.8000000 0.6842105 0.8235294 0.7500000 0.8125000
## 125 0.9285714 0.9411765 0.9166667 1.0000000 0.9375000
## 126 0.6428571 0.6000000 0.5000000 0.6470588 0.7272727
## 127 0.5000000 0.4117647 0.4705882 0.4736842 0.5000000
## 128 0.5625000 0.4285714 0.5000000 0.4166667 0.6428571
## 129 0.5833333 0.5555556 0.5625000 0.5333333 0.5294118
## 130 0.6666667 0.5714286 0.5384615 0.5384615 0.5833333
## 131 0.6153846 0.5833333 0.5263158 0.5333333 0.6000000
## 132 0.6153846 0.6250000 0.6000000 0.6153846 0.5333333
## 133 0.7333333 0.9090909 0.7333333 0.7857143 0.8000000
## 134 0.8461538 0.8888889 0.7857143 0.7500000 0.9090909
## 135 0.4444444 0.5714286 0.4444444 0.5000000 0.5000000
## 136 0.6470588 0.5882353 0.6666667 0.6875000 0.6875000
## 137 0.6666667 0.6428571 0.5714286 0.5714286 0.5384615
## 138 0.5714286 0.6875000 0.7857143 0.6000000 0.8181818
## 139 0.8181818 0.7692308 0.8333333 0.7333333 0.7857143
## 140 0.8571429 0.8235294 0.8333333 0.8823529 0.8750000
## 141 0.6666667 0.6470588 0.6111111 0.6470588 0.5714286
## 142 0.6315789 0.5882353 0.6875000 0.6470588 0.6153846
## 143 0.8181818 0.7857143 0.7142857 0.8666667 0.8333333
## 144 0.5294118 0.5882353 0.5000000 0.5555556 0.5000000
## 145 0.8000000 0.7857143 0.7272727 0.9000000 0.7692308
## 146 0.7692308 0.8235294 0.7500000 0.8125000 0.7333333
## 147 0.8125000 0.8666667 0.8235294 0.8750000 0.8666667
## 148 0.6875000 0.5882353 0.7333333 0.8333333 0.7058824
## 149 0.5625000 0.5333333 0.5000000 0.6250000 0.5294118
## 150 0.9375000 0.9230769 0.9411765 1.0000000 0.9411765
## 151 0.8571429 0.8125000 0.7692308 0.8181818 0.7500000
## 152 0.8461538 0.8000000 0.8666667 0.7500000 0.8000000
## 153 0.6250000 0.6666667 0.7692308 0.5333333 0.5263158
## 154 0.9230769 0.8125000 0.8823529 1.0000000 0.8750000
## 155 0.7142857 0.9230769 0.8000000 0.7500000 0.8235294
## 156 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 157 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
```

```
## 158 0.6428571 0.7333333 0.6666667 0.6666667 0.6250000
## 159 0.6250000 0.7692308 0.5263158 0.5625000 0.6875000
## 160 0.9285714 0.8235294 0.8888889 0.8333333 0.8666667
## 161 0.7857143 0.8461538 0.8000000 0.8000000 0.8333333
## 162 0.7777778 0.6428571 0.7857143 0.8333333 0.7894737
## 163 0.8750000 0.8235294 0.8125000 0.7777778 0.8823529
## 164 0.8000000 0.7894737 0.7500000 0.8571429 0.8461538
## 165 0.8750000 0.8750000 0.7777778 0.8235294 0.8750000
## 166 0.8461538 0.8461538 0.8823529 0.8461538 0.9285714
## 167 0.7142857 0.7222222 0.6875000 0.5000000 0.7500000
## 168 0.9375000 0.9230769 1.0000000 0.9285714 0.9375000
## 169 0.9411765 0.9333333 1.0000000 0.9444444 0.9333333
## 170 0.6470588 0.6470588 0.7222222 0.6666667 0.6315789
## 171 0.9230769 0.7857143 0.8333333 0.8750000 0.8000000
## 172 0.8000000 0.8000000 0.8571429 0.7500000 0.6666667
## 173 0.6153846 0.5294118 0.5000000 0.6666667 0.5000000
## 174 0.9375000 0.8666667 0.8750000 0.8888889 0.8750000
## 175 0.6428571 0.6153846 0.5625000 0.6470588 0.6153846
## 176 0.7500000 0.7857143 0.6428571 0.6666667 0.7500000
## 177 0.9285714 0.8888889 0.8823529 0.8750000 0.8888889
## 178 0.6153846 0.5714286 0.5333333 0.6666667 0.6111111
## 179 0.7500000 0.7692308 0.7333333 0.5714286 0.7058824
## 180 0.9285714 0.8750000 0.9333333 0.9285714 1.0000000
## 181 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 182 0.7222222 0.6875000 0.6250000 0.7857143 0.7222222
## 183 0.8333333 0.7500000 0.7647059 0.7894737 0.8000000
## 184 0.9230769 0.7777778 0.8235294 0.8750000 0.8571429
## 185 0.8666667 0.8125000 0.7500000 0.9090909 0.8000000
## 186 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 187 0.8750000 0.8571429 1.0000000 0.7857143 0.7142857
## 188 0.8823529 0.8333333 0.8750000 0.8823529 0.8888889
## 189 0.8000000 0.7058824 0.7368421 0.8235294 0.7222222
## 190 0.6428571 0.7058824 0.6428571 0.6666667 0.5714286
## 191 0.7500000 0.8333333 0.8125000 0.7857143 0.8125000
## 192 0.8666667 0.8571429 0.8823529 0.9285714 0.8823529
## 193 1.0000000 0.9411765 0.9411765 1.0000000 0.9444444
## 194 0.7222222 0.7000000 0.6666667 0.8125000 0.8750000
## 195 0.7857143 0.8000000 0.7333333 0.7500000 0.6666667
## 196 1.0000000 0.9444444 0.9444444 1.0000000 0.9411765
## 197 0.7333333 0.5714286 0.7142857 0.7333333 0.7333333
## 198 0.9375000 0.8823529 0.8750000 1.0000000 0.8888889
## 199 0.9230769 0.8823529 0.9375000 0.9285714 0.9285714
## 200 0.9375000 1.0000000 0.8571429 0.9375000 0.9375000
## 201 0.8888889 0.9333333 0.9333333 0.9285714 0.8666667
## 202 0.7333333 0.6250000 0.7333333 0.6428571 0.7142857
## 203 0.8000000 0.8125000 0.8000000 0.7777778 0.8666667
## 204 0.8823529 0.8125000 0.8750000 0.8888889 0.8750000
## 205 0.8750000 0.8235294 1.0000000 0.8750000 1.0000000
## 206 0.8947368 0.9333333 0.9411765 0.9444444 0.9375000
## 207 0.8571429 0.7692308 0.7500000 0.7777778 0.8125000
## 208 0.7500000 0.7333333 0.7500000 0.7058824 0.7647059
## 209 0.7000000 0.6428571 0.6250000 0.7500000 0.8125000
## 210 0.9333333 0.9375000 1.0000000 0.9444444 0.9375000
## 211 0.9333333 0.9285714 0.8823529 0.9444444 0.9375000
## 212 0.8333333 0.8333333 0.8421053 0.8823529 0.8823529
## 213 0.7058824 0.7647059 0.7777778 0.7777778 0.8750000
## 214 0.9230769 0.9411765 0.8750000 0.8888889 0.8125000
## 215 0.7500000 0.7333333 0.7368421 0.7333333 0.7333333
```

```
## 216 0.8571429 0.8333333 0.7500000 0.7777778 0.8235294
## 217 0.8235294 0.8666667 0.7333333 0.8125000 0.9285714
## 218 0.7058824 0.7777778 0.7777778 0.6875000 0.8666667
## 219 0.8000000 0.9285714 0.8235294 0.7368421 0.8125000
## 220 0.7647059 0.7894737 0.8000000 0.8235294 0.8823529
## 221 0.8947368 0.9375000 1.0000000 1.0000000 0.9333333
## 222 0.9375000 0.9333333 1.0000000 0.9375000 1.0000000
## 223 1.0000000 0.9411765 0.9375000 0.9333333 0.9473684
## 224 0.8666667 0.8421053 0.8235294 0.8750000 0.8888889
## 225 0.9375000 0.8750000 0.9375000 0.8750000 0.9230769
## 226 0.8125000 0.9333333 0.7647059 0.8235294 0.8666667
## 227 0.7777778 0.6470588 0.7647059 0.7777778 0.6666667
## 228 1.0000000 0.9375000 0.9411765 0.9444444 1.0000000
## 229 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 230 0.8235294 0.8750000 0.8823529 0.8235294 0.8333333
## 231 0.7894737 0.7647059 0.7777778 0.7368421 0.7222222
## 232 0.8666667 1.0000000 0.7894737 0.8750000 0.8333333
## 233 0.7894737 0.7894737 0.8235294 0.8750000 0.8888889
## 234 1.0000000 0.8750000 0.8888889 0.8421053 0.9333333
## 235 0.9444444 1.0000000 0.9411765 1.0000000 1.0000000
## 236 0.9285714 0.8666667 0.8750000 0.8571429 0.8666667
## 237 0.8750000 0.8823529 0.9375000 0.8750000 0.8750000
## 238 1.0000000 0.9473684 1.0000000 1.0000000 0.9411765
## 239 0.8750000 0.9375000 0.9375000 0.8888889 0.8333333
## 240 1.0000000 0.9333333 0.9411765 1.0000000 0.9285714
## 241 0.9375000 0.9375000 1.0000000 0.9333333 1.0000000
## 242 0.9375000 0.9333333 0.9375000 1.0000000 0.9444444
## 243 0.9444444 0.9375000 0.8421053 0.8888889 0.8947368
## 244 0.9375000 0.9411765 0.8823529 0.9285714 0.8500000
## 245 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 246 1.0000000 0.9444444 0.9375000 1.0000000 0.9473684
## 247 1.0000000 0.9444444 0.9500000 1.0000000 0.9411765
## 248 1.0000000 0.8125000 0.8823529 0.9375000 0.8888889
## 249 0.9411765 0.8333333 0.8823529 0.8333333 0.8125000
## 250 1.0000000 0.8888889 1.0000000 1.0000000 0.9411765
## 251 0.9285714 0.9411765 0.9375000 0.8750000 0.8823529
## 252 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 253 1.0000000 0.9444444 0.9411765 0.9285714 0.9411765
## 254 1.0000000 1.0000000 0.9444444 1.0000000 0.9473684
## 255 0.9375000 0.8888889 0.8823529 0.9473684 0.9411765
## 256 1.0000000 0.9411765 1.0000000 1.0000000 0.8888889
## 257 0.9375000 0.8888889 0.8125000 0.8000000 0.8235294
## 258 1.0000000 0.8750000 1.0000000 0.9285714 0.9411765
## 259 0.9411765 0.9333333 0.9333333 0.9444444 0.8888889
## 260 0.9444444 0.9000000 0.9411765 1.0000000 0.9375000
## 261 0.9411765 0.8750000 0.8888889 0.9333333 0.9411765
## 262 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 263 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 264 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 265 0.9333333 0.9375000 0.8125000 1.0000000 0.8888889
## 266 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 267 1.0000000 1.0000000 0.9375000 1.0000000 1.0000000
## 268 0.9411765 0.9444444 1.0000000 1.0000000 0.9285714
## 269 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 270 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 271 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 272 0.9411765 1.0000000 1.0000000 1.0000000 0.9411765
## 273 0.9411765 0.9411765 0.8888889 0.9285714 0.8666667
```

