

11: Ordination

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Ideas and issues illustrated by the graphs in this vignette

Ordination is a generic name for methods for providing a low-dimensional view of points in multi-dimensional space, such that “similar” objects are near each other and dissimilar objects are separated. The plot(s) from an ordination in 2 or 3 dimensions may provide useful visual clues on clusters in the data and on outliers. The methods described here all use some form of multi-dimensional scaling (MDS)

```
# To include the figures, change `showFigs <- FALSE`  
# to `showFigs <- TRUE` in the source `.Rnw` file,  
# and regenerate the PDF.  
#  
showFigs <- FALSE
```

1 Code for the Figures

```
fig11.1 <- function(){  
  opar <- par(xpd=TRUE)  
  if(!exists("aupoints")){  
    cat("Trying to obtain audists from DAAG")  
    if(!require(DAAG))return("'DAAG' must be installed")  
    aupoints <- cmdscale(audists)  
  }  
  assign('aupoints', aupoints, pos=1)  
  xlim <- range(aupoints[,1])  
  xlim <- xlim + diff(xlim)*c(-0.05, 0.2)  
  plot(aupoints, bty="n", xlab="", ylab="", xlim=xlim)  
  labs <- rownames(aupoints)  
  labpos <- rep(1, length(labs))  
  labpos[labs%in%c("Cairns", "Melbourne")] <- 3  
  labpos[labs=="Canberra"] <- 4
```

```

    text(aupoints, labels=labs, pos=labpos, xpd=TRUE)
  par(opar)
}

```

```

fig11.2A <- function(){
  if(!require(DAAG))return("'DAAG' must be installed")
  if(!require(oz))return("Package 'oz' must be installed")
  if(!exists('aupoints'))aupoints <- cmdscale(audists)
  oz()
  points(aulatlong, col="red", pch=16, cex=1.5)
  latlong <- align2D(lat=aulatlong[,1], long=aulatlong[,2],
                    x1=aupoints[,1], x2 = aupoints[,2])
  x <- with(latlong, as.vector(rbind(lat, fitlat, rep(NA,10))))
  y <- with(latlong, as.vector(rbind(long, fitlong, rep(NA,10))))
  lines(x, y, col="gray40", lwd=3)
}

```

```

fig11.2B <- function(){
  if(!require(MASS))return("Package 'MASS' must be installed")
  if(!require(oz))return("Package 'oz' must be installed")
  aupoints.sam <- sammon(audists, trace=FALSE)
  oz()
  points(aulatlong, col="red", pch=16, cex=1.5)
  wt <- apply(as.matrix(audists), 1,function(x)sum(1/x[x>0]))
  latlong <- align2D(lat=aulatlong[,1], long=aulatlong[,2],
                    x1=aupoints.sam$points[,1],
                    x2 = aupoints.sam$points[,2], wts=wt)
  x <- with(latlong, as.vector(rbind(lat, fitlat, rep(NA,10))))
  y <- with(latlong, as.vector(rbind(long, fitlong, rep(NA,10))))
  lines(x, y, col="gray40", lwd=3)
}

```

```

fig11.2 <- function(){
  par(fig=c(0,1,0.5,1))
  fig11.2A()
  fig11.2B()
}

```

```

fig11.3A <- function(seed=47, xlab="Axis 1", ylab="Axis 2"){
  if(!require(DAAGbio))return("Package 'DAAGbio' must be installed")
  if(!require(ape))return("Package 'ape' must be installed")
}

```

```

## Calculate distances, using Kimura's K80 model
primates.dist <- dist.dna(as.DNABin(primateDNA), model="K80")
primates.cmd <- cmdscale(primates.dist)
eqscplot(primates.cmd, xlab=xlab, ylab=ylab, cex.lab=1.15)
lefrt <- 2+2*(primates.cmd[,1] < mean(par())$usr[1:2]))
text(primates.cmd[,1], primates.cmd[,2], row.names(primates.cmd),
     pos=lefrt)
}

```

```

fig11.3B <- function(seed=47, xlab="Axis 1", ylab="Axis 2"){
  if(!require(DAAGbio))return("Package 'DAAGbio' must be installed")
  if(!require(ape))return("Package 'ape' must be installed")
  if(!require(MASS))return("Package 'MASS' must be installed")
  primates.dist <- dist.dna(as.DNABin(primateDNA), model="K80")
  primates.cmd <- cmdscale(primates.dist)
  primates.mds <- isoMDS(primates.dist, primates.cmd, k=2, trace=FALSE)
  eqscplot(primates.mds$points, xlab=xlab, ylab=ylab,
           cex.lab=1.15)
  lefrt <- 2+2*(primates.mds$points[,1] < mean(par())$usr[1:2]))
  text(primates.mds$points[,1], primates.mds$points[,2],
       row.names(primates.mds$points), pos=lefrt)
}

```

```

fig11.3 <- function(){
  opar <- par(fig=c(0,0.5,0,1), mar=c(3.1,3.1,1.6,0.1))
  fig11.3A()
  par(fig=c(0.5,1,0,1), new=TRUE)
  fig11.3B(ylab="")
  par(fig=c(0,1,0,1))
  par(opar)
}

```

```

fig11.4 <- function(){
  if(!require(DAAG))return("Package 'DAAG' must be installed")
  if(!require(MASS))return("Package 'MASS' must be installed")
  pacific.dist <- dist(x = as.matrix(rockArt[-c(47,54,60,63,92),
                                         28:641]), method = "binary")
  sum(pacific.dist==1)/length(pacific.dist)
  ## Now check that in all columns at least one distance < 1
  symmat <- as.matrix(pacific.dist)
  checksum <- sum(apply(symmat, 2, function(x) sum(x<1)))
  checksum <- sum(apply(symmat, 2, function(x) sum(x<1)==0))
}

```

```
print(c("No of cols where all distances are one"=checksum))
pacific.cmd <- cmdscale(pacific.dist)
pacific.mds <- isoMDS(pacific.dist, pacific.cmd, trace=FALSE)
plot(pacific.mds$points)
}
```

2 Show the Figures

```
pkgs <- c("DAAG", "DAAGbio", "MASS", "oz", "ape")
z <- sapply(pkgs, require, character.only=TRUE, warn.conflicts=FALSE)
if(any(!z)){
  notAvail <- paste(names(z)[!z], collapse=", ")
  print(paste("The following packages should be installed:", notAvail))
}
```

```
fig11.1()
```

```
if(!exists("aupoints"))
aupoints <- cmdscale(audists)
```

```
fig11.2()
```

```
fig11.3()
```

```
fig11.4()
```