Examples and Figures from Wang et al. Journal of Circadian Rhythms 2011

Carlos Gonzalez, Berkley Shands, Elena Deych, William Shannon

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First we need to load the `Actigraphy` package:

```
> library(Actigraphy)
```

1 Figure 1(a)

```
> ### Load Data
> data(weekday)
> ###
> ### Data Management
> data2 <- NULL
> data2$act <- weekday[,3]
> data2$t <- weekday[,2]
> data2$day <- weekday[,1]
> data2$date <- factor(data2$day, levels=c("Monday", "Tuesday",
+         "Wednesday", "Thursday", "Friday"))
> ###
> ### Plot Options and Parameters
> lb <- c("Midnight", "6AM", "Noon", "6PM", "Midnight")
> L <- 1440
> xat <- c(0, L/4, L/2, 3*L/4, L)
> ###
> ### Plot Figure
> xyplot(act ~ t | date, data=data2, as.table=TRUE,
+         main="Subject 002 Activity from Monday to Friday",
+         scales=list(x=list(at=xat,labels=lb)), cex.main=0.5,
+         layout=c(1, 5, 1), xlim=c(0, L), xlab="(a)",
+         ylab="Activity", panel=function(x,y) {
+                 fbase <- create.fourier.basis(rangeval=c(0,L),
+                         nbasis=9)
+                 fpar <- fdPar(fbase)
+                 fd <- smooth.basis(c(1:L), y, fpar)
+                 panel.xyplot(x,y,type="h")
+         })
```

2 Figure 2

```
> ### Load Data
> data(act_8pt)
> data(clinic_8pt)
> ###
> ### Plot Options and Parameters
> lb <- c("Midnight", "6AM", "Noon", "6PM", "Midnight")
> L <- 1440
> xat <- c(0, L/4, L/2, 3*L/4, L)
> ###
> matchid <- fda.matchid(act_8pt[,-1], clinic_8pt, type="factor",
+         grouplab = c("AHI", "NO AHI"))
> idhigh <- paste("Subj", colnames(matchid$mat)[matchid$cov$"NO AHI" != 1])
> idlow <- paste("Subj", colnames(matchid$mat)[matchid$cov$"NO AHI" == 1])
> idorder <- c(idhigh, idlow)
> ###
> datavec <- matchid$mat
> dim(datavec) <- NULL
> ###
> datanew <- data.frame(y=datavec, id=rep(paste("Subj",
+         colnames(matchid$mat)), each=L), t=rep(c(1:L), 8))
> datanew$id <- factor(datanew$id, idorder)
> ###
> ### Plot Figure
> xyplot(y~t|id, data=datanew, as.table=TRUE,
+         main="Circadian Activity from 8 Subjects",
+         ylab="Activity", xlab="", cex.main=.7,
+         scales=list(x=list(at=xat, labels=lb)), cex=.05,
+         type="p", layout=c(4, 2, 1), ylim=c(0, 1200),
+         xlim=c(0, L), panel=function(x,y) {
+                 fbase <- create.fourier.basis(rangeval=c(0, L),
+                         nbasis=9)
+                 fpar <- fdPar(fbase)
+                 sm <- smooth.basis(c(1:L), y, fpar)
+                 panel.xyplot(x, y, col=1, cex=0.1)
+                 panel.lines(predict(sm$fd,c(1:L)), col=2, lwd=3)
+         })
```

3 Figure 3

```
> ### Load Data
> data(act_8pt)
> data(clinic_8pt)
> ###
> ahidatav2 <- fda.matchid(act_8pt[,-1], clinic_8pt,
+         type="factor", grouplab = c("AHI", "NO AHI"))
> tempv2 <- ahidatav2[[2]]
> tempv2[,3] <- ifelse(tempv2[,3] == 0, -1, 1)
```

```
> ahidatav2$cov <- data.frame(id=tempv2$id, mean=1,
+         ahi=tempv2[,3])
> ###
> colv2 <- ifelse(tempv2[,3] == -1, 4, 2)
> smoothDatav2 <- fda.smoothdata(ahidatav2, nbasis=9,
+         basistype="Fourier")
> geftahiv2 <- flm_cate(smoothDatav2, nbasis=9,
+         basistype="Fourier")
> meanefv2 <- geftahiv2$freg$betaestlist[[1]]
> ahiefv2 <- geftahiv2$freg$betaestlist[[2]]
> ###
> ### Plot Options and Parameters
> L <- 1440
> xat <- c(0, L/4, L/2, 3*L/4, L)
> lb <- c("Midnight", "6AM", "Noon", "6PM", "Midnight")
> ###
> ### Plot Figure
> par(mfrow=c(2,1), mar=c(4,4,3,1))
> plot(0, 0, xlim=c(0,L), ylim=c(0,1200), xaxt="n",
+         xlab="(a)", ylab="Acitivity", type="n",
+         main="Circadian Activity Curves of 8 Subjects")
> ###
> for(i in 1:8) {
+         lines(predict(smoothDatav2$fd$fd, c(1:L))[,i],
+                 col = colv2[i])
+ }
> ###
> ### Plot the group mean activities
> lines(meanefv2$fd-ahiefv2$fd, col=4, lwd=3)
> lines(meanefv2$fd+ahiefv2$fd, col=2, lwd=3)
> ###
> ### Plot the overall mean
> lines(meanefv2$fd, col=1, lwd=3)
> ###
> ### Add the axis and legend to finish the plot
> axis(1, at=xat, labels=lb)
> legend("topleft", c("AHI High Curves", "AHI High Mean",
+                 "AHI Low Curves", "AHI Low Mean ", "Overall Mean"),
+         lty=1, col=c(4,4,2,2,1), lwd=c(1,3,1,3,3), cex=.8)
> ###
> ### F Test
> cov2 <- smoothDatav2$cov[, -1]
> grp2 <- ncol(cov2)
> fd <- smoothDatav2$fd
> L <- length(fd$argvals)
> npt <- ncol(fd$y)
> ###
> fbase <- create.fourier.basis(rangeval = c(0, 1440), nbasis=9)
> fpar <- fdPar(fbase)
> xfdlist <- vector("list", grp2)
```

```
> xfdlist[[1]] <- cov2[, 1] + 0
> ###
> for (i in 2:grp2) {
+         xfdlist[[i]] <- cov2[, i] + 0
+ }
> ###
> betalist <- xfdlist
> for (i in 1:grp2){
+         betalist[[i]] <- fpar
+ }
> ###
> freg2 <- fRegress(fd$fd, xfdlist, betalist)
> preact2 <- predict(freg2$yhatfdobj, c(1:L))
> resid2 <- fd$y - preact2[, 1:npt]
> sigma2 <- cov(t(resid2))
> fregstd2 <- fRegress.stderr(freg2, fd$y2cMap, sigma2)
> ###
> Fratio <- Ftest(fd$fd, xfdlist, betalist,
+         argvals = c(1:1440),  nperm = 10, xaxt = "n")
> axis(1, at = xat, labels = lb)
```