```
## 274 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## 275 1.0000000 1.0000000 0.9473684 1.0000000 0.9411765
## 276 0.7333333 1.0000000 0.9000000 0.6923077 0.8181818
## 277 0.6470588 0.7000000 0.6666667 0.6428571 0.5384615
## 278 0.7500000 0.7000000 0.8000000 1.0000000 0.9000000
## 279 0.6470588 0.7692308 0.6923077 0.6923077 0.6153846
## 280 0.5000000 0.4666667 0.5333333 0.4444444 0.5000000
## 281 0.9473684 0.9444444 0.9444444 1.0000000 0.9444444
## 282 0.6875000 0.6428571 0.7857143 0.6470588 0.7692308
## 283 0.9333333 1.0000000 0.9333333 0.8947368 0.9411765
## 284 0.6875000 0.7058824 0.6153846 0.7142857 0.7500000
## 285 0.8888889 0.8666667 0.8421053 0.8666667 0.9375000
## 286 0.8125000 0.8823529 0.8500000 0.8750000 0.8235294
## 287 0.9285714 0.7777778 0.9230769 0.8125000 0.7647059
## 288 0.8888889 0.8125000 0.8125000 0.8235294 0.8888889
## 289 0.8571429 0.9375000 0.8333333 0.9375000 0.9411765
## 290 1.0000000 0.9333333 0.9333333 1.0000000 0.9444444
## 291 0.8823529 0.8823529 0.8888889 0.8235294 0.8000000
## 292 0.8947368 0.8750000 0.8888889 0.9375000 0.8823529
## 293 0.9333333 1.0000000 0.8823529 0.9285714 0.9230769
## 294 0.8750000 0.8750000 0.7894737 0.8750000 0.8750000
## 295 0.8888889 0.8823529 0.7894737 0.8750000 0.8823529
## 296 1.0000000 0.8823529 0.9444444 0.8235294 0.9444444
## 297 0.9285714 0.9333333 0.8125000 0.9285714 0.8947368
## 298 0.7000000 0.7272727 0.8888889 0.6250000 0.8750000
## 299 0.9375000 1.0000000 0.9411765 1.0000000 1.0000000
## 300 0.9473684 0.9444444 0.9444444 0.9444444 0.9444444
##
## $kappa
##                   1           2           3           4           5
## 1     -0.17647059  0.45945946 -0.20689655  0.38461538  0.21568627
## 2      0.20000000  0.40000000  0.25531915  0.19354839  0.33962264
## 3      0.13043478  0.42857143  0.50000000  0.36842105  0.30434783
## 4      0.15789474  0.36842105  0.42857143  0.23809524  0.57894737
## 5      0.16666667 -0.19047619  0.23913043  0.16666667  0.16666667
## 6      0.30000000  0.90000000  0.50000000  0.60000000  0.60000000
## 7      0.30000000  0.23809524  0.57894737  0.05882353  0.36842105
## 8      0.36363636  0.23809524  0.36363636  0.50000000  0.36363636
## 9      0.20000000  0.60000000  0.20000000  0.40000000  0.60000000
## 10     0.15789474  0.42857143  0.44444444  0.15789474  0.57894737
## 11     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
## 12     0.78260870  0.56521739  0.68085106  0.48979592  0.89795918
## 13     0.70000000  0.20000000  0.70000000  0.60000000  0.60000000
## 14     0.61165049  0.10000000  0.58762887  0.41747573  0.22330097
## 15     0.20792079  0.19191919  0.30000000  0.50000000  0.20792079
## 16     0.50000000  0.50000000  0.60000000  0.50000000  0.50000000
## 17     0.60000000  0.13461538  0.13461538  0.19642857  0.56521739
## 18     0.25531915  0.56043956  0.46808511  0.46808511  0.58762887
## 19     0.30434783  0.50000000  0.50000000  0.57894737  0.50000000
## 20     0.44954128  0.52830189  0.10000000  0.52830189  0.50000000
## 21     0.40000000  0.23076923  0.11764706  0.33962264  0.50980392
## 22     0.10000000  0.10000000  0.02912621  0.33962264  0.33962264
## 23     0.21052632  0.25531915  0.33962264  0.31818182  0.40000000
## 24     0.50000000  0.50000000  0.00000000  0.30000000  0.30000000
## 25     0.40000000  0.46808511  0.31818182  0.57142857 -0.05263158
## 26     0.20454545  0.56521739  0.41176471  0.78260870  0.43181818
## 27     0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
## 28     0.15094340  0.50000000  0.33962264  0.10000000  0.38144330
```

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```
## 29   0.40000000   0.34782609   0.37500000   0.34782609   0.68085106
## 30   0.37500000   0.34782609   0.13461538   0.07407407   0.44444444
## 31   0.30000000   0.40000000   0.50000000   0.30000000   0.50000000
## 32   0.60396040   0.39393939   0.59595960   0.40594059   0.31372549
## 33   0.88636364   0.30000000   0.52830189   0.61165049  -0.17021277
## 34   0.50000000   0.38144330   0.33962264   0.33962264   0.22330097
## 35   0.40000000   0.50000000   0.60000000   0.10000000   0.50000000
## 36   0.25925926   0.25925926   0.60000000   0.15094340   0.03846154
## 37   0.44954128   0.52830189   0.58762887   0.38144330   0.30000000
## 38   0.10000000   0.15094340   0.10000000   0.44954128   0.10000000
## 39   0.40000000   0.40000000   0.30000000   0.50000000   0.40000000
## 40   0.40000000   0.80000000   0.70000000   0.40000000   0.90000000
## 41   0.50000000   0.23809524   0.60396040   0.50980392   0.50980392
## 42   0.40000000   0.30000000   0.40000000   0.10000000   0.30000000
## 43   0.40000000   0.04255319   0.48979592   0.40000000   0.46808511
## 44   0.50000000   0.30000000   0.50000000   0.70000000   0.40000000
## 45   0.20000000   0.70000000   0.40000000   0.60000000   0.30000000
## 46   0.11764706   0.16666667   0.37500000   0.48979592   0.68085106
## 47   0.21052632   0.20454545   0.40000000   0.28571429   0.12500000
## 48   0.58333333  -0.08695652   0.13043478   0.31818182   0.68085106
## 49   0.20000000   0.69387755   0.46808511   0.28571429   0.28571429
## 50   0.70588235   0.61538462   0.48979592   0.36363636   0.52830189
## 51   0.04761905   0.31372549   0.41747573   0.13461538   0.22330097
## 52  -0.17647059   0.22222222   0.44444444   0.36842105   0.05882353
## 53   0.46808511   0.17525773   0.58762887   0.50000000   0.38144330
## 54   0.80000000   0.48979592   0.40000000   0.31372549   0.48979592
## 55   0.15789474   0.30000000   0.57894737   0.23809524   0.23809524
## 56   0.10714286   0.40000000   0.46808511   0.31818182   0.31818182
## 57   0.10000000   0.70000000   0.20792079   0.20792079  -0.01010101
## 58   0.50980392   0.68085106   0.31372549   0.70588235   0.20000000
## 59   0.39393939   0.60396040   0.50000000   0.69387755   0.68750000
## 60  -0.02272727   0.34782609   0.20454545   0.28571429   0.56521739
## 61   0.10000000   0.10000000   0.30000000   0.50000000   0.40000000
## 62   0.69387755   0.58762887   0.48979592   0.48979592   0.38144330
## 63   0.58762887   0.28571429   0.36842105   0.28571429   0.58762887
## 64   0.47368421   0.37500000   0.41176471   0.02777778   0.52380952
## 65   0.00000000   0.00000000   0.40000000   0.10000000   0.50000000
## 66   0.15094340   0.11764706   0.33962264  -0.03773585   0.20792079
## 67   0.20792079   0.31372549   0.42857143   0.20792079   0.22330097
## 68   0.59595960   0.50000000   0.39393939   0.40594059   0.70000000
## 69   0.28571429   0.59595960   0.28571429   0.68750000   0.20792079
## 70   0.07407407   0.25925926   0.18181818  -0.07142857   0.61538462
## 71   0.20000000   0.20000000  -0.11111111   0.13461538   0.34782609
## 72   0.20000000   0.40000000   0.50000000   0.20000000   0.50000000
## 73   0.30000000   0.30000000   0.19191919   0.50000000   0.59595960
## 74   0.19191919   0.08163265  -0.14583333   0.17525773   0.28571429
## 75   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
## 76   0.51923077   0.19642857   0.40000000   0.44444444   0.40000000
## 77   0.28571429   0.42307692   0.25531915   0.48979592   0.48979592
## 78   0.40594059   0.33962264   0.60396040   0.41747573   0.20792079
## 79   0.07894737   0.23076923   0.23076923   0.00000000   0.04761905
## 80   0.58762887   0.30000000   0.25531915   0.05882353   0.25531915
## 81   0.18181818   0.31372549   0.52830189   0.23076923   0.23076923
## 82   0.56521739   0.13043478   0.50980392   0.46808511   0.34782609
## 83   0.40000000   0.42307692   0.44444444   0.31372549   0.25925926
## 84   0.34210526   0.07894737   0.11764706  -0.16666667  -0.15384615
## 85   0.35483871   0.21568627   0.24050633   0.30000000   0.30555556
## 86   0.40000000   0.50000000   0.40000000   0.10000000   0.10000000
```

```
## 87    0.00990099  0.23809524  0.50000000  0.22330097  0.40594059
## 88    0.20000000  0.60000000  0.70000000  0.10000000  0.40000000
## 89    0.16666667  0.28571429  0.25531915 -0.08695652 -0.08695652
## 90    0.68750000  0.48979592  0.02173913  0.38144330  0.27083333
## 91    0.50000000  0.40000000  0.10000000 -0.10000000  0.00000000
## 92    0.22330097  0.59595960  0.50980392  0.50000000  0.13461538
## 93    0.23076923  0.50980392  0.31372549  0.23076923  0.40000000
## 94    0.47916667  0.37500000  0.40000000  0.56521739  0.43181818
## 95    0.40000000  0.52830189  0.20000000  0.07407407  0.42307692
## 96    0.30000000  0.40000000  0.40000000  0.30000000  0.50000000
## 97    0.30000000  0.10000000 -0.38297872  0.29411765 -0.17021277
## 98   -0.14583333  0.36842105  0.35483871  0.17525773 -0.05263158
## 99    0.16666667 -0.22641509 -0.16504854  0.02912621  0.15094340
## 100   0.13043478 -0.22222222  0.09090909 -0.04166667  0.22222222
## 101   0.22330097  0.25531915  0.20454545  0.29411765  0.17525773
## 102   0.46808511  0.34782609  0.09090909  0.22222222  0.00000000
## 103   0.25531915  0.40000000  0.16666667  0.13043478  0.48979592
## 104   0.11764706  0.33962264  0.15094340  0.31372549  0.07407407
## 105   0.07894737  0.43181818  0.43181818 -0.01265823  0.05882353
## 106   0.24050633  0.05882353  0.24050633 -0.01265823  0.34065934
## 107   0.21052632  0.28571429  0.30555556 -0.17647059 -0.12500000
## 108   0.40000000  0.40000000  0.60000000  0.20000000  0.10000000
## 109   0.22330097  0.32692308  0.22330097  0.25233645  0.13461538
## 110   0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
## 111   0.34782609  0.04255319  0.46808511  0.44444444  0.68085106
## 112   0.40000000  0.00000000  0.40000000  0.40000000  0.20000000
## 113   0.31818182  0.44444444  0.28571429  0.28571429  0.00000000
## 114  -0.12149533 -0.25000000  0.58333333  0.18604651  0.02777778
## 115   0.34782609  0.16666667  0.16666667 -0.22222222  0.31818182
## 116   0.45945946  0.21875000 -0.08108108  0.27272727  0.17808219
## 117   0.33962264  0.23809524  0.32692308  0.41747573 -0.03773585
## 118   0.52830189  0.19642857  0.19642857  0.22330097 -0.04347826
## 119   0.07692308 -0.01265823  0.13793103  0.24050633  0.07692308
## 120   0.07692308  0.02777778 -0.26582278 -0.27906977  0.21568627
## 121   0.37500000  0.21052632  0.20454545 -0.25000000  0.12500000
## 122   0.41747573  0.61165049  0.23809524  0.41747573  0.40594059
## 123   0.02173913  0.17525773 -0.29032258 -0.05263158  0.35483871
## 124   0.37500000 -0.09375000  0.58333333  0.21052632  0.47368421
## 125   0.11764706  0.31818182  0.04761905  0.50000000  0.23076923
## 126   0.13043478  0.00000000 -0.30434783  0.18604651  0.28571429
## 127   0.15094340 -0.12149533  0.06542056  0.08256881  0.16666667
## 128   0.33962264 -0.05769231  0.13461538 -0.07843137  0.51923077
## 129   0.20000000  0.20000000  0.20000000  0.10000000  0.10000000
## 130   0.40000000  0.20000000  0.10000000  0.10000000  0.20000000
## 131   0.30000000  0.20000000  0.10000000  0.10000000  0.30000000
## 132   0.30000000  0.40000000  0.30000000  0.30000000  0.10000000
## 133  -0.06666667  0.36842105 -0.06666667  0.12500000  0.20000000
## 134   0.29411765  0.23809524  0.12500000  0.00000000  0.36842105
## 135  -0.01851852  0.32692308 -0.01851852  0.15094340  0.13461538
## 136   0.18604651 -0.04651163  0.22222222  0.31818182  0.31818182
## 137   0.28571429  0.27083333  0.06250000  0.06250000 -0.03092784
## 138  -0.25000000  0.14634146  0.43181818 -0.17647059  0.38144330
## 139   0.04255319 -0.09756098  0.09090909 -0.28571429 -0.05263158
## 140   0.02777778 -0.17647059 -0.13636364  0.21568627  0.13793103
## 141   0.22222222  0.18604651  0.04761905  0.18604651 -0.08695652
## 142   0.14634146 -0.04651163  0.31818182  0.18604651  0.04255319
## 143   0.04255319 -0.05263158 -0.31578947  0.28571429  0.23076923
## 144   0.10000000  0.30000000  0.00000000  0.20000000  0.00000000
```

```
## 145   0.20000000   0.12500000  -0.05263158   0.30000000   0.05882353
## 146   0.05882353   0.38461538   0.00000000   0.28571429  -0.06666667
## 147   0.06250000   0.28571429   0.13793103   0.37500000   0.28571429
## 148   0.31818182  -0.04651163   0.44444444   0.58333333   0.41860465
## 149   0.20000000   0.10000000   0.00000000   0.40000000   0.10000000
## 150   0.23076923   0.07894737   0.31818182   0.34210526   0.31818182
## 151   0.52380952   0.47368421   0.20454545   0.27083333   0.21052632
## 152   0.14634146   0.00000000   0.28571429  -0.25000000   0.00000000
## 153   0.25531915   0.36842105   0.58762887  -0.05263158  -0.09890110
## 154   0.24050633  -0.20689655   0.21568627   0.58333333   0.13793103
## 155  -0.12500000   0.52941176   0.20000000   0.00000000   0.38461538
## 156   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
## 157   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
## 158   0.27083333   0.57894737   0.36842105   0.28571429   0.25531915
## 159   0.25531915   0.58762887  -0.09890110   0.04255319   0.46808511
## 160   0.30555556  -0.17647059   0.06542056  -0.13636364   0.07692308
## 161  -0.05263158   0.14634146   0.00000000   0.00000000   0.09090909
## 162   0.16666667  -0.37500000   0.12500000   0.50000000   0.27272727
## 163   0.57142857   0.38461538   0.28571429   0.16666667   0.69230769
## 164   0.00000000  -0.08695652  -0.25000000   0.21052632   0.14634146
## 165   0.37500000   0.37500000  -0.15384615   0.13793103   0.37500000
## 166  -0.18421053  -0.18421053  -0.13636364  -0.18421053   0.11764706
## 167   0.20454545   0.34210526   0.14634146  -0.38297872   0.39024390
## 168   0.23076923   0.07894737   0.41176471   0.11764706   0.23076923
## 169  -0.08108108  -0.09090909   0.45945946  -0.07142857  -0.09090909
## 170  -0.01265823  -0.01265823   0.34210526   0.05882353  -0.09589041
## 171   0.39024390  -0.05263158   0.09090909   0.37500000   0.00000000
## 172   0.20000000   0.20000000   0.37500000   0.00000000  -0.22222222
## 173   0.30000000   0.10000000   0.00000000   0.50000000   0.00000000
## 174   0.23076923  -0.16666667  -0.15384615  -0.11111111  -0.15384615
## 175   0.13043478   0.04255319  -0.13636364   0.18604651   0.04255319
## 176   0.21052632   0.28571429  -0.19047619  -0.17647059   0.21052632
## 177   0.30555556   0.31818182   0.21568627   0.13793103   0.31818182
## 178   0.17525773   0.06250000  -0.05263158   0.36842105   0.23913043
## 179   0.54545455   0.46808511   0.44444444  -0.08695652   0.41860465
## 180   0.30555556   0.13793103   0.38461538   0.30555556   0.49367089
## 181   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
## 182   0.11764706  -0.05263158  -0.31578947   0.28571429   0.11764706
## 183   0.50000000   0.00000000   0.07692308   0.27272727   0.20000000
## 184   0.52941176   0.16666667   0.38461538   0.57142857   0.37500000
## 185   0.46666667   0.28571429   0.00000000   0.36842105   0.20000000
## 186   1.00000000   0.21875000   0.34782609   0.45945946   0.64285714
## 187   0.57142857   0.37500000   0.76470588   0.12500000  -0.12500000
## 188   0.21568627  -0.04651163   0.13793103   0.21568627   0.31818182
## 189   0.20000000  -0.23076923  -0.09090909   0.38461538  -0.16666667
## 190   0.13043478   0.41860465   0.13043478   0.22222222  -0.08695652
## 191   0.00000000   0.50000000   0.28571429   0.12500000   0.28571429
## 192   0.07692308   0.02777778   0.21568627   0.30555556   0.21568627
## 193   0.34782609  -0.08108108  -0.08108108   0.21875000  -0.07142857
## 194   0.11764706   0.00000000  -0.12500000   0.47368421   0.73684211
## 195   0.43181818   0.52941176   0.29411765   0.39024390   0.07894737
## 196   0.34782609  -0.07142857  -0.07142857   0.17808219  -0.08108108
## 197   0.44444444  -0.08695652   0.34782609   0.44444444   0.44444444
## 198   0.23076923  -0.13636364  -0.15384615   0.61538462  -0.11111111
## 199   0.07894737  -0.13636364   0.23076923   0.11764706   0.11764706
## 200   0.23076923   0.41176471  -0.17647059   0.23076923   0.23076923
## 201  -0.11111111   0.16666667   0.16666667   0.11764706  -0.16666667
## 202   0.44444444   0.09090909   0.44444444   0.13043478   0.34782609
```

```
## 203   0.00000000   0.06250000   0.00000000 -0.15384615   0.28571429
## 204   0.48275862   0.06250000   0.37500000   0.61538462   0.37500000
## 205   0.13793103 -0.17647059   1.00000000   0.13793103   1.00000000
## 206  -0.07142857   0.16666667   0.31818182   0.44444444   0.23076923
## 207   0.52380952   0.20454545   0.21052632   0.41176471   0.47368421
## 208   0.00000000 -0.06666667   0.00000000 -0.23076923   0.07692308
## 209   0.00000000 -0.19047619 -0.31578947   0.13043478   0.47368421
## 210  -0.09090909 -0.08695652   0.27272727 -0.07142857 -0.08695652
## 211   0.16666667   0.11764706 -0.13636364   0.44444444   0.23076923
## 212   0.09090909   0.23076923   0.34782609   0.48275862   0.48275862
## 213  -0.23076923   0.07692308   0.16666667   0.16666667   0.57142857
## 214   0.24050633   0.60784314   0.13793103   0.31818182 -0.20689655
## 215   0.00000000 -0.06666667 -0.09090909 -0.06666667 -0.06666667
## 216   0.21052632   0.23076923 -0.25000000 -0.15384615   0.13793103
## 217   0.13793103   0.28571429 -0.28571429   0.06250000   0.47368421
## 218  -0.23076923   0.16666667   0.16666667 -0.28571429   0.46666667
## 219   0.20000000   0.62500000   0.38461538 -0.09090909   0.28571429
## 220   0.07692308   0.27272727   0.20000000   0.38461538   0.69230769
## 221   0.45945946   0.48275862   0.58333333   0.69230769   0.38461538
## 222   0.48275862   0.38461538   0.69230769   0.48275862   0.82758621
## 223   0.27272727 -0.08108108 -0.08695652 -0.09090909 -0.05263158
## 224   0.28571429   0.34782609   0.13793103   0.37500000   0.61538462
## 225   0.68750000   0.37500000   0.68750000   0.37500000   0.39024390
## 226   0.47368421   0.87500000   0.30555556   0.58333333   0.62500000
## 227   0.41176471 -0.25000000   0.30555556   0.41176471 -0.12500000
## 228   0.27272727 -0.08695652 -0.08108108 -0.07142857   0.21875000
## 229   0.45945946   0.27272727   0.45945946   0.27272727   0.34782609
## 230   0.13793103   0.37500000   0.48275862   0.13793103   0.23076923
## 231   0.27272727   0.07692308   0.16666667 -0.09090909 -0.16666667
## 232   0.46666667   0.87500000   0.27272727   0.57142857   0.50000000
## 233  -0.08695652 -0.08695652   0.13793103   0.37500000   0.61538462
## 234   0.82758621   0.13793103   0.31818182 -0.08108108   0.38461538
## 235  -0.07142857   0.45945946 -0.08108108   0.17808219   0.45945946
## 236   0.30555556   0.07692308   0.13793103   0.02777778   0.07692308
## 237  -0.15384615 -0.13636364   0.23076923 -0.15384615 -0.15384615
## 238   0.45945946 -0.05263158   1.00000000   0.45945946 -0.08108108
## 239   0.13793103   0.48275862   0.48275862   0.31818182 -0.13636364
## 240   0.61538462   0.16666667   0.31818182   0.61538462   0.11764706
## 241  -0.08695652 -0.08695652   0.27272727 -0.09090909   0.34782609
## 242  -0.08695652 -0.09090909 -0.08695652   0.21875000 -0.07142857
## 243   0.77272727   0.48275862 -0.08108108   0.31818182   0.45945946
## 244   0.48275862   0.60784314   0.21568627   0.30555556   0.00000000
## 245   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
## 246   0.64285714 -0.07142857 -0.08695652   0.27272727 -0.05263158
## 247   0.64285714 -0.07142857   0.00000000   0.45945946 -0.08108108
## 248   0.82758621 -0.20689655   0.21568627   0.48275862   0.31818182
## 249   0.82758621   0.23076923   0.48275862   0.23076923   0.06250000
## 250   0.69230769   0.31818182   1.00000000   0.69230769   0.60784314
## 251   0.30555556   0.60784314   0.48275862   0.13793103   0.21568627
## 252   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
## 253   0.45945946 -0.07142857 -0.08108108 -0.09375000 -0.08108108
## 254   0.45945946   0.45945946 -0.07142857   0.34782609 -0.05263158
## 255   0.23076923 -0.11111111 -0.13636364   0.64285714   0.31818182
## 256   0.50000000   0.31818182   0.77272727   0.28571429 -0.11111111
## 257   0.68750000   0.61538462   0.06250000   0.00000000   0.13793103
## 258   0.41176471 -0.15384615   0.61538462   0.11764706   0.31818182
## 259   0.31818182   0.16666667   0.16666667   0.44444444 -0.11111111
## 260   0.44444444   0.00000000   0.31818182   0.50000000   0.23076923
```

```
## 261   0.31818182 -0.15384615 -0.11111111  0.16666667  0.31818182
## 262   0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
## 263   0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
## 264   0.21875000  0.34782609  0.45945946  0.27272727  0.27272727
## 265   0.38461538  0.48275862 -0.20689655  0.69230769  0.31818182
## 266   0.34782609  0.45945946  0.27272727  0.34782609  0.27272727
## 267   0.50000000  1.00000000  0.23076923  0.77272727  0.61538462
## 268   0.31818182  0.44444444  0.50000000  0.61538462  0.11764706
## 269   0.45945946  0.34782609  0.34782609  1.00000000  0.64285714
## 270   0.64285714  0.45945946  0.64285714  0.45945946  0.27272727
## 271   0.45945946  0.34782609  0.45945946  0.34782609  0.45945946
## 272  -0.08108108  0.34782609  0.45945946  0.64285714 -0.08108108
## 273   0.31818182  0.31818182 -0.11111111  0.11764706 -0.16666667
## 274   0.21875000  0.45945946  0.21875000  0.34782609  0.34782609
## 275   0.61538462  0.50000000  0.64285714  0.50000000  0.31818182
## 276   0.12500000  0.51923077  0.40000000 -0.02272727  0.27083333
## 277   0.18604651  0.20000000  0.16666667  0.13043478 -0.17021277
## 278   0.15094340  0.10000000  0.52941176  0.52830189  0.50000000
## 279  -0.01265823  0.34065934  0.12087912  0.12087912 -0.09890110
## 280   0.16666667  0.04761905  0.23809524 -0.01851852  0.15094340
## 281  -0.05263158 -0.07142857 -0.07142857  0.64285714 -0.07142857
## 282   0.14634146 -0.02272727  0.43181818 -0.01265823  0.34065934
## 283   0.16666667  0.61538462  0.16666667 -0.07142857  0.31818182
## 284  -0.05263158  0.02777778 -0.25000000  0.04761905  0.21052632
## 285   0.31818182  0.07692308 -0.08108108  0.07692308  0.48275862
## 286  -0.20689655  0.21568627  0.00000000  0.13793103 -0.17647059
## 287   0.62500000  0.16666667  0.52941176  0.28571429  0.07692308
## 288   0.31818182 -0.20689655 -0.20689655 -0.17647059  0.31818182
## 289   0.21052632  0.68750000  0.23076923  0.68750000  0.82758621
## 290   0.61538462  0.16666667  0.16666667  0.77272727  0.44444444
## 291   0.21568627  0.21568627  0.31818182 -0.17647059 -0.23076923
## 292   0.45945946  0.13793103  0.31818182  0.48275862  0.21568627
## 293   0.57142857  1.00000000  0.48275862  0.47368421  0.39024390
## 294   0.37500000  0.37500000 -0.08695652  0.37500000  0.37500000
## 295   0.61538462  0.48275862 -0.08695652  0.37500000  0.48275862
## 296   0.58333333  0.21568627  0.77272727 -0.17647059  0.77272727
## 297   0.30555556  0.38461538 -0.20689655  0.30555556  0.45945946
## 298   0.40000000  0.50000000  0.70000000  0.20000000  0.60000000
## 299   0.23076923  0.77272727  0.31818182  0.61538462  1.00000000
## 300   0.64285714  0.44444444  0.44444444  0.44444444  0.44444444
##
## $TSS
##              1          2          3          4          5
## 1   -0.17647059  0.89473684 -0.18750000  0.33333333  0.21568627
## 2    0.20000000  0.40000000  0.24242424  0.28571429  0.36363636
## 3    0.16483516  0.45454545  0.50000000  0.35353535  0.38461538
## 4    0.15151515  0.35353535  0.45454545  0.25252525  0.55555556
## 5    0.18181818 -0.16666667  0.22222222  0.18181818  0.18181818
## 6    0.30303030  0.90909091  0.50505051  0.62500000  0.62500000
## 7    0.30000000  0.25252525  0.55555556  0.05494505  0.35353535
## 8    0.41666667  0.25252525  0.41666667  0.50000000  0.41666667
## 9    0.23809524  0.62500000  0.31250000  0.62500000  0.62500000
## 10   0.15151515  0.45454545  0.41666667  0.15151515  0.55555556
## 11   0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
## 12   0.85714286  0.61904762  0.70329670  0.48484848  0.88888889
## 13   0.76923077  0.20000000  0.70707071  0.60000000  0.60000000
## 14   0.63636364  0.10000000  0.57575758  0.43434343  0.23232323
## 15   0.21212121  0.19191919  0.30000000  0.50000000  0.21212121
```

