Appendix 13.A: FROC vs. AFROC

The code comparing the two operating characteristics is in file **mainFrocVsAfroc.R** the listing of which follows:

Appendix 13.A.1: Code Listing

```
# mainFrocVsAfroc.R
rm(list = ls())
library(RJafroc)
library(abind)
library(ggplot2)

seed <- 1;set.seed(seed)
nu <- 1;lambda <- 1;K1 <- 500;K2 <- 700 # these parameters do not change between RAD and CAD
observers
mu <- 1;zeta1 <- -1 # these are CAD parameters
Lmax <- 2;Lk2 <- floor(runif(K2, 1, Lmax + 1))
cat("constant parameters:", ", nu = ", nu, ", lambda = ", lambda, ", K1 = ", K1, ", K2 = ",
K2,"\n")
cat("CAD parameters: mu = ", mu,", zeta1 = ", zeta1 ,"\n")
frocDataCad <- FROCSimulator (mu, lambda, nu, K1, K2, Lk2, zeta1 = zeta1)

mu <- 1.5;zeta1 <- 1.5 # these are RAD parameters
cat("RAD parameters: mu = ", mu,", zeta1 = ", zeta1 ,"\n")
set.seed(seed)
frocDataRad <- FROCSimulator (mu, lambda, nu, K1, K2, Lk2, zeta1 = zeta1)

numNL1 <- dim(frocDataCad$NL)[4]
numNL2 <- dim(frocDataRad$NL)[4]
numNL <- max(numNL1, numNL2) # the max number of NLs in the combined dataset

if (numNL1 < numNL){ # dataset 1 has smaller number of NLs
  NL <- frocDataCad$NL
  NL <- abind(NL, array(-Inf, dim = c(1, 1, K1 + K2, numNL - numNL1))) # add more -Inf NLs to make
the number of NL in two datasets consistent
  NL <- abind(NL, frocDataRad$NL, along = 2) # combine the two NLs
}else if (numNL2 < numNL){ # dataset 2 has smaller number of NLs
  NL <- frocDataRad$NL
  NL <- abind(NL, array(-Inf, dim = c(1, 1, K1 + K2, numNL - numNL2)))
  NL <- abind(frocDataCad$NL, NL, along = 2)
}else{ # the number of NLs in the two datasets are same, combine them directly
  NL <- frocDataCad$NL
  NL <- abind(NL, frocDataRad$NL, along = 2)
}

LL <- frocDataCad$LL
LL <- abind(LL, frocDataRad$LL, along = 2) # combine the two LLs

frocDataRaw <- ToRJafrocDataset(NL, LL, "FROC", lesionNum = Lk2) # convert the the combined NLs
and LLs to RJafroc dataset

wafroc <- FigureOfMerit(frocDataRaw);cat("wafroc = ", wafroc, "\n")

wafroc <- FigureOfMerit(frocDataRaw);cat("wafroc = ", wafroc, "\n")

froc <- EmpiricalOpCharac(frocDataRaw, trts= 1, rdrs = c(1, 2), opChType = "FROC")
plotFROC <- froc$FROCPlot + scale_color_discrete(breaks=c("M-1\nR-1", "M-1\nR-2"), labels=c("CAD",
"RAD"))
print(plotFROC)

afroc <- EmpiricalOpCharac(frocDataRaw, trts= 1, rdrs = c(1, 2), opChType = "AFROC")
plotAFROC <- afroc$AFROCPlot + scale_color_discrete(breaks=c("M-1\nR-1", "M-1\nR-2"),
labels=c("CAD", "RAD"))
print(plotAFROC)
```

Line 8 sets parameters that do not change between the two lines: **nu** = 1, **lambda** = 1, **K1** = 500 and **K2** = 700. Line 9 sets the values corresponding to the CAD observers in **Error! Reference source not found.** (A) and B): **mu** = 1 and **zeta1** = -1. Line 12 simulates the CAD dataset and saves it to **frocDataCad**. Line 15 sets the values corresponding to the radiologists in **Error! Reference source not found.** (A) and (B): **mu** = 1.5 and **eta1** = 1.5. Line 18 simulates the RAD dataset and saves it to **frocDataRad**. Line 20 – 40 combines the two datasets so that they appear as two treatments in the combined dataset **frocDataRaw**. This is done for

convenience of plotting the two datasets on the same plot. Line 42 calculates the areas under the two AFROC curves in Fig. 13.6 (B) and prints out the values. Lines 44 – 46 calculate and display the two FROC plots and line 48 – 50 calculates and displays the two AFROC plots.