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## 16   0.54945055   0.54945055   0.62500000   0.54945055   0.50505051
## 17   0.60000000   0.14141414   0.14141414   0.24175824   0.54166667
## 18   0.25000000   0.56043956   0.45833333   0.45833333   0.57575758
## 19   0.38461538   0.50000000   0.50000000   0.55555556   0.50000000
## 20   0.53846154   0.58333333   0.10000000   0.58333333   0.50000000
## 21   0.40000000   0.25000000   0.12121212   0.39560440   0.52525253
## 22   0.10000000   0.10000000   0.03030303   0.37500000   0.37500000
## 23   0.19047619   0.24242424   0.36363636   0.29166667   0.40000000
## 24   0.50505051   0.54945055   0.00000000   0.30303030   0.30303030
## 25   0.40000000   0.44444444   0.29166667   0.53333333  -0.04761905
## 26   0.19780220   0.54166667   0.77777778   0.75000000   0.41758242
## 27   0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
## 28   0.16666667   0.50000000   0.37500000   0.10000000   0.37373737
## 29   0.40000000   0.38095238   0.37500000   0.38095238   0.70329670
## 30   0.46153846   0.33333333   0.14141414   0.08333333   0.50000000
## 31   0.30303030   0.47619048   0.50505051   0.30303030   0.54945055
## 32   0.61616162   0.39393939   0.59595960   0.41414141   0.33333333
## 33   0.92857143   0.30000000   0.58333333   0.63636364  -0.16666667
## 34   0.50000000   0.37373737   0.37500000   0.37500000   0.23232323
## 35   0.40000000   0.50505051   0.62500000   0.10989011   0.50505051
## 36   0.33333333   0.33333333   0.60000000   0.17582418   0.04166667
## 37   0.53846154   0.58333333   0.57575758   0.37373737   0.30000000
## 38   0.10000000   0.16666667   0.10000000   0.53846154   0.10000000
## 39   0.40000000   0.41666667   0.32967033   0.50505051   0.40000000
## 40   0.41666667   0.80000000   0.70707071   0.40000000   0.90909091
## 41   0.50000000   0.33333333   0.61616162   0.54166667   0.54166667
## 42   0.41666667   0.30303030   0.40000000   0.10989011   0.32967033
## 43   0.40000000   0.04395604   0.48484848   0.40000000   0.48351648
## 44   0.50505051   0.30303030   0.50505051   0.76923077   0.41666667
## 45   0.20833333   0.70707071   0.40000000   0.60000000   0.30303030
## 46   0.12121212   0.16666667   0.37500000   0.48484848   0.70329670
## 47   0.25000000   0.19780220   0.40000000   0.28571429   0.13333333
## 48   0.58333333  -0.09523810   0.14285714   0.43750000   0.70329670
## 49   0.20000000   0.68686869   0.48351648   0.28282828   0.28282828
## 50   0.72727273   0.66666667   0.48484848   0.53333333   0.61538462
## 51   0.06666667   0.33333333   0.47252747   0.16666667   0.25274725
## 52  -0.16483516   0.20833333   0.41666667   0.35353535   0.05494505
## 53   0.68750000   0.18681319   0.62637363   0.50000000   0.40659341
## 54   0.80000000   0.48484848   0.40000000   0.32323232   0.48484848
## 55   0.15151515   0.30000000   0.55555556   0.25252525   0.25252525
## 56   0.12500000   0.40000000   0.44444444   0.29166667   0.29166667
## 57   0.10000000   0.70000000   0.21212121   0.21212121  -0.01010101
## 58   0.52525253   0.70329670   0.32323232   0.72727273   0.20000000
## 59   0.39393939   0.61616162   0.50000000   0.70833333   0.78571429
## 60  -0.02197802   0.33333333   0.19780220   0.28571429   0.54166667
## 61   0.10101010   0.10989011   0.32967033   0.50505051   0.41666667
## 62   0.70833333   0.62637363   0.50000000   0.50000000   0.40659341
## 63   0.62637363   0.29166667   0.46666667   0.29166667   0.62637363
## 64   0.56250000   0.40000000   0.77777778   0.03921569   0.52380952
## 65   0.00000000   0.00000000   0.47619048   0.13333333   0.54945055
## 66   0.25000000   0.12500000   0.56250000  -0.06250000   0.21212121
## 67   0.21212121   0.33333333   0.60000000   0.21212121   0.25274725
## 68   0.59595960   0.50000000   0.39393939   0.41414141   0.70000000
## 69   0.29166667   0.59595960   0.29166667   0.78571429   0.21212121
## 70   0.09523810   0.33333333   0.26666667  -0.12500000   0.66666667
## 71   0.20000000   0.20000000  -0.12500000   0.14141414   0.33333333
## 72   0.20000000   0.41666667   0.50505051   0.20833333   0.50505051
## 73   0.30000000   0.30000000   0.19191919   0.50000000   0.59595960
```

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```
## 74    0.19191919  0.08333333 -0.16666667  0.18681319  0.29166667
## 75    0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
## 76    0.54545455  0.24175824  0.40000000  0.50000000  0.40000000
## 77    0.28282828  0.45833333  0.26373626  0.48484848  0.48484848
## 78    0.41414141  0.56250000  0.61616162  0.47252747  0.21212121
## 79    0.06593407  0.18750000  0.18750000  0.00000000  0.04166667
## 80    0.57575758  0.30000000  0.25000000  0.06666667  0.25000000
## 81    0.26666667  0.32323232  0.61538462  0.25000000  0.25000000
## 82    0.61904762  0.14285714  0.52525253  0.48351648  0.38095238
## 83    0.40000000  0.45833333  0.57142857  0.32323232  0.33333333
## 84    0.28571429  0.06593407  0.09523810 -0.13333333 -0.12500000
## 85    0.33333333  0.21568627  0.20879121  0.30000000  0.26190476
## 86    0.47619048  0.54945055  0.47619048  0.13333333  0.10989011
## 87    0.01010101  0.33333333  0.50000000  0.25274725  0.41414141
## 88    0.23809524  0.71428571  0.70707071  0.13333333  0.62500000
## 89    0.16666667  0.28282828  0.26373626 -0.09523810 -0.09523810
## 90    0.78571429  0.50000000  0.05555556  0.40659341  0.30952381
## 91    0.54945055  0.47619048  0.13333333 -0.10989011  0.00000000
## 92    0.25274725  0.59595960  0.54166667  0.50000000  0.16666667
## 93    0.25000000  0.52525253  0.32323232  0.25000000  0.40000000
## 94    0.46464646  0.40000000  0.40000000  0.54166667  0.41758242
## 95    0.40000000  0.61538462  0.20000000  0.09523810  0.45833333
## 96    0.58823529  0.47619048  0.62500000  0.32967033  0.54945055
## 97    0.30000000  0.10000000 -0.37500000  0.33333333 -0.16666667
## 98   -0.16666667  0.46666667  0.64705882  0.18681319 -0.06666667
## 99    0.50000000 -0.37500000 -0.18681319  0.03296703  0.25000000
## 100   0.14285714 -0.26666667  0.12500000 -0.04166667  0.26666667
## 101   0.23232323  0.25000000  0.21428571  0.33333333  0.17171717
## 102   0.48351648  0.38095238  0.12500000  0.26666667  0.00000000
## 103   0.26373626  0.40000000  0.16666667  0.14285714  0.48484848
## 104   0.12121212  0.39560440  0.17582418  0.32323232  0.09523810
## 105   0.16666667  0.45238095  0.45238095 -0.01960784  0.06666667
## 106   0.37254902  0.06666667  0.37254902 -0.01960784  0.34065934
## 107   0.25000000  0.28571429  0.43137255 -0.33333333 -0.13333333
## 108   0.40000000  0.40000000  0.71428571  0.23809524  0.13333333
## 109   0.25274725  0.40476190  0.25274725  0.52941176  0.16666667
## 110   0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
## 111   0.38095238  0.04395604  0.48351648  0.53333333  0.70329670
## 112   0.62500000  0.00000000  0.47619048  0.47619048  0.31250000
## 113   0.43750000  0.53333333  0.66666667  0.28282828  0.00000000
## 114  -0.13131313 -0.21428571  0.50000000  0.16666667  0.02380952
## 115   0.38095238  0.16666667  0.16666667 -0.26666667  0.43750000
## 116   0.33333333  0.16666667 -0.05882353  0.20000000  0.14285714
## 117   0.56250000  0.33333333  0.40476190  0.47252747 -0.06250000
## 118   0.58333333  0.26190476  0.26190476  0.23232323 -0.06666667
## 119   0.06666667 -0.01098901  0.12500000  0.20879121  0.06666667
## 120   0.06666667  0.02380952 -0.23076923 -0.25000000  0.21568627
## 121   0.40000000  0.25000000  0.19780220 -0.24175824  0.13333333
## 122   0.47252747  0.69230769  0.33333333  0.47252747  0.41414141
## 123   0.05555556  0.18681319 -0.52941176 -0.06666667  0.64705882
## 124   0.40000000 -0.31578947  0.82352941  0.25000000  0.56250000
## 125   0.09523810  0.27450980  0.04166667  0.40000000  0.18750000
## 126   0.14285714  0.00000000 -0.33333333  0.31372549  0.28282828
## 127   0.25000000 -0.25490196  0.13725490  0.47368421  0.50000000
## 128   0.56250000 -0.07142857  0.16666667 -0.08333333  0.64285714
## 129   0.20833333  0.55555556  0.31250000  0.13333333  0.19607843
## 130   0.41666667  0.23809524  0.10989011  0.10989011  0.20833333
## 131   0.32967033  0.20833333  0.52631579  0.13333333  0.40000000
```

```
## 132  0.32967033   0.62500000   0.40000000   0.32967033   0.13333333
## 133 -0.06666667   0.35353535  -0.06666667   0.11904762   0.20000000
## 134  0.27472527   0.25252525   0.11904762   0.00000000   0.35353535
## 135 -0.05555556   0.40476190  -0.05555556   0.25000000   0.16666667
## 136  0.31372549  -0.07843137   0.26666667   0.43750000   0.43750000
## 137  0.29166667   0.30952381   0.07142857   0.07142857  -0.03296703
## 138 -0.26190476   0.18750000   0.45238095  -0.20000000   0.37373737
## 139  0.04040404  -0.08791209   0.08333333  -0.26666667  -0.04761905
## 140  0.02380952  -0.17647059  -0.16666667   0.21568627   0.12500000
## 141  0.26666667   0.31372549   0.11111111   0.31372549  -0.09523810
## 142  0.63157895  -0.07843137   0.43750000   0.31372549   0.04395604
## 143  0.04040404  -0.04761905  -0.28571429   0.26666667   0.33333333
## 144  0.19607843   0.58823529   0.00000000   0.55555556          NaN
## 145  0.20000000   0.11904762  -0.05050505   0.30000000   0.05494505
## 146  0.05494505   0.49019608   0.00000000   0.31250000  -0.06666667
## 147  0.06250000   0.26666667   0.15686275   0.37500000   0.26666667
## 148  0.43750000  -0.07843137   0.53333333   0.58333333   0.70588235
## 149  0.31250000   0.13333333   0.00000000   0.62500000   0.19607843
## 150  0.18750000   0.06593407   0.27450980   0.28571429   0.27450980
## 151  0.52380952   0.56250000   0.19780220   0.26262626   0.25000000
## 152  0.13186813   0.00000000   0.26666667  -0.25000000   0.00000000
## 153  0.37500000   0.46666667   0.62637363  -0.06666667  -0.47368421
## 154  0.20879121  -0.18750000   0.21568627   0.50000000   0.12500000
## 155 -0.11904762   0.49450549   0.20000000   0.00000000   0.49019608
## 156  0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
## 157  0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
## 158  0.30952381   0.73333333   0.46666667   0.29166667   0.37500000
## 159  0.37500000   0.62637363  -0.47368421   0.06250000   0.68750000
## 160  0.26190476  -0.17647059   0.07070707  -0.16666667   0.06666667
## 161 -0.04761905   0.13186813   0.00000000   0.00000000   0.08333333
## 162  0.27777778  -0.35714286   0.11904762   0.83333333   0.78947368
## 163  0.62500000   0.49019608   0.31250000   0.27777778   0.88235294
## 164  0.00000000  -0.21052632  -0.25000000   0.19047619   0.13186813
## 165  0.37500000   0.37500000  -0.22222222   0.15686275   0.37500000
## 166 -0.15384615  -0.15384615  -0.11764706  -0.15384615   0.09523810
## 167  0.21428571   0.72222222   0.18750000  -0.37500000   0.50000000
## 168  0.18750000   0.06593407   0.33333333   0.09523810   0.18750000
## 169 -0.05882353  -0.06666667   0.33333333  -0.05555556  -0.06666667
## 170 -0.01960784  -0.01960784   0.72222222   0.06666667  -0.36842105
## 171  0.35164835  -0.04761905   0.08333333   0.37500000   0.00000000
## 172  0.20000000   0.20000000   0.35714286   0.00000000  -0.20833333
## 173  0.32967033   0.19607843   0.00000000   0.66666667   0.00000000
## 174  0.18750000  -0.13333333  -0.12500000  -0.11111111  -0.12500000
## 175  0.14285714   0.04395604  -0.18750000   0.31372549   0.04395604
## 176  0.25000000   0.28571429  -0.19047619  -0.33333333   0.25000000
## 177  0.26190476   0.38888889   0.21568627   0.12500000   0.38888889
## 178  0.18681319   0.07142857  -0.06666667   0.46666667   0.61111111
## 179  0.75000000   0.48351648   0.53333333  -0.09523810   0.70588235
## 180  0.26190476   0.12500000   0.33333333   0.26190476   0.42857143
## 181  0.00000000   0.00000000   0.00000000   0.00000000   0.00000000
## 182  0.22222222  -0.06250000  -0.37500000   0.28571429   0.22222222
## 183  0.83333333   0.00000000   0.09803922   0.78947368   0.20000000
## 184  0.49450549   0.27777778   0.49019608   0.62500000   0.35714286
## 185  0.46666667   0.31250000   0.00000000   0.35353535   0.20000000
## 186  1.00000000   0.16666667   0.25000000   0.33333333   0.50000000
## 187  0.62500000   0.35714286   0.71428571   0.11904762  -0.11904762
## 188  0.21568627  -0.04166667   0.12500000   0.21568627   0.38888889
## 189  0.20000000  -0.29411765  -0.26315789   0.49019608  -0.27777778
```

```
## 190  0.14285714  0.70588235  0.14285714  0.26666667 -0.09523810
## 191  0.00000000  0.83333333  0.31250000  0.11904762  0.31250000
## 192  0.06666667  0.02380952  0.21568627  0.26190476  0.21568627
## 193  0.25000000 -0.05882353 -0.05882353  0.16666667 -0.05555556
## 194  0.22222222         NaN -0.13333333  0.56250000  0.87500000
## 195  0.45238095  0.60000000  0.33333333  0.50000000  0.16666667
## 196  0.25000000 -0.05555556 -0.05555556  0.14285714 -0.05882353
## 197  0.53333333 -0.09523810  0.38095238  0.53333333  0.53333333
## 198  0.18750000 -0.11764706 -0.12500000  0.50000000 -0.11111111
## 199  0.06593407 -0.11764706  0.18750000  0.09523810  0.09523810
## 200  0.18750000  0.33333333 -0.14285714  0.18750000  0.18750000
## 201 -0.11111111  0.13333333  0.13333333  0.09523810 -0.13333333
## 202  0.53333333  0.12500000  0.53333333  0.14285714  0.38095238
## 203  0.00000000  0.06250000  0.00000000 -0.22222222  0.26666667
## 204  0.54901961  0.06250000  0.37500000  0.88888889  0.37500000
## 205  0.12500000 -0.17647059  1.00000000  0.12500000  1.00000000
## 206 -0.10526316  0.13333333  0.27450980  0.44444444  0.18750000
## 207  0.52380952  0.19780220  0.25000000  0.77777778  0.56250000
## 208  0.00000000 -0.06666667         NaN -0.29411765  0.09803922
## 209         NaN -0.19047619 -0.37500000  0.12500000  0.56250000
## 210 -0.06666667 -0.06250000  0.20000000 -0.05555556 -0.06250000
## 211  0.13333333  0.09523810 -0.11764706  0.44444444  0.18750000
## 212  0.08333333  0.33333333  0.84210526  0.54901961  0.54901961
## 213 -0.29411765  0.09803922  0.27777778  0.27777778  0.62500000
## 214  0.20879121  0.60784314  0.12500000  0.38888889 -0.18750000
## 215  0.00000000 -0.06666667 -0.26315789 -0.06666667 -0.06666667
## 216  0.19047619  0.33333333 -0.25000000 -0.22222222  0.15686275
## 217  0.15686275  0.26666667 -0.26666667  0.06250000  0.42857143
## 218 -0.29411765  0.27777778  0.27777778 -0.31250000  0.46666667
## 219  0.20000000  0.59523810  0.49019608 -0.26315789  0.31250000
## 220  0.09803922  0.78947368  0.20000000  0.49019608  0.88235294
## 221  0.89473684  0.43750000  0.50000000  0.60000000  0.33333333
## 222  0.43750000  0.33333333  0.60000000  0.43750000  0.75000000
## 223  0.20000000 -0.05882353 -0.06250000 -0.06666667 -0.05263158
## 224  0.26666667  0.84210526  0.15686275  0.37500000  0.88888889
## 225  0.68750000  0.37500000  0.68750000  0.37500000  0.35164835
## 226  0.56250000  0.93333333  0.43137255  0.82352941  0.66666667
## 227  0.77777778 -0.35294118  0.43137255  0.77777778 -0.13333333
## 228  0.20000000 -0.06250000 -0.05882353 -0.05555556  0.16666667
## 229  0.33333333  0.20000000  0.33333333  0.20000000  0.25000000
## 230  0.15686275  0.37500000  0.54901961  0.15686275  0.33333333
## 231  0.78947368  0.09803922  0.27777778 -0.26315789 -0.27777778
## 232  0.46666667  0.83333333  0.78947368  0.62500000  0.83333333
## 233 -0.21052632 -0.21052632  0.15686275  0.37500000  0.88888889
## 234  0.75000000  0.12500000  0.38888889 -0.15789474  0.33333333
## 235 -0.05555556  0.33333333 -0.05882353  0.14285714  0.33333333
## 236  0.26190476  0.06666667  0.12500000  0.02380952  0.06666667
## 237 -0.12500000 -0.11764706  0.18750000 -0.12500000 -0.12500000
## 238  0.33333333 -0.05263158  1.00000000  0.33333333 -0.05882353
## 239  0.12500000  0.43750000  0.43750000  0.38888889 -0.16666667
## 240  0.50000000  0.13333333  0.27450980  0.50000000  0.09523810
## 241 -0.06250000 -0.06250000  0.20000000 -0.06666667  0.25000000
## 242 -0.06250000 -0.06666667 -0.06250000  0.16666667 -0.05555556
## 243  0.94444444  0.43750000 -0.15789474  0.38888889  0.89473684
## 244  0.43750000  0.60784314  0.21568627  0.26190476         NaN
## 245  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
## 246  0.50000000 -0.05555556 -0.06250000  0.20000000 -0.05263158
## 247  0.50000000 -0.05555556         NaN  0.33333333 -0.05882353
```

```
## 248  0.75000000 -0.18750000  0.21568627  0.43750000  0.38888889
## 249  0.94117647  0.33333333  0.54901961  0.33333333  0.06250000
## 250  0.60000000  0.38888889  1.00000000  0.60000000  0.60784314
## 251  0.26190476  0.60784314  0.43750000  0.12500000  0.21568627
## 252  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
## 253  0.33333333 -0.05555556 -0.05882353 -0.07142857 -0.05882353
## 254  0.33333333  0.33333333 -0.05555556  0.25000000 -0.05263158
## 255  0.18750000 -0.11111111 -0.11764706  0.94736842  0.27450980
## 256  0.40000000  0.27450980  0.66666667  0.25000000 -0.11111111
## 257  0.68750000  0.88888889  0.06250000         NaN  0.15686275
## 258  0.33333333 -0.12500000  0.50000000  0.09523810  0.27450980
## 259  0.27450980  0.13333333  0.13333333  0.44444444 -0.11111111
## 260  0.44444444         NaN  0.27450980  0.40000000  0.18750000
## 261  0.27450980 -0.12500000 -0.11111111  0.13333333  0.27450980
## 262  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
## 263  0.00000000  0.00000000  0.00000000  0.00000000  0.00000000
## 264  0.16666667  0.25000000  0.33333333  0.20000000  0.20000000
## 265  0.33333333  0.43750000 -0.18750000  0.60000000  0.38888889
## 266  0.25000000  0.33333333  0.20000000  0.25000000  0.20000000
## 267  0.40000000  1.00000000  0.18750000  0.66666667  0.50000000
## 268  0.27450980  0.44444444  0.40000000  0.50000000  0.09523810
## 269  0.33333333  0.25000000  0.25000000  1.00000000  0.50000000
## 270  0.50000000  0.33333333  0.50000000  0.33333333  0.20000000
## 271  0.33333333  0.25000000  0.33333333  0.25000000  0.33333333
## 272 -0.05882353  0.25000000  0.33333333  0.50000000 -0.05882353
## 273  0.27450980  0.27450980 -0.11111111  0.09523810 -0.13333333
## 274  0.16666667  0.33333333  0.16666667  0.25000000  0.25000000
## 275  0.50000000  0.40000000  0.94736842  0.40000000  0.27450980
## 276  0.13333333  0.54545455  0.40000000 -0.02197802  0.26262626
## 277  0.31372549  0.20000000  0.16666667  0.14285714 -0.17582418
## 278  0.16666667  0.10000000  0.60000000  0.58333333  0.50000000
## 279 -0.01960784  0.34065934  0.12087912  0.12087912 -0.09890110
## 280  0.50000000  0.06666667  0.33333333 -0.05555556  0.25000000
## 281 -0.05263158 -0.05555556 -0.05555556  0.50000000 -0.05555556
## 282  0.18750000 -0.02380952  0.45238095 -0.01960784  0.34065934
## 283  0.13333333  0.50000000  0.13333333 -0.10526316  0.27450980
## 284 -0.06250000  0.03921569 -0.24175824  0.04761905  0.25000000
## 285  0.38888889  0.06666667 -0.15789474  0.06666667  0.43750000
## 286 -0.18750000  0.21568627         NaN  0.12500000 -0.17647059
## 287  0.59523810  0.27777778  0.49450549  0.31250000  0.09803922
## 288  0.38888889 -0.18750000 -0.18750000 -0.17647059  0.38888889
## 289  0.19047619  0.68750000  0.33333333  0.68750000  0.94117647
## 290  0.50000000  0.13333333  0.13333333  0.66666667  0.44444444
## 291  0.21568627  0.21568627  0.38888889 -0.17647059 -0.20000000
## 292  0.89473684  0.12500000  0.38888889  0.43750000  0.21568627
## 293  0.53333333  1.00000000  0.54901961  0.42857143  0.35164835
## 294  0.37500000  0.37500000 -0.21052632  0.37500000  0.37500000
## 295  0.88888889  0.54901961 -0.21052632  0.37500000  0.54901961
## 296  0.50000000  0.21568627  0.94444444 -0.17647059  0.94444444
## 297  0.26190476  0.33333333 -0.18750000  0.26190476  0.89473684
## 298  0.40000000  0.50505051  0.70707071  0.20833333  0.62500000
## 299  0.18750000  0.66666667  0.27450980  0.50000000  1.00000000
## 300  0.94736842  0.44444444  0.44444444  0.44444444  0.44444444
##
## $similarity
##           1         2         3         4         5
## 1  0.0000000 0.5000000 0.0000000 0.5000000 0.3333333
## 2  0.4285714 0.5714286 0.4615385 0.4444444 0.5333333
```

```
## 3    0.4444444 0.6250000 0.6666667 0.5714286 0.5555556
## 4    0.4285714 0.5714286 0.6250000 0.5000000 0.7142857
## 5    0.3076923 0.0000000 0.3636364 0.3076923 0.3076923
## 6    0.6666667 0.9473684 0.7368421 0.8181818 0.8181818
## 7    0.5333333 0.5000000 0.7142857 0.3333333 0.5714286
## 8    0.5882353 0.5000000 0.5882353 0.6666667 0.5882353
## 9    0.5000000 0.7777778 0.4285714 0.5714286 0.7777778
## 10   0.4285714 0.6250000 0.6153846 0.4285714 0.7142857
## 11   0.0000000 0.0000000 0.0000000 0.0000000 0.0000000
## 12   0.9230769 0.8461538 0.8800000 0.7826087 0.9565217
## 13   0.8695652 0.6000000 0.8421053 0.8000000 0.8000000
## 14   0.7777778 0.4705882 0.7500000 0.6666667 0.5555556
## 15   0.6000000 0.6363636 0.6666667 0.7619048 0.6000000
## 16   0.7826087 0.7826087 0.8181818 0.7826087 0.7619048
## 17   0.7500000 0.4705882 0.4705882 0.5263158 0.7142857
## 18   0.5333333 0.7142857 0.6666667 0.6666667 0.7500000
## 19   0.6363636 0.8000000 0.8000000 0.8461538 0.8000000
## 20   0.7000000 0.7368421 0.4705882 0.7368421 0.7058824
## 21   0.6666667 0.6000000 0.5263158 0.6666667 0.7368421
## 22   0.4705882 0.4705882 0.4444444 0.6315789 0.6315789
## 23   0.4000000 0.4615385 0.5333333 0.5000000 0.5714286
## 24   0.7368421 0.7058824 0.4444444 0.6315789 0.6315789
## 25   0.5714286 0.6153846 0.5000000 0.6666667 0.2000000
## 26   0.4615385 0.7142857 0.5000000 0.8571429 0.6153846
## 27   0.0000000 0.0000000 0.0000000 0.0000000 0.0000000
## 28   0.5263158 0.7058824 0.6315789 0.4705882 0.6250000
## 29   0.6666667 0.5714286 0.6250000 0.5714286 0.8000000
## 30   0.6315789 0.5714286 0.4705882 0.4444444 0.6666667
## 31   0.6666667 0.7500000 0.7368421 0.6666667 0.7826087
## 32   0.8000000 0.7272727 0.8181818 0.7000000 0.6315789
## 33   0.9230769 0.5882353 0.7368421 0.7777778 0.2666667
## 34   0.7058824 0.6250000 0.6315789 0.6315789 0.5555556
## 35   0.7000000 0.7619048 0.7777778 0.4705882 0.7368421
## 36   0.6363636 0.6363636 0.7777778 0.5714286 0.5000000
## 37   0.7000000 0.7619048 0.8333333 0.7500000 0.6956522
## 38   0.4705882 0.5263158 0.4705882 0.7000000 0.4705882
## 39   0.7000000 0.6666667 0.5882353 0.7368421 0.7000000
## 40   0.7272727 0.9000000 0.8571429 0.7000000 0.9523810
## 41   0.7619048 0.5000000 0.8000000 0.7368421 0.7368421
## 42   0.6666667 0.6315789 0.7000000 0.4705882 0.5882353
## 43   0.6666667 0.4000000 0.7058824 0.6666667 0.6666667
## 44   0.7619048 0.6315789 0.7368421 0.8235294 0.6666667
## 45   0.5555556 0.8571429 0.7000000 0.8000000 0.6666667
## 46   0.5263158 0.5000000 0.6250000 0.7058824 0.8000000
## 47   0.4000000 0.4615385 0.6250000 0.5000000 0.3636364
## 48   0.7500000 0.2857143 0.4285714 0.5000000 0.8000000
## 49   0.5555556 0.8235294 0.6666667 0.5882353 0.5882353
## 50   0.8571429 0.8000000 0.7826087 0.5882353 0.7368421
## 51   0.3750000 0.6315789 0.6666667 0.4705882 0.5555556
## 52   0.1666667 0.4615385 0.6153846 0.5714286 0.3333333
## 53   0.6153846 0.5000000 0.7500000 0.7368421 0.6250000
## 54   0.9090909 0.7826087 0.7272727 0.6666667 0.7826087
## 55   0.4285714 0.5333333 0.7142857 0.5000000 0.5000000
## 56   0.3750000 0.5714286 0.6153846 0.5000000 0.5000000
## 57   0.5263158 0.8421053 0.6000000 0.6000000 0.4444444
## 58   0.7368421 0.8000000 0.6315789 0.8421053 0.5555556
## 59   0.7272727 0.8000000 0.7619048 0.8695652 0.8800000
## 60   0.3076923 0.5714286 0.4615385 0.5000000 0.7142857
```

```
## 61   0.5263158 0.4705882 0.5882353 0.7368421 0.6666667
## 62   0.8235294 0.7500000 0.7058824 0.7058824 0.6250000
## 63   0.7500000 0.5882353 0.5714286 0.5882353 0.7500000
## 64   0.6000000 0.5454545 0.5000000 0.2222222 0.6666667
## 65   0.2857143 0.3750000 0.6250000 0.4000000 0.7058824
## 66   0.4000000 0.5263158 0.5333333 0.2666667 0.6000000
## 67   0.6000000 0.6315789 0.6250000 0.6000000 0.5555556
## 68   0.8181818 0.7619048 0.7272727 0.7000000 0.8571429
## 69   0.5882353 0.7777778 0.5882353 0.8000000 0.6000000
## 70   0.4444444 0.5555556 0.4705882 0.2500000 0.8000000
## 71   0.5000000 0.5000000 0.3333333 0.4705882 0.5714286
## 72   0.6000000 0.7272727 0.7619048 0.5555556 0.7368421
## 73   0.6666667 0.6666667 0.6363636 0.7619048 0.8181818
## 74   0.5555556 0.4705882 0.2666667 0.5000000 0.5882353
## 75   0.0000000 0.0000000 0.0000000 0.0000000 0.0000000
## 76   0.7826087 0.5714286 0.7500000 0.7272727 0.7500000
## 77   0.6956522 0.7000000 0.7200000 0.7826087 0.7826087
## 78   0.7000000 0.5333333 0.8000000 0.6666667 0.6000000
## 79   0.2222222 0.3333333 0.3333333 0.1666667 0.2000000
## 80   0.7500000 0.5882353 0.5333333 0.3333333 0.5333333
## 81   0.4705882 0.6666667 0.7368421 0.6000000 0.6000000
## 82   0.7142857 0.4285714 0.7368421 0.6666667 0.5714286
## 83   0.7272727 0.7000000 0.6666667 0.6666667 0.5555556
## 84   0.4444444 0.2222222 0.2500000 0.0000000 0.0000000
## 85   0.5000000 0.3333333 0.4000000 0.4615385 0.4444444
## 86   0.6250000 0.7058824 0.6250000 0.4000000 0.4705882
## 87   0.5000000 0.5000000 0.7619048 0.5555556 0.7000000
## 88   0.5000000 0.7500000 0.8421053 0.4000000 0.5714286
## 89   0.5000000 0.5882353 0.5333333 0.2857143 0.2857143
## 90   0.8000000 0.7058824 0.1818182 0.6250000 0.5333333
## 91   0.7058824 0.6250000 0.4000000 0.3529412 0.2857143
## 92   0.5555556 0.8181818 0.7368421 0.7619048 0.4705882
## 93   0.6000000 0.7619048 0.6666667 0.6000000 0.7272727
## 94   0.6666667 0.5454545 0.6250000 0.7142857 0.6153846
## 95   0.7272727 0.7368421 0.6363636 0.4444444 0.7000000
## 96   0.4615385 0.6250000 0.5714286 0.5882353 0.7058824
## 97   0.5882353 0.4705882 0.1333333 0.5000000 0.2666667
## 98   0.2666667 0.5714286 0.5000000 0.5000000 0.2857143
## 99   0.3076923 0.1333333 0.3333333 0.4444444 0.4000000
## 100  0.4285714 0.1538462 0.3333333 0.3750000 0.4615385
## 101  0.5555556 0.5333333 0.4615385 0.5000000 0.5000000
## 102  0.6666667 0.5714286 0.3333333 0.4615385 0.3076923
## 103  0.5333333 0.6666667 0.5000000 0.4285714 0.7058824
## 104  0.5714286 0.6315789 0.5263158 0.6666667 0.4444444
## 105  0.2222222 0.6153846 0.6153846 0.2000000 0.3333333
## 106  0.4000000 0.3333333 0.4000000 0.2000000 0.5714286
## 107  0.4000000 0.5000000 0.4444444 0.0000000 0.1818182
## 108  0.7000000 0.7000000 0.7500000 0.5000000 0.4000000
## 109  0.5555556 0.5882353 0.5555556 0.4285714 0.4705882
## 110  0.0000000 0.0000000 0.0000000 0.0000000 0.0000000
## 111  0.5714286 0.4000000 0.6666667 0.6153846 0.8000000
## 112  0.5714286 0.2857143 0.6250000 0.6250000 0.4285714
## 113  0.5000000 0.6153846 0.4000000 0.5882353 0.3076923
## 114  0.1428571 0.0000000 0.6666667 0.3636364 0.2222222
## 115  0.5714286 0.5000000 0.5000000 0.1538462 0.5000000
## 116  0.5000000 0.2857143 0.0000000 0.3333333 0.2500000
## 117  0.5333333 0.5000000 0.5882353 0.6666667 0.2666667
## 118  0.7619048 0.5263158 0.5263158 0.6363636 0.3333333
```

```
## 119 0.2500000 0.2000000 0.2857143 0.4000000 0.2500000
## 120 0.2500000 0.2222222 0.0000000 0.0000000 0.3333333
## 121 0.5454545 0.4000000 0.4615385 0.1538462 0.3636364
## 122 0.6666667 0.7777778 0.5000000 0.6666667 0.7000000
## 123 0.1818182 0.5000000 0.0000000 0.2857143 0.5000000
## 124 0.5454545 0.0000000 0.6666667 0.4000000 0.6000000
## 125 0.2500000 0.4000000 0.2000000 0.5714286 0.3333333
## 126 0.4285714 0.3076923 0.1428571 0.3636364 0.5882353
## 127 0.4000000 0.1428571 0.2857143 0.1666667 0.3076923
## 128 0.5333333 0.3529412 0.4705882 0.4210526 0.7058824
## 129 0.5555556 0.3333333 0.4285714 0.4000000 0.3076923
## 130 0.6666667 0.5000000 0.4705882 0.4705882 0.5555556
## 131 0.5882353 0.5555556 0.1818182 0.4000000 0.5333333
## 132 0.5882353 0.5714286 0.5333333 0.5882353 0.4000000
## 133 0.2000000 0.5714286 0.2000000 0.3636364 0.4000000
## 134 0.5000000 0.5000000 0.3636364 0.3529412 0.5714286
## 135 0.1538462 0.5882353 0.1538462 0.4000000 0.4705882
## 136 0.3636364 0.1818182 0.4615385 0.5000000 0.5000000
## 137 0.5882353 0.5333333 0.4000000 0.4000000 0.3750000
## 138 0.1538462 0.3636364 0.6153846 0.1666667 0.6250000
## 139 0.3076923 0.1818182 0.3333333 0.0000000 0.2000000
## 140 0.2222222 0.0000000 0.0000000 0.3333333 0.2857143
## 141 0.4615385 0.3636364 0.2000000 0.3636364 0.2857143
## 142 0.2222222 0.1818182 0.5000000 0.3636364 0.4000000
## 143 0.3076923 0.2000000 0.0000000 0.4444444 0.3333333
## 144 0.3076923 0.4615385 0.1666667 0.3333333 0.0000000
## 145 0.4000000 0.3636364 0.2857143 0.5333333 0.3333333
## 146 0.3333333 0.5000000 0.2222222 0.4444444 0.2000000
## 147 0.2500000 0.4444444 0.2857143 0.5000000 0.4444444
## 148 0.5000000 0.1818182 0.6153846 0.7500000 0.5454545
## 149 0.4285714 0.4000000 0.4444444 0.5714286 0.3076923
## 150 0.3333333 0.2222222 0.4000000 0.4444444 0.4000000
## 151 0.6666667 0.6000000 0.4615385 0.5333333 0.4000000
## 152 0.3636364 0.2222222 0.4444444 0.0000000 0.2222222
## 153 0.4615385 0.5714286 0.7500000 0.2857143 0.0000000
## 154 0.4000000 0.0000000 0.3333333 0.6666667 0.2857143
## 155 0.1818182 0.6666667 0.4000000 0.2222222 0.5000000
## 156 0.0000000 0.0000000 0.0000000 0.0000000 0.0000000
## 157 0.0000000 0.0000000 0.0000000 0.0000000 0.0000000
## 158 0.5333333 0.7142857 0.5714286 0.5882353 0.4615385
## 159 0.4615385 0.7500000 0.0000000 0.3076923 0.6153846
## 160 0.4444444 0.0000000 0.2857143 0.0000000 0.2500000
## 161 0.2000000 0.3636364 0.2222222 0.2222222 0.3333333
## 162 0.2857143 0.0000000 0.3636364 0.5714286 0.3333333
## 163 0.6666667 0.5000000 0.4444444 0.2857143 0.7500000
## 164 0.2222222 0.0000000 0.0000000 0.4000000 0.3636364
## 165 0.5000000 0.5000000 0.0000000 0.2857143 0.5000000
## 166 0.0000000 0.0000000 0.0000000 0.0000000 0.2500000
## 167 0.4615385 0.4444444 0.3636364 0.1333333 0.5454545
## 168 0.3333333 0.2222222 0.5000000 0.2500000 0.3333333
## 169 0.0000000 0.0000000 0.5000000 0.0000000 0.0000000
## 170 0.2000000 0.2000000 0.4444444 0.3333333 0.0000000
## 171 0.5454545 0.2000000 0.3333333 0.5000000 0.2222222
## 172 0.4000000 0.4000000 0.5454545 0.2222222 0.1538462
## 173 0.5882353 0.3076923 0.3750000 0.6666667 0.4444444
## 174 0.3333333 0.0000000 0.0000000 0.0000000 0.0000000
## 175 0.4285714 0.4000000 0.1666667 0.3636364 0.4000000
## 176 0.4000000 0.5000000 0.1666667 0.0000000 0.4000000
```

```
## 177 0.4444444 0.4000000 0.3333333 0.2857143 0.4000000
## 178 0.5000000 0.4000000 0.2857143 0.5714286 0.3636364
## 179 0.6666667 0.6666667 0.6153846 0.2857143 0.5454545
## 180 0.4444444 0.2857143 0.5000000 0.4444444 0.6000000
## 181 0.0000000 0.0000000 0.0000000 0.0000000 0.0000000
## 182 0.2500000 0.2000000 0.0000000 0.5000000 0.2500000
## 183 0.5714286 0.3076923 0.2500000 0.3333333 0.4000000
## 184 0.6666667 0.2857143 0.5000000 0.6666667 0.5454545
## 185 0.6000000 0.4444444 0.2222222 0.5714286 0.4000000
## 186 1.0000000 0.2857143 0.4000000 0.5000000 0.6666667
## 187 0.6666667 0.5454545 0.8333333 0.3636364 0.1818182
## 188 0.3333333 0.1818182 0.2857143 0.3333333 0.4000000
## 189 0.4000000 0.0000000 0.0000000 0.5000000 0.0000000
## 190 0.4285714 0.5454545 0.4285714 0.4615385 0.2857143
## 191 0.2222222 0.5714286 0.4444444 0.3636364 0.4444444
## 192 0.2500000 0.2222222 0.3333333 0.4444444 0.3333333
## 193 0.4000000 0.0000000 0.0000000 0.2857143 0.0000000
## 194 0.2500000 0.0000000 0.1818182 0.6000000 0.8000000
## 195 0.6153846 0.6666667 0.5000000 0.5454545 0.2222222
## 196 0.4000000 0.0000000 0.0000000 0.2500000 0.0000000
## 197 0.6153846 0.2857143 0.5714286 0.6153846 0.6153846
## 198 0.3333333 0.0000000 0.0000000 0.6666667 0.0000000
## 199 0.2222222 0.0000000 0.3333333 0.2500000 0.2500000
## 200 0.3333333 0.5000000 0.0000000 0.3333333 0.3333333
## 201 0.0000000 0.2857143 0.2857143 0.2500000 0.0000000
## 202 0.6153846 0.3333333 0.6153846 0.4285714 0.5714286
## 203 0.2222222 0.2500000 0.2222222 0.0000000 0.4444444
## 204 0.5714286 0.2500000 0.5000000 0.6666667 0.5000000
## 205 0.2857143 0.0000000 1.0000000 0.2857143 1.0000000
## 206 0.0000000 0.2857143 0.4000000 0.5000000 0.3333333
## 207 0.6666667 0.4615385 0.4000000 0.5000000 0.6000000
## 208 0.2222222 0.2000000 0.0000000 0.0000000 0.2500000
## 209 0.0000000 0.1666667 0.0000000 0.4285714 0.6000000
## 210 0.0000000 0.0000000 0.3333333 0.0000000 0.0000000
## 211 0.2857143 0.2500000 0.0000000 0.5000000 0.3333333
## 212 0.3333333 0.3333333 0.4000000 0.5714286 0.5714286
## 213 0.0000000 0.2500000 0.2857143 0.2857143 0.6666667
## 214 0.4000000 0.6666667 0.2857143 0.4000000 0.0000000
## 215 0.2222222 0.2000000 0.0000000 0.2000000 0.2000000
## 216 0.4000000 0.3333333 0.0000000 0.0000000 0.2857143
## 217 0.2857143 0.4444444 0.0000000 0.2500000 0.6000000
## 218 0.0000000 0.2857143 0.2857143 0.0000000 0.6000000
## 219 0.4000000 0.7272727 0.5000000 0.0000000 0.4444444
## 220 0.2500000 0.3333333 0.4000000 0.5000000 0.7500000
## 221 0.5000000 0.5714286 0.6666667 0.7500000 0.5000000
## 222 0.5714286 0.5000000 0.7500000 0.5714286 0.8571429
## 223 0.3333333 0.0000000 0.0000000 0.0000000 0.0000000
## 224 0.4444444 0.4000000 0.2857143 0.5000000 0.6666667
## 225 0.7500000 0.5000000 0.7500000 0.5000000 0.5454545
## 226 0.6000000 0.9090909 0.4444444 0.6666667 0.7272727
## 227 0.5000000 0.0000000 0.4444444 0.5000000 0.1818182
## 228 0.3333333 0.0000000 0.0000000 0.0000000 0.2857143
## 229 0.5000000 0.3333333 0.5000000 0.3333333 0.4000000
## 230 0.2857143 0.5000000 0.5714286 0.2857143 0.3333333
## 231 0.3333333 0.2500000 0.2857143 0.0000000 0.0000000
## 232 0.6000000 0.9090909 0.3333333 0.6666667 0.5714286
## 233 0.0000000 0.0000000 0.2857143 0.5000000 0.6666667
## 234 0.8571429 0.2857143 0.4000000 0.0000000 0.5000000
```

```
## 235 0.0000000 0.5000000 0.0000000 0.2500000 0.5000000
## 236 0.4444444 0.2500000 0.2857143 0.2222222 0.2500000
## 237 0.0000000 0.0000000 0.3333333 0.0000000 0.0000000
## 238 0.5000000 0.0000000 1.0000000 0.5000000 0.0000000
## 239 0.2857143 0.5714286 0.5714286 0.4000000 0.0000000
## 240 0.6666667 0.2857143 0.4000000 0.6666667 0.2500000
## 241 0.0000000 0.0000000 0.3333333 0.0000000 0.4000000
## 242 0.0000000 0.0000000 0.0000000 0.2857143 0.0000000
## 243 0.8000000 0.5714286 0.0000000 0.4000000 0.5000000
## 244 0.5714286 0.6666667 0.3333333 0.4444444 0.0000000
## 245 0.0000000 0.0000000 0.0000000 0.0000000 0.0000000
## 246 0.6666667 0.0000000 0.0000000 0.3333333 0.0000000
## 247 0.6666667 0.0000000 0.0000000 0.5000000 0.0000000
## 248 0.8571429 0.0000000 0.3333333 0.5714286 0.4000000
## 249 0.8571429 0.3333333 0.5714286 0.3333333 0.2500000
## 250 0.7500000 0.4000000 1.0000000 0.7500000 0.6666667
## 251 0.4444444 0.6666667 0.5714286 0.2857143 0.3333333
## 252 0.0000000 0.0000000 0.0000000 0.0000000 0.0000000
## 253 0.5000000 0.0000000 0.0000000 0.0000000 0.0000000
## 254 0.5000000 0.5000000 0.0000000 0.4000000 0.0000000
## 255 0.3333333 0.0000000 0.0000000 0.6666667 0.4000000
## 256 0.5714286 0.4000000 0.8000000 0.4000000 0.0000000
## 257 0.7500000 0.6666667 0.2500000 0.0000000 0.2857143
## 258 0.5000000 0.0000000 0.6666667 0.2500000 0.4000000
## 259 0.4000000 0.2857143 0.2857143 0.5000000 0.0000000
## 260 0.5000000 0.0000000 0.4000000 0.5714286 0.3333333
## 261 0.4000000 0.0000000 0.0000000 0.2857143 0.4000000
## 262 0.0000000 0.0000000 0.0000000 0.0000000 0.0000000
## 263 0.0000000 0.0000000 0.0000000 0.0000000 0.0000000
## 264 0.2857143 0.4000000 0.5000000 0.3333333 0.3333333
## 265 0.5000000 0.5714286 0.0000000 0.7500000 0.4000000
## 266 0.4000000 0.5000000 0.3333333 0.4000000 0.3333333
## 267 0.5714286 1.0000000 0.3333333 0.8000000 0.6666667
## 268 0.4000000 0.5000000 0.5714286 0.6666667 0.2500000
## 269 0.5000000 0.4000000 0.4000000 1.0000000 0.6666667
## 270 0.6666667 0.5000000 0.6666667 0.5000000 0.3333333
## 271 0.5000000 0.4000000 0.5000000 0.4000000 0.5000000
## 272 0.0000000 0.4000000 0.5000000 0.6666667 0.0000000
## 273 0.4000000 0.4000000 0.0000000 0.2500000 0.0000000
## 274 0.2857143 0.5000000 0.2857143 0.4000000 0.4000000
## 275 0.6666667 0.5714286 0.6666667 0.5714286 0.4000000
## 276 0.3636364 0.7058824 0.6250000 0.3076923 0.5333333
## 277 0.3636364 0.5555556 0.5000000 0.4285714 0.2666667
## 278 0.5263158 0.4705882 0.6666667 0.7368421 0.7058824
## 279 0.2000000 0.5714286 0.4285714 0.4285714 0.2857143
## 280 0.3076923 0.3750000 0.5000000 0.1538462 0.4000000
## 281 0.0000000 0.0000000 0.0000000 0.6666667 0.0000000
## 282 0.3636364 0.3076923 0.6153846 0.2000000 0.5714286
## 283 0.2857143 0.6666667 0.2857143 0.0000000 0.4000000
## 284 0.2000000 0.2222222 0.1538462 0.3333333 0.4000000
## 285 0.4000000 0.2500000 0.0000000 0.2500000 0.5714286
## 286 0.0000000 0.3333333 0.0000000 0.2857143 0.0000000
## 287 0.7272727 0.2857143 0.6666667 0.4444444 0.2500000
## 288 0.4000000 0.0000000 0.0000000 0.0000000 0.4000000
## 289 0.4000000 0.7500000 0.3333333 0.7500000 0.8571429
## 290 0.6666667 0.2857143 0.2857143 0.8000000 0.5000000
## 291 0.3333333 0.3333333 0.4000000 0.0000000 0.0000000
## 292 0.5000000 0.2857143 0.4000000 0.5714286 0.3333333
```

```
## 293 0.6666667 1.0000000 0.5714286 0.6000000 0.5454545
## 294 0.5000000 0.5000000 0.0000000 0.5000000 0.5000000
## 295 0.6666667 0.5714286 0.0000000 0.5000000 0.5714286
## 296 0.6666667 0.3333333 0.8000000 0.0000000 0.8000000
## 297 0.4444444 0.5000000 0.0000000 0.4444444 0.5000000
## 298 0.7000000 0.7368421 0.8571429 0.6363636 0.8181818
## 299 0.3333333 0.8000000 0.4000000 0.6666667 1.0000000
## 300 0.6666667 0.5000000 0.5000000 0.5000000 0.5000000
##
## $Jaccard
##                1          2          3          4          5
## 1    0.00000000 0.33333333 0.00000000 0.33333333 0.20000000
## 2    0.27272727 0.40000000 0.30000000 0.28571429 0.36363636
## 3    0.28571429 0.45454545 0.50000000 0.40000000 0.38461538
## 4    0.27272727 0.40000000 0.45454545 0.33333333 0.55555556
## 5    0.18181818 0.00000000 0.22222222 0.18181818 0.18181818
## 6    0.50000000 0.90000000 0.58333333 0.69230769 0.69230769
## 7    0.36363636 0.33333333 0.55555556 0.20000000 0.40000000
## 8    0.41666667 0.33333333 0.41666667 0.50000000 0.41666667
## 9    0.33333333 0.63636364 0.27272727 0.40000000 0.63636364
## 10   0.27272727 0.45454545 0.44444444 0.27272727 0.55555556
## 11   0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 12   0.85714286 0.73333333 0.78571429 0.64285714 0.91666667
## 13   0.76923077 0.42857143 0.72727273 0.66666667 0.66666667
## 14   0.63636364 0.30769231 0.60000000 0.50000000 0.38461538
## 15   0.42857143 0.46666667 0.50000000 0.61538462 0.42857143
## 16   0.64285714 0.64285714 0.69230769 0.64285714 0.61538462
## 17   0.60000000 0.30769231 0.30769231 0.35714286 0.55555556
## 18   0.36363636 0.55555556 0.50000000 0.50000000 0.60000000
## 19   0.46666667 0.66666667 0.66666667 0.73333333 0.66666667
## 20   0.53846154 0.58333333 0.30769231 0.58333333 0.54545455
## 21   0.50000000 0.42857143 0.35714286 0.50000000 0.58333333
## 22   0.30769231 0.30769231 0.28571429 0.46153846 0.46153846
## 23   0.25000000 0.30000000 0.36363636 0.33333333 0.40000000
## 24   0.58333333 0.54545455 0.28571429 0.46153846 0.46153846
## 25   0.40000000 0.44444444 0.33333333 0.50000000 0.11111111
## 26   0.30000000 0.55555556 0.33333333 0.75000000 0.44444444
## 27   0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 28   0.35714286 0.54545455 0.46153846 0.30769231 0.45454545
## 29   0.50000000 0.40000000 0.45454545 0.40000000 0.66666667
## 30   0.46153846 0.40000000 0.30769231 0.28571429 0.50000000
## 31   0.50000000 0.60000000 0.58333333 0.50000000 0.64285714
## 32   0.66666667 0.57142857 0.69230769 0.53846154 0.46153846
## 33   0.85714286 0.41666667 0.58333333 0.63636364 0.15384615
## 34   0.54545455 0.45454545 0.46153846 0.46153846 0.38461538
## 35   0.53846154 0.61538462 0.63636364 0.30769231 0.58333333
## 36   0.46666667 0.46666667 0.63636364 0.40000000 0.33333333
## 37   0.53846154 0.61538462 0.71428571 0.60000000 0.53333333
## 38   0.30769231 0.35714286 0.30769231 0.53846154 0.30769231
## 39   0.53846154 0.50000000 0.41666667 0.58333333 0.53846154
## 40   0.57142857 0.81818182 0.75000000 0.53846154 0.90909091
## 41   0.61538462 0.33333333 0.66666667 0.58333333 0.58333333
## 42   0.50000000 0.46153846 0.53846154 0.30769231 0.41666667
## 43   0.50000000 0.25000000 0.54545455 0.50000000 0.50000000
## 44   0.61538462 0.46153846 0.58333333 0.70000000 0.50000000
## 45   0.38461538 0.75000000 0.53846154 0.66666667 0.50000000
## 46   0.35714286 0.33333333 0.45454545 0.54545455 0.66666667
## 47   0.25000000 0.30000000 0.45454545 0.33333333 0.22222222
```

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```
## 48   0.60000000 0.16666667 0.27272727 0.33333333 0.66666667
## 49   0.38461538 0.70000000 0.50000000 0.41666667 0.41666667
## 50   0.75000000 0.66666667 0.64285714 0.41666667 0.58333333
## 51   0.23076923 0.46153846 0.50000000 0.30769231 0.38461538
## 52   0.09090909 0.30000000 0.44444444 0.40000000 0.20000000
## 53   0.44444444 0.33333333 0.60000000 0.58333333 0.45454545
## 54   0.83333333 0.64285714 0.57142857 0.50000000 0.64285714
## 55   0.27272727 0.36363636 0.55555556 0.33333333 0.33333333
## 56   0.23076923 0.40000000 0.44444444 0.33333333 0.33333333
## 57   0.35714286 0.72727273 0.42857143 0.42857143 0.28571429
## 58   0.58333333 0.66666667 0.46153846 0.72727273 0.38461538
## 59   0.57142857 0.66666667 0.61538462 0.76923077 0.78571429
## 60   0.18181818 0.40000000 0.30000000 0.33333333 0.55555556
## 61   0.35714286 0.30769231 0.41666667 0.58333333 0.50000000
## 62   0.70000000 0.60000000 0.54545455 0.54545455 0.45454545
## 63   0.60000000 0.41666667 0.40000000 0.41666667 0.60000000
## 64   0.42857143 0.37500000 0.33333333 0.12500000 0.50000000
## 65   0.16666667 0.23076923 0.45454545 0.25000000 0.54545455
## 66   0.25000000 0.35714286 0.36363636 0.15384615 0.42857143
## 67   0.42857143 0.46153846 0.45454545 0.42857143 0.38461538
## 68   0.69230769 0.61538462 0.57142857 0.53846154 0.75000000
## 69   0.41666667 0.63636364 0.41666667 0.66666667 0.42857143
## 70   0.28571429 0.38461538 0.30769231 0.14285714 0.66666667
## 71   0.33333333 0.33333333 0.20000000 0.30769231 0.40000000
## 72   0.42857143 0.57142857 0.61538462 0.38461538 0.58333333
## 73   0.50000000 0.50000000 0.46666667 0.61538462 0.69230769
## 74   0.38461538 0.30769231 0.15384615 0.33333333 0.41666667
## 75   0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 76   0.64285714 0.40000000 0.60000000 0.57142857 0.60000000
## 77   0.53333333 0.53846154 0.56250000 0.64285714 0.64285714
## 78   0.53846154 0.36363636 0.66666667 0.50000000 0.42857143
## 79   0.12500000 0.20000000 0.20000000 0.09090909 0.11111111
## 80   0.60000000 0.41666667 0.36363636 0.20000000 0.36363636
## 81   0.30769231 0.50000000 0.58333333 0.42857143 0.42857143
## 82   0.55555556 0.27272727 0.58333333 0.50000000 0.40000000
## 83   0.57142857 0.53846154 0.50000000 0.50000000 0.38461538
## 84   0.28571429 0.12500000 0.14285714 0.00000000 0.00000000
## 85   0.33333333 0.20000000 0.25000000 0.30000000 0.28571429
## 86   0.45454545 0.54545455 0.45454545 0.25000000 0.30769231
## 87   0.33333333 0.33333333 0.61538462 0.38461538 0.53846154
## 88   0.33333333 0.60000000 0.72727273 0.25000000 0.40000000
## 89   0.33333333 0.41666667 0.36363636 0.16666667 0.16666667
## 90   0.66666667 0.54545455 0.10000000 0.45454545 0.36363636
## 91   0.54545455 0.45454545 0.25000000 0.21428571 0.16666667
## 92   0.38461538 0.69230769 0.58333333 0.61538462 0.30769231
## 93   0.42857143 0.61538462 0.50000000 0.42857143 0.57142857
## 94   0.50000000 0.37500000 0.45454545 0.55555556 0.44444444
## 95   0.57142857 0.58333333 0.46666667 0.28571429 0.53846154
## 96   0.30000000 0.45454545 0.40000000 0.41666667 0.54545455
## 97   0.41666667 0.30769231 0.07142857 0.33333333 0.15384615
## 98   0.15384615 0.40000000 0.33333333 0.33333333 0.16666667
## 99   0.18181818 0.07142857 0.20000000 0.28571429 0.25000000
## 100  0.27272727 0.08333333 0.20000000 0.23076923 0.30000000
## 101  0.38461538 0.36363636 0.30000000 0.33333333 0.33333333
## 102  0.50000000 0.40000000 0.20000000 0.30000000 0.18181818
## 103  0.36363636 0.50000000 0.33333333 0.27272727 0.54545455
## 104  0.40000000 0.46153846 0.35714286 0.50000000 0.28571429
## 105  0.12500000 0.44444444 0.44444444 0.11111111 0.20000000
```

```
## 106 0.25000000 0.20000000 0.25000000 0.11111111 0.40000000
## 107 0.25000000 0.33333333 0.28571429 0.00000000 0.10000000
## 108 0.53846154 0.53846154 0.60000000 0.33333333 0.25000000
## 109 0.38461538 0.41666667 0.38461538 0.27272727 0.30769231
## 110 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 111 0.40000000 0.25000000 0.50000000 0.44444444 0.66666667
## 112 0.40000000 0.16666667 0.45454545 0.45454545 0.27272727
## 113 0.33333333 0.44444444 0.25000000 0.41666667 0.18181818
## 114 0.07692308 0.00000000 0.50000000 0.22222222 0.12500000
## 115 0.40000000 0.33333333 0.33333333 0.08333333 0.33333333
## 116 0.33333333 0.16666667 0.00000000 0.20000000 0.14285714
## 117 0.36363636 0.33333333 0.41666667 0.50000000 0.15384615
## 118 0.61538462 0.35714286 0.35714286 0.46666667 0.20000000
## 119 0.14285714 0.11111111 0.16666667 0.25000000 0.14285714
## 120 0.14285714 0.12500000 0.00000000 0.00000000 0.20000000
## 121 0.37500000 0.25000000 0.30000000 0.08333333 0.22222222
## 122 0.50000000 0.63636364 0.33333333 0.50000000 0.53846154
## 123 0.10000000 0.33333333 0.00000000 0.16666667 0.33333333
## 124 0.37500000 0.00000000 0.50000000 0.25000000 0.42857143
## 125 0.14285714 0.25000000 0.11111111 0.40000000 0.20000000
## 126 0.27272727 0.18181818 0.07692308 0.22222222 0.41666667
## 127 0.25000000 0.07692308 0.16666667 0.09090909 0.18181818
## 128 0.36363636 0.21428571 0.30769231 0.26666667 0.54545455
## 129 0.38461538 0.20000000 0.27272727 0.25000000 0.18181818
## 130 0.50000000 0.33333333 0.30769231 0.30769231 0.38461538
## 131 0.41666667 0.38461538 0.10000000 0.25000000 0.36363636
## 132 0.41666667 0.40000000 0.36363636 0.41666667 0.25000000
## 133 0.11111111 0.40000000 0.11111111 0.22222222 0.25000000
## 134 0.33333333 0.33333333 0.22222222 0.21428571 0.40000000
## 135 0.08333333 0.41666667 0.08333333 0.25000000 0.30769231
## 136 0.22222222 0.10000000 0.30000000 0.33333333 0.33333333
## 137 0.41666667 0.36363636 0.25000000 0.25000000 0.23076923
## 138 0.08333333 0.22222222 0.44444444 0.09090909 0.45454545
## 139 0.18181818 0.10000000 0.20000000 0.00000000 0.11111111
## 140 0.12500000 0.00000000 0.00000000 0.20000000 0.16666667
## 141 0.30000000 0.22222222 0.11111111 0.22222222 0.16666667
## 142 0.12500000 0.10000000 0.33333333 0.22222222 0.25000000
## 143 0.18181818 0.11111111 0.00000000 0.28571429 0.20000000
## 144 0.18181818 0.30000000 0.09090909 0.20000000 0.00000000
## 145 0.25000000 0.22222222 0.16666667 0.36363636 0.20000000
## 146 0.20000000 0.33333333 0.12500000 0.28571429 0.11111111
## 147 0.14285714 0.28571429 0.16666667 0.33333333 0.28571429
## 148 0.33333333 0.10000000 0.44444444 0.60000000 0.37500000
## 149 0.27272727 0.25000000 0.28571429 0.40000000 0.18181818
## 150 0.20000000 0.12500000 0.25000000 0.28571429 0.25000000
## 151 0.50000000 0.42857143 0.30000000 0.36363636 0.25000000
## 152 0.22222222 0.12500000 0.28571429 0.00000000 0.12500000
## 153 0.30000000 0.40000000 0.60000000 0.16666667 0.00000000
## 154 0.25000000 0.00000000 0.20000000 0.50000000 0.16666667
## 155 0.10000000 0.50000000 0.25000000 0.12500000 0.33333333
## 156 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 157 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 158 0.36363636 0.55555556 0.40000000 0.41666667 0.30000000
## 159 0.30000000 0.60000000 0.00000000 0.18181818 0.44444444
## 160 0.28571429 0.00000000 0.16666667 0.00000000 0.14285714
## 161 0.11111111 0.22222222 0.12500000 0.12500000 0.20000000
## 162 0.16666667 0.00000000 0.22222222 0.40000000 0.20000000
## 163 0.50000000 0.33333333 0.28571429 0.16666667 0.60000000
```

```
## 164 0.12500000 0.00000000 0.00000000 0.25000000 0.22222222
## 165 0.33333333 0.33333333 0.00000000 0.16666667 0.33333333
## 166 0.00000000 0.00000000 0.00000000 0.00000000 0.14285714
## 167 0.30000000 0.28571429 0.22222222 0.07142857 0.37500000
## 168 0.20000000 0.12500000 0.33333333 0.14285714 0.20000000
## 169 0.00000000 0.00000000 0.33333333 0.00000000 0.00000000
## 170 0.11111111 0.11111111 0.28571429 0.20000000 0.00000000
## 171 0.37500000 0.11111111 0.20000000 0.33333333 0.12500000
## 172 0.25000000 0.25000000 0.37500000 0.12500000 0.08333333
## 173 0.41666667 0.18181818 0.23076923 0.50000000 0.28571429
## 174 0.20000000 0.00000000 0.00000000 0.00000000 0.00000000
## 175 0.27272727 0.25000000 0.09090909 0.22222222 0.25000000
## 176 0.25000000 0.33333333 0.09090909 0.00000000 0.25000000
## 177 0.28571429 0.25000000 0.20000000 0.16666667 0.25000000
## 178 0.33333333 0.25000000 0.16666667 0.40000000 0.22222222
## 179 0.50000000 0.50000000 0.44444444 0.16666667 0.37500000
## 180 0.28571429 0.16666667 0.33333333 0.28571429 0.42857143
## 181 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 182 0.14285714 0.11111111 0.00000000 0.33333333 0.14285714
## 183 0.40000000 0.18181818 0.14285714 0.20000000 0.25000000
## 184 0.50000000 0.16666667 0.33333333 0.50000000 0.37500000
## 185 0.42857143 0.28571429 0.12500000 0.40000000 0.25000000
## 186 1.00000000 0.16666667 0.25000000 0.33333333 0.50000000
## 187 0.50000000 0.37500000 0.71428571 0.22222222 0.10000000
## 188 0.20000000 0.10000000 0.16666667 0.20000000 0.25000000
## 189 0.25000000 0.00000000 0.00000000 0.33333333 0.00000000
## 190 0.27272727 0.37500000 0.27272727 0.30000000 0.16666667
## 191 0.12500000 0.40000000 0.28571429 0.22222222 0.28571429
## 192 0.14285714 0.12500000 0.20000000 0.28571429 0.20000000
## 193 0.25000000 0.00000000 0.00000000 0.16666667 0.00000000
## 194 0.14285714 0.00000000 0.10000000 0.42857143 0.66666667
## 195 0.44444444 0.50000000 0.33333333 0.37500000 0.12500000
## 196 0.25000000 0.00000000 0.00000000 0.14285714 0.00000000
## 197 0.44444444 0.16666667 0.40000000 0.44444444 0.44444444
## 198 0.20000000 0.00000000 0.00000000 0.50000000 0.00000000
## 199 0.12500000 0.00000000 0.20000000 0.14285714 0.14285714
## 200 0.20000000 0.33333333 0.00000000 0.20000000 0.20000000
## 201 0.00000000 0.16666667 0.16666667 0.14285714 0.00000000
## 202 0.44444444 0.20000000 0.44444444 0.27272727 0.40000000
## 203 0.12500000 0.14285714 0.12500000 0.00000000 0.28571429
## 204 0.40000000 0.14285714 0.33333333 0.50000000 0.33333333
## 205 0.16666667 0.00000000 1.00000000 0.16666667 1.00000000
## 206 0.00000000 0.16666667 0.25000000 0.33333333 0.20000000
## 207 0.50000000 0.30000000 0.25000000 0.33333333 0.42857143
## 208 0.12500000 0.11111111 0.00000000 0.00000000 0.14285714
## 209 0.00000000 0.09090909 0.00000000 0.27272727 0.42857143
## 210 0.00000000 0.00000000 0.20000000 0.00000000 0.00000000
## 211 0.16666667 0.14285714 0.00000000 0.33333333 0.20000000
## 212 0.20000000 0.20000000 0.25000000 0.40000000 0.40000000
## 213 0.00000000 0.14285714 0.16666667 0.16666667 0.50000000
## 214 0.25000000 0.50000000 0.16666667 0.25000000 0.00000000
## 215 0.12500000 0.11111111 0.00000000 0.11111111 0.11111111
## 216 0.25000000 0.20000000 0.00000000 0.00000000 0.16666667
## 217 0.16666667 0.28571429 0.00000000 0.14285714 0.42857143
## 218 0.00000000 0.16666667 0.16666667 0.00000000 0.42857143
## 219 0.25000000 0.57142857 0.33333333 0.00000000 0.28571429
## 220 0.14285714 0.20000000 0.25000000 0.33333333 0.60000000
## 221 0.33333333 0.40000000 0.50000000 0.60000000 0.33333333
```

```
## 222 0.40000000 0.33333333 0.60000000 0.40000000 0.75000000
## 223 0.20000000 0.00000000 0.00000000 0.00000000 0.00000000
## 224 0.28571429 0.25000000 0.16666667 0.33333333 0.50000000
## 225 0.60000000 0.33333333 0.60000000 0.33333333 0.37500000
## 226 0.42857143 0.83333333 0.28571429 0.50000000 0.57142857
## 227 0.33333333 0.00000000 0.28571429 0.33333333 0.10000000
## 228 0.20000000 0.00000000 0.00000000 0.00000000 0.16666667
## 229 0.33333333 0.20000000 0.33333333 0.20000000 0.25000000
## 230 0.16666667 0.33333333 0.40000000 0.16666667 0.20000000
## 231 0.20000000 0.14285714 0.16666667 0.00000000 0.00000000
## 232 0.42857143 0.83333333 0.20000000 0.50000000 0.40000000
## 233 0.00000000 0.00000000 0.16666667 0.33333333 0.50000000
## 234 0.75000000 0.16666667 0.25000000 0.00000000 0.33333333
## 235 0.00000000 0.33333333 0.00000000 0.14285714 0.33333333
## 236 0.28571429 0.14285714 0.16666667 0.12500000 0.14285714
## 237 0.00000000 0.00000000 0.20000000 0.00000000 0.00000000
## 238 0.33333333 0.00000000 1.00000000 0.33333333 0.00000000
## 239 0.16666667 0.40000000 0.40000000 0.25000000 0.00000000
## 240 0.50000000 0.16666667 0.25000000 0.50000000 0.14285714
## 241 0.00000000 0.00000000 0.20000000 0.00000000 0.25000000
## 242 0.00000000 0.00000000 0.00000000 0.16666667 0.00000000
## 243 0.66666667 0.40000000 0.00000000 0.25000000 0.33333333
## 244 0.40000000 0.50000000 0.20000000 0.28571429 0.00000000
## 245 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 246 0.50000000 0.00000000 0.00000000 0.20000000 0.00000000
## 247 0.50000000 0.00000000 0.00000000 0.33333333 0.00000000
## 248 0.75000000 0.00000000 0.20000000 0.40000000 0.25000000
## 249 0.75000000 0.20000000 0.40000000 0.20000000 0.14285714
## 250 0.60000000 0.25000000 1.00000000 0.60000000 0.50000000
## 251 0.28571429 0.50000000 0.40000000 0.16666667 0.20000000
## 252 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 253 0.33333333 0.00000000 0.00000000 0.00000000 0.00000000
## 254 0.33333333 0.33333333 0.00000000 0.25000000 0.00000000
## 255 0.20000000 0.00000000 0.00000000 0.50000000 0.25000000
## 256 0.40000000 0.25000000 0.66666667 0.25000000 0.00000000
## 257 0.60000000 0.50000000 0.14285714 0.00000000 0.16666667
## 258 0.33333333 0.00000000 0.50000000 0.14285714 0.25000000
## 259 0.25000000 0.16666667 0.16666667 0.33333333 0.00000000
## 260 0.33333333 0.00000000 0.25000000 0.40000000 0.20000000
## 261 0.25000000 0.00000000 0.00000000 0.16666667 0.25000000
## 262 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 263 0.00000000 0.00000000 0.00000000 0.00000000 0.00000000
## 264 0.16666667 0.25000000 0.33333333 0.20000000 0.20000000
## 265 0.33333333 0.40000000 0.00000000 0.60000000 0.25000000
## 266 0.25000000 0.33333333 0.20000000 0.25000000 0.20000000
## 267 0.40000000 1.00000000 0.20000000 0.66666667 0.50000000
## 268 0.25000000 0.33333333 0.40000000 0.50000000 0.14285714
## 269 0.33333333 0.25000000 0.25000000 1.00000000 0.50000000
## 270 0.50000000 0.33333333 0.50000000 0.33333333 0.20000000
## 271 0.33333333 0.25000000 0.33333333 0.25000000 0.33333333
## 272 0.00000000 0.25000000 0.33333333 0.50000000 0.00000000
## 273 0.25000000 0.25000000 0.00000000 0.14285714 0.00000000
## 274 0.16666667 0.33333333 0.16666667 0.25000000 0.25000000
## 275 0.50000000 0.40000000 0.50000000 0.40000000 0.25000000
## 276 0.22222222 0.54545455 0.45454545 0.18181818 0.36363636
## 277 0.22222222 0.38461538 0.33333333 0.27272727 0.15384615
## 278 0.35714286 0.30769231 0.50000000 0.58333333 0.54545455
## 279 0.11111111 0.40000000 0.27272727 0.27272727 0.16666667
```

```
## 280 0.18181818 0.23076923 0.33333333 0.08333333 0.25000000
## 281 0.00000000 0.00000000 0.00000000 0.50000000 0.00000000
## 282 0.22222222 0.18181818 0.44444444 0.11111111 0.40000000
## 283 0.16666667 0.50000000 0.16666667 0.00000000 0.25000000
## 284 0.11111111 0.12500000 0.08333333 0.20000000 0.25000000
## 285 0.25000000 0.14285714 0.00000000 0.14285714 0.40000000
## 286 0.00000000 0.20000000 0.00000000 0.16666667 0.00000000
## 287 0.57142857 0.16666667 0.50000000 0.28571429 0.14285714
## 288 0.25000000 0.00000000 0.00000000 0.00000000 0.25000000
## 289 0.25000000 0.60000000 0.20000000 0.60000000 0.75000000
## 290 0.50000000 0.16666667 0.16666667 0.66666667 0.33333333
## 291 0.20000000 0.20000000 0.25000000 0.00000000 0.00000000
## 292 0.33333333 0.16666667 0.25000000 0.40000000 0.20000000
## 293 0.50000000 1.00000000 0.40000000 0.42857143 0.37500000
## 294 0.33333333 0.33333333 0.00000000 0.33333333 0.33333333
## 295 0.50000000 0.40000000 0.00000000 0.33333333 0.40000000
## 296 0.50000000 0.20000000 0.66666667 0.00000000 0.66666667
## 297 0.28571429 0.33333333 0.00000000 0.28571429 0.33333333
## 298 0.53846154 0.58333333 0.75000000 0.46666667 0.69230769
## 299 0.20000000 0.66666667 0.25000000 0.50000000 1.00000000
## 300 0.50000000 0.33333333 0.33333333 0.33333333 0.33333333
```

## 3.2 Spatial Predictions and Projections

### 3.2.1 ESM Ensemble of Small Models

```r
library(biomod2)
```

```
## Loading required package: raster

##
## Attaching package: 'raster'

## The following objects are masked from 'package:ape':
##
##      rotate, zoom

## Loading required package: reshape

## Loading required package: ggplot2

## biomod2 3.3-7 loaded.
##
## Type browseVignettes(package='biomod2') to access directly biomod2 vignettes.
```

```r
path.wd<-getwd()
```

```r
# species
# occurrences
xy <- inv[,1:2]
head(xy)
```

```
##        x       y
## 1 142.25 -10.25
## 2 142.25 -10.75
## 3 131.25 -11.25
## 4 132.25 -11.25
## 5 142.25 -11.25
## 6 142.75 -11.25
```

```r
sp_occ <- inv[11]

# env
current <- inv[3:7]
head(current)
```

```
##      aetpet    gdd      p     pet     stdp
## 1 0.3180346 7965.1 1595.7 1950.320 137.8134
## 2 0.2807616 7888.9 1693.7 1991.475 156.3950
## 3 0.2638533 8165.3 1595.0 2179.968 127.0621
## 4 0.2790938 8195.6 1346.0 1919.897 114.7686
## 5 0.3030646 7858.1 1711.1 1795.255 158.3286
## 6 0.3217786 7888.5 1711.1 1788.220 151.8030
```

```r
## BIOMOD
setwd(path.wd)
t1 <- Sys.time()
sp<-1
```

### Formating the data with the BIOMOD_FormatingData() function form the package biomod2

```r
myBiomodData <- BIOMOD_FormatingData( resp.var = as.numeric(sp_occ[,sp]),
                                      expl.var = current,
                                      resp.xy = xy,
                                      resp.name = colnames(sp_occ)[sp])
```

```
##
## -=-=-=-=-=-=-=-=-=-=-= species_occ Data Formating -=-=-=-=-=-=-=-=-=-=-=-=
##
##  Response variable name was converted into species.occ
## > No pseudo absences selection !
##       ! No data has been set aside for modeling evaluation
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
```

```r
myBiomodOption <- Print_Default_ModelingOptions()
```

```
##
##  Defaut modeling options. copy, change what you want paste it as arg to BIOMOD_ModelingOptions
##
##
## -=-=-=-=-=-=-=-=-=-=-=  'BIOMOD.Model.Options'  -=-=-=-=-=-=-=-=-=-=-=
##
##
## GLM = list( type = 'quadratic',
##             interaction.level = 0,
##             myFormula = NULL,
##             test = 'AIC',
##             family = binomial(link = 'logit'),
##             mustart = 0.5,
##             control = glm.control(epsilon = 1e-08, maxit = 50
## , trace = FALSE) ),
##
##
## GBM = list( distribution = 'bernoulli',
##             n.trees = 2500,
##             interaction.depth = 7,
##             n.minobsinnode = 5,
##             shrinkage = 0.001,
##             bag.fraction = 0.5,
##             train.fraction = 1,
```

```
##                 cv.folds = 3,
##                 keep.data = FALSE,
##                 verbose = FALSE,
##                 perf.method = 'cv'),
##
## GAM = list( algo = 'GAM_mgcv',
##                 type = 's_smoother',
##                 k = -1,
##                 interaction.level = 0,
##                 myFormula = NULL,
##                 family = binomial(link = 'logit'),
##                 method = 'GCV.Cp',
##                 optimizer = c('outer','newton'),
##                 select = FALSE,
##                 knots = NULL,
##                 paraPen = NULL,
##                 control = list(nthreads = 1, irls.reg = 0, epsilon = 1e-07
## , maxit = 200, trace = FALSE, mgcv.tol = 1e-07, mgcv.half = 15
## , rank.tol = 1.49011611938477e-08
## , nlm = list(ndigit=7, gradtol=1e-06, stepmax=2, steptol=1e-04, iterlim=200, check.analyticals=0)
## , optim = list(factr=1e+07)
## , newton = list(conv.tol=1e-06, maxNstep=5, maxSstep=2, maxHalf=30, use.svd=0)
## , outerPIsteps = 0, idLinksBases = TRUE, scalePenalty = TRUE
## , keepData = FALSE, scale.est = fletcher) ),
##
##
## CTA = list( method = 'class',
##                 parms = 'default',
##                 cost = NULL,
##                 control = list(xval = 5, minbucket = 5, minsplit = 5
## , cp = 0.001, maxdepth = 25) ),
##
##
## ANN = list( NbCV = 5,
##                 size = NULL,
##                 decay = NULL,
##                 rang = 0.1,
##                 maxit = 200),
##
## SRE = list( quant = 0.025),
##
## FDA = list( method = 'mars',
##                 add_args = NULL),
##
## MARS = list( type = 'simple',
##                 interaction.level = 0,
##                 myFormula = NULL,
##                 nk = NULL,
##                 penalty = 2,
##                 thresh = 0.001,
##                 nprune = NULL,
##                 pmethod = 'backward'),
##
## RF = list( do.classif = TRUE,
##                 ntree = 500,
##                 mtry = 'default',
##                 nodesize = 5,
##                 maxnodes = NULL),
```

```
##
## MAXENT.Phillips = list( path_to_maxent.jar = '/private/var/folders/tq/p13f4x0n75d94lvlkzzr4ylr000
##                 memory_allocated = 512,
##                 background_data_dir = 'default',
##                 maximumbackground = 'default',
##                 maximumiterations = 200,
##                 visible = FALSE,
##                 linear = TRUE,
##                 quadratic = TRUE,
##                 product = TRUE,
##                 threshold = TRUE,
##                 hinge = TRUE,
##                 lq2lqptthreshold = 80,
##                 l2lqthreshold = 10,
##                 hingethreshold = 15,
##                 beta_threshold = -1,
##                 beta_categorical = -1,
##                 beta_lqp = -1,
##                 beta_hinge = -1,
##                 betamultiplier = 1,
##                 defaultprevalence = 0.5),
##
## MAXENT.Tsuruoka = list( l1_regularizer = 0,
##                         l2_regularizer = 0,
##                         use_sgd = FALSE,
##                         set_heldout = 0,
##                         verbose = FALSE)
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
```

```
myBiomodOption@GLM$test = 'none'
myBiomodOption@GBM$interaction.depth = 2
```

```
### Calibration of simple bivariate models
my.ESM <- ecospat.ESM.Modeling( data=myBiomodData,
                                models=c('GLM','RF'),
                                models.options=myBiomodOption,
                                NbRunEval=1,
                                DataSplit=70,
                                weighting.score=c("AUC"),
                                parallel=F)
```

```
##
##  > Automatic weights creation to rise a 0.5 prevalence
##
## Loading required library...
##
## Checking Models arguments...
##
## ! User defined data-split table was given -> NbRunEval, DataSplit and do.full.models argument wil
## Creating suitable Workdir...
##
##  > Automatic weights creation to rise a 0.5 prevalence
##
##
## -=-=-=-=-=-=-=-=-=- ESM.BIOMOD.1 Modeling Summary -=-=-=-=-=-=-=-=-=-=-
##
##  2  environmental variables ( aetpet gdd )
## Number of evaluation repetitions : 2
## Models selected : GLM RF
```

```
##
## Total number of model runs : 4
##
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
##
## -=-=-=- Run :  ESM.BIOMOD.1_AllData
##
##
## -=-=-=--=-=-=- ESM.BIOMOD.1_AllData_RUN1
##
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.1 ~ 1 + aetpet + I(aetpet^2) + gdd + I(gdd^2)
## <environment: 0x7ff3455dbb18>
##
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##  Evaluating Model stuff...
##
## -=-=-=--=-=-=- ESM.BIOMOD.1_AllData_RUN2
##
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.1 ~ 1 + aetpet + I(aetpet^2) + gdd + I(gdd^2)
## <environment: 0x7ff360111948>
##
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
##
##
##  Evaluating Model stuff...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=- Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
##
## Loading required library...
##
## Checking Models arguments...
##
## ! User defined data-split table was given -> NbRunEval, DataSplit and do.full.models argument wil
## Creating suitable Workdir...
##
##  > Automatic weights creation to rise a 0.5 prevalence
##
##
## -=-=-=-=-=-=-=-=-=-=- ESM.BIOMOD.2 Modeling Summary -=-=-=-=-=-=-=-=-=-=-
##
##  2  environmental variables ( aetpet p )
## Number of evaluation repetitions : 2
## Models selected : GLM RF
##
```

```
## Total number of model runs : 4
##
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
##
## -=-=-=- Run :  ESM.BIOMOD.2_AllData
##
##
## -=-=-=--=-=-=- ESM.BIOMOD.2_AllData_RUN1
##
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.2 ~ 1 + aetpet + I(aetpet^2) + p + I(p^2)
## <environment: 0x7ff35c44e440>
##
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##  Evaluating Model stuff...
##
## -=-=-=--=-=-=- ESM.BIOMOD.2_AllData_RUN2
##
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.2 ~ 1 + aetpet + I(aetpet^2) + p + I(p^2)
## <environment: 0x7ff3603d8cd8>
##
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##
## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
##
##  Evaluating Model stuff...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
##
## Loading required library...
##
## Checking Models arguments...
##
## ! User defined data-split table was given -> NbRunEval, DataSplit and do.full.models argument wil
## Creating suitable Workdir...
##
##  > Automatic weights creation to rise a 0.5 prevalence
##
##
## -=-=-=-=-=-=-=-=-=-= ESM.BIOMOD.3 Modeling Summary -=-=-=-=-=-=-=-=-=-=
##
##  2  environmental variables ( aetpet pet )
## Number of evaluation repetitions : 2
## Models selected : GLM RF
```

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```
## 
## Total number of model runs : 4
## 
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
## 
## 
## -=-=-=- Run :  ESM.BIOMOD.3_AllData
## 
## 
## -=-=-=-=-=-=- ESM.BIOMOD.3_AllData_RUN1
## 
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.3 ~ 1 + aetpet + I(aetpet^2) + pet + I(pet^2)
## <environment: 0x7ff3601e8a40>
## 
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##  Evaluating Model stuff...
## 
## -=-=-=-=-=-=- ESM.BIOMOD.3_AllData_RUN2
## 
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.3 ~ 1 + aetpet + I(aetpet^2) + pet + I(pet^2)
## <environment: 0x7ff3602dd468>
## 
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred

## 
##  Evaluating Model stuff...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
## 
## 
## Loading required library...
## 
## Checking Models arguments...
## 
## ! User defined data-split table was given -> NbRunEval, DataSplit and do.full.models argument wil
## Creating suitable Workdir...
## 
##  > Automatic weights creation to rise a 0.5 prevalence
## 
## 
## -=-=-=-=-=-=-=-=-=-=-=-= ESM.BIOMOD.4 Modeling Summary -=-=-=-=-=-=-=-=-=-=-=-=
## 
##  2  environmental variables ( aetpet stdp )
## Number of evaluation repetitions : 2
```

78

```
## Models selected : GLM RF
##
## Total number of model runs : 4
##
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
##
## -=-=-=- Run :  ESM.BIOMOD.4_AllData
##
##
## -=-=-=-=-=-=-=- ESM.BIOMOD.4_AllData_RUN1
##
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.4 ~ 1 + aetpet + I(aetpet^2) + stdp + I(stdp^2)
## <environment: 0x7ff3608202a8>
##
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##  Evaluating Model stuff...
##
## -=-=-=-=-=-=-=- ESM.BIOMOD.4_AllData_RUN2
##
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.4 ~ 1 + aetpet + I(aetpet^2) + stdp + I(stdp^2)
## <environment: 0x7ff346e35898>
##
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
##
##
##  Evaluating Model stuff...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
##
## Loading required library...
##
## Checking Models arguments...
##
## ! User defined data-split table was given -> NbRunEval, DataSplit and do.full.models argument wil
## Creating suitable Workdir...
##
##  > Automatic weights creation to rise a 0.5 prevalence
##
##
## -=-=-=-=-=-=-=-=-=-=-= ESM.BIOMOD.5 Modeling Summary -=-=-=-=-=-=-=-=-=-=-=
##
##  2  environmental variables ( gdd p )
## Number of evaluation repetitions : 2
## Models selected : GLM RF
```

```
## 
## Total number of model runs : 4
## 
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
## 
## 
## -=-=-=- Run :  ESM.BIOMOD.5_AllData
## 
## 
## -=-=-=--=-=-=- ESM.BIOMOD.5_AllData_RUN1
## 
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.5 ~ 1 + gdd + I(gdd^2) + p + I(p^2)
## <environment: 0x7ff3608f24b0>
## 
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
## 
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
## 
## 
##  Evaluating Model stuff...
## 
## -=-=-=--=-=-=- ESM.BIOMOD.5_AllData_RUN2
## 
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.5 ~ 1 + gdd + I(gdd^2) + p + I(p^2)
## <environment: 0x7ff360340b88>
## 
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
## 
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
## 
## 
##  Evaluating Model stuff...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
## 
## 
## Loading required library...
## 
## Checking Models arguments...
## 
## ! User defined data-split table was given -> NbRunEval, DataSplit and do.full.models argument wil
## Creating suitable Workdir...
## 
##  > Automatic weights creation to rise a 0.5 prevalence
## 
## 
## -=-=-=-=-=-=-=-=-=-=-= ESM.BIOMOD.6 Modeling Summary -=-=-=-=-=-=-=-=-=-=-=
## 
##  2  environmental variables ( gdd pet )
```

```
## Number of evaluation repetitions : 2
## Models selected : GLM RF
##
## Total number of model runs : 4
##
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
##
## -=-=-=- Run :  ESM.BIOMOD.6_AllData
##
##
## -=-=-=-=-=-=-=- ESM.BIOMOD.6_AllData_RUN1
##
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.6 ~ 1 + gdd + I(gdd^2) + pet + I(pet^2)
## <environment: 0x7ff35c7382e8>
##
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##  Evaluating Model stuff...
##
## -=-=-=-=-=-=-=- ESM.BIOMOD.6_AllData_RUN2
##
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.6 ~ 1 + gdd + I(gdd^2) + pet + I(pet^2)
## <environment: 0x7ff3606726b0>
##
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...

## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred

##
##  Evaluating Model stuff...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
##
## Loading required library...
##
## Checking Models arguments...
##
## ! User defined data-split table was given -> NbRunEval, DataSplit and do.full.models argument wil
## Creating suitable Workdir...
##
##  > Automatic weights creation to rise a 0.5 prevalence
##
##
## -=-=-=-=-=-=-=-=-=-= ESM.BIOMOD.7 Modeling Summary -=-=-=-=-=-=-=-=-=-=
##
```

```
##  2  environmental variables ( gdd stdp )
## Number of evaluation repetitions : 2
## Models selected : GLM RF
##
## Total number of model runs : 4
##
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
##
## -=-=-=- Run :  ESM.BIOMOD.7_AllData
##
##
## -=-=-=-=-=-=-=- ESM.BIOMOD.7_AllData_RUN1
##
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.7 ~ 1 + gdd + I(gdd^2) + stdp + I(stdp^2)
## <environment: 0x7ff3608f1520>
##
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##  Evaluating Model stuff...
##
## -=-=-=-=-=-=-=- ESM.BIOMOD.7_AllData_RUN2
##
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.7 ~ 1 + gdd + I(gdd^2) + stdp + I(stdp^2)
## <environment: 0x7ff3603d3200>
##
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##
## Warning: glm.fit: algorithm did not converge

## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred

##
##  Evaluating Model stuff...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=- Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-
##
##
## Loading required library...
##
## Checking Models arguments...
##
## ! User defined data-split table was given -> NbRunEval, DataSplit and do.full.models argument wil
## Creating suitable Workdir...
##
##  > Automatic weights creation to rise a 0.5 prevalence
##
##
## -=-=-=-=-=-=-=-=-=-= ESM.BIOMOD.8 Modeling Summary -=-=-=-=-=-=-=-=-=-=
```

```
## 
##  2  environmental variables ( p pet )
## Number of evaluation repetitions : 2
## Models selected : GLM RF
## 
## Total number of model runs : 4
## 
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
## 
## 
## -=-=-=- Run :  ESM.BIOMOD.8_AllData
## 
## 
## -=-=-=-=-=-=- ESM.BIOMOD.8_AllData_RUN1
## 
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.8 ~ 1 + p + I(p^2) + pet + I(pet^2)
## <environment: 0x7ff3608fa8d8>
## 
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##  Evaluating Model stuff...
## 
## -=-=-=-=-=-=- ESM.BIOMOD.8_AllData_RUN2
## 
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.8 ~ 1 + p + I(p^2) + pet + I(pet^2)
## <environment: 0x7ff3603d3510>
## 
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
## 
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
## 
## 
##  Evaluating Model stuff...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=- Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=
## 
## 
## Loading required library...
## 
## Checking Models arguments...
## 
## ! User defined data-split table was given -> NbRunEval, DataSplit and do.full.models argument wil
## Creating suitable Workdir...
## 
##  > Automatic weights creation to rise a 0.5 prevalence
## 
## 
## -=-=-=-=-=-=-=-=-=- ESM.BIOMOD.9 Modeling Summary -=-=-=-=-=-=-=-=-=-=
## 
```

```
##  2  environmental variables ( p stdp )
## Number of evaluation repetitions : 2
## Models selected : GLM RF
##
## Total number of model runs : 4
##
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
##
## -=-=-=- Run :  ESM.BIOMOD.9_AllData
##
##
## -=-=-=--=-=-=- ESM.BIOMOD.9_AllData_RUN1
##
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.9 ~ 1 + p + I(p^2) + stdp + I(stdp^2)
## <environment: 0x7ff3606d7838>
##
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##  Evaluating Model stuff...
##
## -=-=-=--=-=-=- ESM.BIOMOD.9_AllData_RUN2
##
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.9 ~ 1 + p + I(p^2) + stdp + I(stdp^2)
## <environment: 0x7ff346372740>
##
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
##
##  Evaluating Model stuff...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
##
## Loading required library...
##
## Checking Models arguments...
##
## ! User defined data-split table was given -> NbRunEval, DataSplit and do.full.models argument wil
## Creating suitable Workdir...
##
##  > Automatic weights creation to rise a 0.5 prevalence
##
##
## -=-=-=-=-=-=-=-=-=-= ESM.BIOMOD.10 Modeling Summary -=-=-=-=-=-=-=-=-=-=
##
##  2  environmental variables ( pet stdp )
```

```
## Number of evaluation repetitions : 2
## Models selected : GLM RF
##
## Total number of model runs : 4
##
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
##
## -=-=-=- Run :  ESM.BIOMOD.10_AllData
##
##
## -=-=-=-=-=-=-=- ESM.BIOMOD.10_AllData_RUN1
##
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.10 ~ 1 + pet + I(pet^2) + stdp + I(stdp^2)
## <environment: 0x7ff36012dcd0>
##
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##  Evaluating Model stuff...
##
## -=-=-=-=-=-=-=- ESM.BIOMOD.10_AllData_RUN2
##
## Model=GLM ( quadratic with no interaction )
##  No stepwise procedure
##  ! You might be confronted to models convergence issues !
##  selected formula : ESM.BIOMOD.10 ~ 1 + pet + I(pet^2) + stdp + I(stdp^2)
## <environment: 0x7ff35c789b88>
##
##  Model scaling...
##  Evaluating Model stuff...
## Model=Breiman and Cutler's random forests for classification and regression
##  Model scaling...
##
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
##
##  Evaluating Model stuff...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=- Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-
### Evaluation and average of simple bivariate models to ESMs
my.ESM_EF <- ecospat.ESM.EnsembleModeling(my.ESM,weighting.score=c("SomersD"),threshold=0)

### Projection of simple bivariate models into new space
my.ESM_proj_current <- ecospat.ESM.Projection(ESM.modeling.output=my.ESM,
                                              new.env=current)

##
## -=-=-=-=-=-=-=-=-=-=-=-= Do Models Projections -=-=-=-=-=-=-=-=-=-=-=-=
##
##      ! 'do.stack' arg is always set as TRUE for data.frame/matrix dataset
##  > Projecting ESM.BIOMOD.1_AllData_RUN2_GLM ...
##  > Projecting ESM.BIOMOD.1_AllData_RUN2_RF ...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=- Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-
##
## -=-=-=-=-=-=-=-=-=-=-=-= Do Models Projections -=-=-=-=-=-=-=-=-=-=-=-=
```

```
##
##       ! 'do.stack' arg is always set as TRUE for data.frame/matrix dataset
##  > Projecting ESM.BIOMOD.2_AllData_RUN2_GLM ...
##  > Projecting ESM.BIOMOD.2_AllData_RUN2_RF ...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
## -=-=-=-=-=-=-=-=-=-=-=-= Do Models Projections -=-=-=-=-=-=-=-=-=-=-=-=
##
##       ! 'do.stack' arg is always set as TRUE for data.frame/matrix dataset
##  > Projecting ESM.BIOMOD.3_AllData_RUN2_GLM ...
##  > Projecting ESM.BIOMOD.3_AllData_RUN2_RF ...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
## -=-=-=-=-=-=-=-=-=-=-=-= Do Models Projections -=-=-=-=-=-=-=-=-=-=-=-=
##
##       ! 'do.stack' arg is always set as TRUE for data.frame/matrix dataset
##  > Projecting ESM.BIOMOD.4_AllData_RUN2_GLM ...
##  > Projecting ESM.BIOMOD.4_AllData_RUN2_RF ...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
## -=-=-=-=-=-=-=-=-=-=-=-= Do Models Projections -=-=-=-=-=-=-=-=-=-=-=-=
##
##       ! 'do.stack' arg is always set as TRUE for data.frame/matrix dataset
##  > Projecting ESM.BIOMOD.5_AllData_RUN2_GLM ...
##  > Projecting ESM.BIOMOD.5_AllData_RUN2_RF ...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
## -=-=-=-=-=-=-=-=-=-=-=-= Do Models Projections -=-=-=-=-=-=-=-=-=-=-=-=
##
##       ! 'do.stack' arg is always set as TRUE for data.frame/matrix dataset
##  > Projecting ESM.BIOMOD.6_AllData_RUN2_GLM ...
##  > Projecting ESM.BIOMOD.6_AllData_RUN2_RF ...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
## -=-=-=-=-=-=-=-=-=-=-=-= Do Models Projections -=-=-=-=-=-=-=-=-=-=-=-=
##
##       ! 'do.stack' arg is always set as TRUE for data.frame/matrix dataset
##  > Projecting ESM.BIOMOD.7_AllData_RUN2_GLM ...
##  > Projecting ESM.BIOMOD.7_AllData_RUN2_RF ...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
## -=-=-=-=-=-=-=-=-=-=-=-= Do Models Projections -=-=-=-=-=-=-=-=-=-=-=-=
##
##       ! 'do.stack' arg is always set as TRUE for data.frame/matrix dataset
##  > Projecting ESM.BIOMOD.8_AllData_RUN2_GLM ...
##  > Projecting ESM.BIOMOD.8_AllData_RUN2_RF ...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
## -=-=-=-=-=-=-=-=-=-=-=-= Do Models Projections -=-=-=-=-=-=-=-=-=-=-=-=
##
##       ! 'do.stack' arg is always set as TRUE for data.frame/matrix dataset
##  > Projecting ESM.BIOMOD.9_AllData_RUN2_GLM ...
##  > Projecting ESM.BIOMOD.9_AllData_RUN2_RF ...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=
##
## -=-=-=-=-=-=-=-=-=-=-=-= Do Models Projections -=-=-=-=-=-=-=-=-=-=-=-=
##
##       ! 'do.stack' arg is always set as TRUE for data.frame/matrix dataset
```

```
## > Projecting ESM.BIOMOD.10_AllData_RUN2_GLM ...
## > Projecting ESM.BIOMOD.10_AllData_RUN2_RF ...
## -=-=-=-=-=-=-=-=-=-=-=-=-=-= Done -=-=-=-=-=-=-=-=-=-=-=-=-=-=
### Projection of calibrated ESMs into new space
my.ESM_EFproj_current <- ecospat.ESM.EnsembleProjection(ESM.prediction.output=my.ESM_proj_current,
                                                        ESM.EnsembleModeling.output=my.ESM_EF)
```

## 3.3 Spatial prediction of communities

Input data for the first argument (proba) as data frame of rough probabilities from SDMs for all species in columns in the considered sites in rows.

```
proba <- ecospat.testData[,73:92]
```

Input data for the second argument (sr) as data frame with richness value in the first column and sites.

```
sr <- as.data.frame(rowSums(proba))
```

## 3.4 SESAM framework with *ecospat.SESAM.prr()*

```
ecospat.SESAM.prr(proba, sr)
```

```
## [1] "test.prr, processing row 1"
## [1] "test.prr, processing row 2"
## [1] "test.prr, processing row 3"
## [1] "test.prr, processing row 4"
## [1] "test.prr, processing row 5"
## [1] "test.prr, processing row 6"
## [1] "test.prr, processing row 7"
## [1] "test.prr, processing row 8"
## [1] "test.prr, processing row 9"
## [1] "test.prr, processing row 10"
## [1] "test.prr, processing row 11"
## [1] "test.prr, processing row 12"
## [1] "test.prr, processing row 13"
## [1] "test.prr, processing row 14"
## [1] "test.prr, processing row 15"
## [1] "test.prr, processing row 16"
## [1] "test.prr, processing row 17"
## [1] "test.prr, processing row 18"
## [1] "test.prr, processing row 19"
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## [1] "test.prr, processing row 30"
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## [1] "test.prr, processing row 32"
## [1] "test.prr, processing row 33"
## [1] "test.prr, processing row 34"
```

```
## [1] "test.prr, processing row 35"
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## [1] "test.prr, processing row 37"
## [1] "test.prr, processing row 38"
## [1] "test.prr, processing row 39"
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## [1] "test.prr, processing row 60"
## [1] "test.prr, processing row 61"
## [1] "test.prr, processing row 62"
## [1] "test.prr, processing row 63"
## [1] "test.prr, processing row 64"
## [1] "test.prr, processing row 65"
## [1] "test.prr, processing row 66"
## [1] "test.prr, processing row 67"
## [1] "test.prr, processing row 68"
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## [1] "test.prr, processing row 70"
## [1] "test.prr, processing row 71"
## [1] "test.prr, processing row 72"
## [1] "test.prr, processing row 73"
## [1] "test.prr, processing row 74"
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## [1] "test.prr, processing row 78"
## [1] "test.prr, processing row 79"
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## [1] "test.prr, processing row 81"
## [1] "test.prr, processing row 82"
## [1] "test.prr, processing row 83"
## [1] "test.prr, processing row 84"
## [1] "test.prr, processing row 85"
## [1] "test.prr, processing row 86"
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## [1] "test.prr, processing row 88"
## [1] "test.prr, processing row 89"
## [1] "test.prr, processing row 90"
## [1] "test.prr, processing row 91"
## [1] "test.prr, processing row 92"
```

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## [1] "test.prr, processing row 93"
## [1] "test.prr, processing row 94"
## [1] "test.prr, processing row 95"
## [1] "test.prr, processing row 96"
## [1] "test.prr, processing row 97"
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## [1] "test.prr, processing row 102"
## [1] "test.prr, processing row 103"
## [1] "test.prr, processing row 104"
## [1] "test.prr, processing row 105"
## [1] "test.prr, processing row 106"
## [1] "test.prr, processing row 107"
## [1] "test.prr, processing row 108"
## [1] "test.prr, processing row 109"
## [1] "test.prr, processing row 110"
## [1] "test.prr, processing row 111"
## [1] "test.prr, processing row 112"
## [1] "test.prr, processing row 113"
## [1] "test.prr, processing row 114"
## [1] "test.prr, processing row 115"
## [1] "test.prr, processing row 116"
## [1] "test.prr, processing row 117"
## [1] "test.prr, processing row 118"
## [1] "test.prr, processing row 119"
## [1] "test.prr, processing row 120"
## [1] "test.prr, processing row 121"
## [1] "test.prr, processing row 122"
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## [1] "test.prr, processing row 126"
## [1] "test.prr, processing row 127"
## [1] "test.prr, processing row 128"
## [1] "test.prr, processing row 129"
## [1] "test.prr, processing row 130"
## [1] "test.prr, processing row 131"
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## [1] "test.prr, processing row 138"
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## [1] "test.prr, processing row 140"
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## [1] "test.prr, processing row 148"
## [1] "test.prr, processing row 149"
## [1] "test.prr, processing row 150"
```

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## [1] "test.prr, processing row 151"
## [1] "test.prr, processing row 152"
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## [1] "test.prr, processing row 154"
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## [1] "test.prr, processing row 160"
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## [1] "test.prr, processing row 176"
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## [1] "test.prr, processing row 180"
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## [1] "test.prr, processing row 183"
## [1] "test.prr, processing row 184"
## [1] "test.prr, processing row 185"
## [1] "test.prr, processing row 186"
## [1] "test.prr, processing row 187"
## [1] "test.prr, processing row 188"
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## [1] "test.prr, processing row 206"
## [1] "test.prr, processing row 207"
## [1] "test.prr, processing row 208"
```

```
## [1] "test.prr, processing row 209"
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## [1] "test.prr, processing row 211"
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## [1] "test.prr, processing row 213"
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## [1] "test.prr, processing row 242"
## [1] "test.prr, processing row 243"
## [1] "test.prr, processing row 244"
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## [1] "test.prr, processing row 265"
## [1] "test.prr, processing row 266"
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## [1] "test.prr, processing row 298"
## [1] "test.prr, processing row 299"
## [1] "test.prr, processing row 300"
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## 22                       1                         0
## 23                       1                         0
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| | | |
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| ## 210 | 0 | 1 |
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| ## 212 | 0 | 1 |
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| ## 214 | 1 | 1 |
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## 300                      0                        0
##     glm_Geranium_sylvaticum glm_Ranunculus_acris_sl glm_Prunella_vulgaris
## 1                         0                       0                     0
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## 58                        1                    1                    1
## 59                        1                    1                    1
```

| | | | |
|---|---|---|---|
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| ## 62 | 0 | 1 | 1 |
| ## 63 | 0 | 1 | 1 |
| ## 64 | 0 | 1 | 1 |
| ## 65 | 0 | 1 | 1 |
| ## 66 | 0 | 1 | 1 |
| ## 67 | 0 | 0 | 0 |
| ## 68 | 0 | 1 | 1 |
| ## 69 | 1 | 0 | 1 |
| ## 70 | 0 | 0 | 1 |
| ## 71 | 1 | 0 | 0 |
| ## 72 | 0 | 0 | 0 |
| ## 73 | 0 | 0 | 0 |
| ## 74 | 0 | 0 | 0 |
| ## 75 | 0 | 1 | 1 |
| ## 76 | 0 | 1 | 1 |
| ## 77 | 1 | 1 | 0 |
| ## 78 | 1 | 1 | 1 |
| ## 79 | 1 | 1 | 0 |
| ## 80 | 0 | 1 | 1 |
| ## 81 | 1 | 1 | 0 |
| ## 82 | 0 | 1 | 0 |
| ## 83 | 1 | 1 | 0 |
| ## 84 | 0 | 1 | 1 |
| ## 85 | 1 | 1 | 1 |
| ## 86 | 1 | 1 | 1 |
| ## 87 | 1 | 1 | 1 |
| ## 88 | 0 | 0 | 0 |
| ## 89 | 1 | 0 | 0 |
| ## 90 | 1 | 1 | 1 |
| ## 91 | 1 | 1 | 0 |
| ## 92 | 0 | 0 | 0 |
| ## 93 | 1 | 1 | 0 |
| ## 94 | 1 | 1 | 0 |
| ## 95 | 1 | 1 | 0 |
| ## 96 | 0 | 1 | 1 |
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| ## 100 | 1 | 1 | 0 |
| ## 101 | 1 | 0 | 0 |
| ## 102 | 1 | 0 | 1 |
| ## 103 | 1 | 1 | 1 |
| ## 104 | 1 | 0 | 0 |
| ## 105 | 0 | 1 | 1 |
| ## 106 | 0 | 0 | 1 |
| ## 107 | 0 | 0 | 0 |
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| ## 109 | 1 | 0 | 0 |
| ## 110 | 0 | 0 | 0 |
| ## 111 | 0 | 0 | 0 |
| ## 112 | 1 | 0 | 0 |
| ## 113 | 0 | 0 | 0 |
| ## 114 | 1 | 0 | 0 |
| ## 115 | 0 | 0 | 0 |
| ## 116 | 1 | 0 | 1 |
| ## 117 | 1 | 0 | 0 |

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|---|---|---|---|
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| ## 244 | 0 | 0 | 0 |
| ## 245 | 0 | 0 | 0 |
| ## 246 | 0 | 0 | 0 |
| ## 247 | 0 | 0 | 0 |
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| ## 257 | 0 | 0 | 0 |
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| ## 260 | 0 | 0 | 0 |
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| ## 266 | 0 | 0 | 0 |
| ## 267 | 0 | 0 | 0 |
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| ## 269 | 0 | 0 | 0 |
| ## 270 | 0 | 0 | 0 |
| ## 271 | 0 | 0 | 0 |
| ## 272 | 0 | 0 | 0 |
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| ## 277 | 1 | 1 | 1 |
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| ## 285 | 1 | 0 | 0 |
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| ## 287 | 0 | 0 | 0 |
| ## 288 | 0 | 0 | 0 |
| ## 289 | 0 | 0 | 0 |
| ## 290 | 0 | 0 | 0 |
| ## 291 | 0 | 0 | 0 |

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108

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## 35                         1                     0                      0
## 36                         1                     1                      0
## 37                         1                     0                      0
```

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| ## 39 | 1 | 0 | 0 |
| ## 40 | 1 | 0 | 0 |
| ## 41 | 0 | 0 | 0 |
| ## 42 | 0 | 0 | 0 |
| ## 43 | 0 | 0 | 0 |
| ## 44 | 0 | 0 | 0 |
| ## 45 | 1 | 0 | 0 |
| ## 46 | 0 | 0 | 0 |
| ## 47 | 0 | 0 | 0 |
| ## 48 | 0 | 0 | 0 |
| ## 49 | 0 | 0 | 0 |
| ## 50 | 1 | 0 | 0 |
| ## 51 | 0 | 0 | 0 |
| ## 52 | 0 | 0 | 0 |
| ## 53 | 1 | 0 | 0 |
| ## 54 | 1 | 0 | 0 |
| ## 55 | 1 | 0 | 0 |
| ## 56 | 1 | 0 | 0 |
| ## 57 | 1 | 0 | 0 |
| ## 58 | 1 | 0 | 0 |
| ## 59 | 1 | 0 | 0 |
| ## 60 | 0 | 0 | 0 |
| ## 61 | 1 | 0 | 0 |
| ## 62 | 0 | 0 | 0 |
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| ## 64 | 0 | 0 | 0 |
| ## 65 | 0 | 1 | 0 |
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| ## 67 | 1 | 1 | 0 |
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| ## 70 | 1 | 1 | 0 |
| ## 71 | 1 | 0 | 0 |
| ## 72 | 1 | 1 | 0 |
| ## 73 | 1 | 1 | 0 |
| ## 74 | 1 | 1 | 0 |
| ## 75 | 1 | 1 | 0 |
| ## 76 | 1 | 0 | 0 |
| ## 77 | 1 | 0 | 0 |
| ## 78 | 0 | 0 | 0 |
| ## 79 | 0 | 0 | 0 |
| ## 80 | 0 | 0 | 0 |
| ## 81 | 0 | 0 | 0 |
| ## 82 | 0 | 0 | 0 |
| ## 83 | 0 | 0 | 0 |
| ## 84 | 0 | 0 | 0 |
| ## 85 | 0 | 0 | 0 |
| ## 86 | 0 | 0 | 0 |
| ## 87 | 0 | 0 | 0 |
| ## 88 | 1 | 0 | 0 |
| ## 89 | 0 | 0 | 0 |
| ## 90 | 0 | 0 | 0 |
| ## 91 | 0 | 0 | 0 |
| ## 92 | 1 | 0 | 0 |
| ## 93 | 1 | 0 | 0 |
| ## 94 | 1 | 0 | 0 |
| ## 95 | 1 | 0 | 0 |

```
## 96                       0                   0                   0
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```

| | | | |
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| ## 155 | 0 | 1 | 0 |
| ## 156 | 0 | 0 | 0 |
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| ## 159 | 0 | 0 | 0 |
| ## 160 | 0 | 0 | 0 |
| ## 161 | 0 | 0 | 0 |
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| ## 166 | 0 | 0 | 0 |
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| ## 169 | 0 | 0 | 1 |
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| ## 180 | 0 | 0 | 1 |
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| ## 186 | 0 | 0 | 1 |
| ## 187 | 0 | 0 | 1 |
| ## 188 | 0 | 0 | 1 |
| ## 189 | 0 | 0 | 0 |
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| ## 199 | 0 | 0 | 0 |
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| ## 204 | 0 | 0 | 1 |
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| ## 219 | 0 | 0 | 1 |
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| ## 225 | 0 | 0 | 0 |
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| ## 228 | 0 | 0 | 1 |
| ## 229 | 0 | 0 | 1 |
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| ## 232 | 0 | 0 | 1 |
| ## 233 | 0 | 0 | 1 |
| ## 234 | 0 | 0 | 1 |
| ## 235 | 0 | 0 | 1 |
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| ## 237 | 0 | 0 | 0 |
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| ## 240 | 0 | 0 | 1 |
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| ## 244 | 0 | 0 | 1 |
| ## 245 | 0 | 0 | 1 |
| ## 246 | 0 | 0 | 1 |
| ## 247 | 0 | 0 | 1 |
| ## 248 | 0 | 0 | 1 |
| ## 249 | 0 | 0 | 1 |
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| ## 260 | 0 | 0 | 1 |
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| ## 269 | 0 | 0 | 1 |

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##      glm_Soldanella_alpina glm_Cynosurus_cristatus
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## 51                           0
```

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## 52                       0
## 53                       0
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## 102                      0
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## 107                      0
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## 110                          0
## 111                          0
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## 168                          0
## 169                          0
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## 177                          1
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## 197                          0
## 198                          0
## 199                          1
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## 209                          0
## 210                          0
## 211                          1
## 212                          0
## 213                          0
## 214                          0
## 215                          0
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## 217                          0
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## 220                          0
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## 222                          0
## 223                          1
## 224                          0
## 225                          0
```

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## 226                      0
## 227                      0
## 228                      1
## 229                      0
## 230                      0
## 231                      0
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## 284                        0
## 285                        0
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## 287                        0
## 288                        0
## 289                        0
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## 291                        0
## 292                        0
## 293                        0
## 294                        0
## 295                        0
## 296                        0
## 297                        0
## 298                        0
## 299                        1
## 300                        0
```

# 4   Post-Modelling

## 4.1   Spatial Predictions of species assamblages

### 4.1.1   Co-occurrence analysis & Environmentally Constrained Null Models

Input data as a matrix of plots (rows) x species (columns). Input matrices should have column names (species names) and row names (sampling plots).

```
presence<-ecospat.testData[c(53,62,58,70,61,66,65,71,69,43,63,56,68,57,55,60,54,67,59,64)]
pred<-ecospat.testData[c(73:92)]
```

Define the number of permutations. It is recomended to use at least 10000 permutatiobns for the test. As an example we used nperm = 100, to reduce the computational time.

```
nbpermut <- 100
```

Define the outpath

```
outpath <- getwd()
```

Run the function *ecospat.cons_Cscore*

The function tests for non-random patterns of species co-occurrence in a presence-absence matrix. It calculates the C-score index for the whole community and for each species pair. An environmental constraint is applied during the generation of the null communities.

```
ecospat.cons_Cscore(presence, pred, nbpermut, outpath)
```

```
## Computing observed co-occurence matrix
## .............
## .............
## .............
## Computing permutations
## .............
## .............
## .............
```
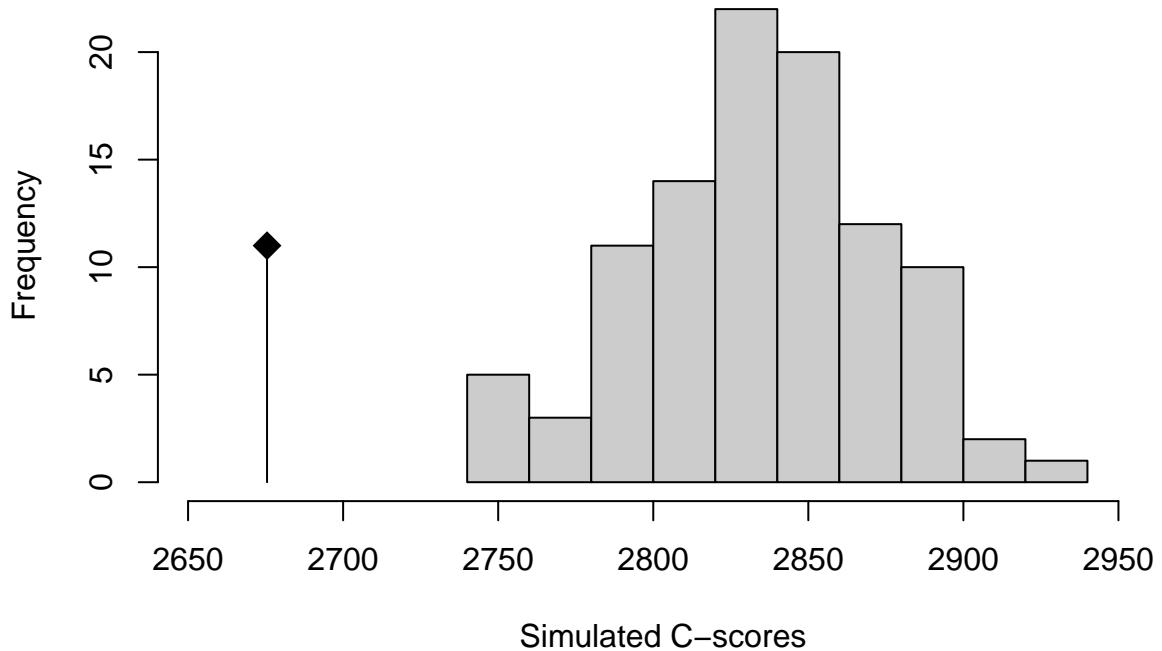
```
## Permutations finished Mon Sep 26 14:43:14 2016
## ..............
## ..............
## Exporting dataset
## ..............
## ..............
## ..............
```

## Histogram of standardized effect size
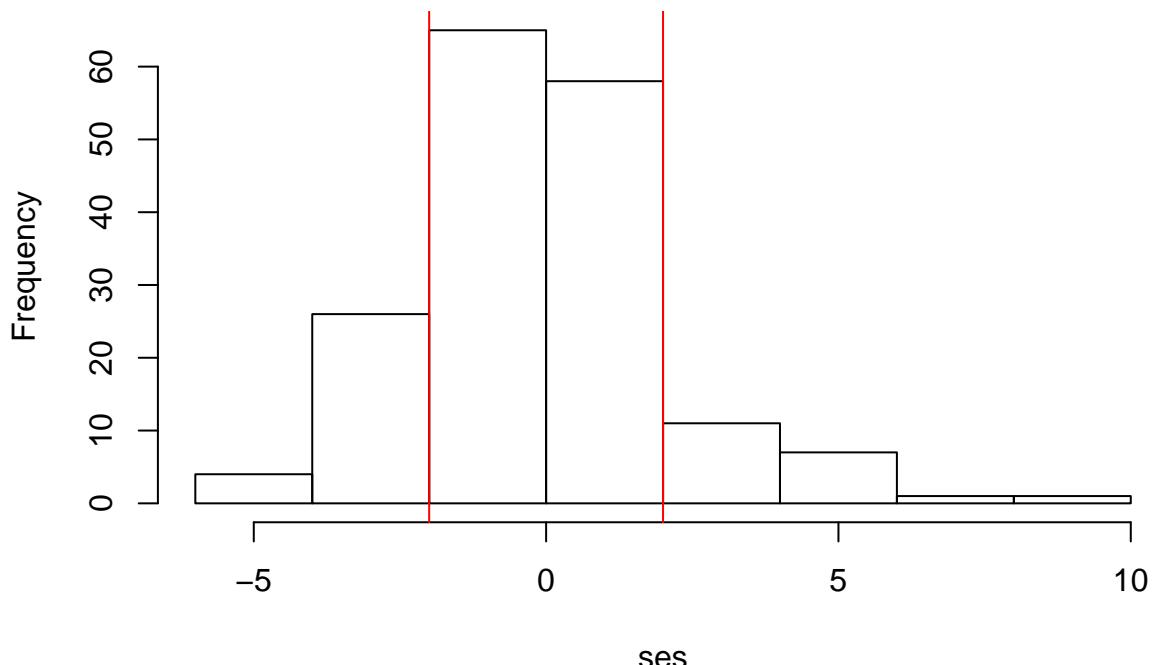


```
## $ObsCscoreTot
## [1] 2675.468
##
## $SimCscoreTot
## [1] 2834.858
```

```
##
## $PVal.less
## [1] 0.00990099
##
## $PVal.greater
## [1] 1
##
## $SES.Tot
## [1] -4.12709
```

The function returns - the C-score index for the observed community (ObsCscoreTot), - the mean of C-score for the simulated communities (SimCscoreTot), - the p.values (PVal.less and PVal.greater) to evaluate the significance of the difference between the former two indices. - the standardized effect size for the whole community (SES.Tot). A SES that is greater than 2 or less than -2 is statistically significant with a tail probability of less than 0.05 (Gotelli & McCabe 2002 - Ecology). If a community is structured by competition, we would expect the C-score to be large relative to a randomly assembled community (positive SES). In this case the observed C-score is significantly lower than expected by chance, this meaning that the community is dominate by positive interactions (aggregated pattern).

A table is saved in the path specified where the same metrics are calculated for each species pair (only the table with species pairs with significant p.values is saved).