Operational Statistics for SAR Imagery Report

Tianrui Li

October 5th, 2019

1 Sample Image

```
imagepath <- ".. Statistics –SAR–Intensity –master/Data/Images/ESAR/"
HH_Complex <- myread.ENVI(paste(imagepath,
                          "ESAR97HH.DAT", sep = ""),
                       paste(imagepath, "ESAR97HH.hdr", sep = ""))
HH_Intensity <- (Mod(HH_Complex))^2
example <- HH_Intensity[1393:1492,2254:2453]
vexample <- data.frame(HH=as.vector(example))

plot(imagematrix(equalize(example)))
imagematrixPNG(name = "./example.png", imagematrix(equalize(example)))

vexample <- data.frame(HH=as.vector(example))
summary(vexample)
        the result:
             HH
        Min.    :       0.6
        1st Qu.:   2572.4
        Median :   6239.5
        Mean    :   9867.7
        3rd Qu.: 12759.1
        Max.    :480108.1
plot(imagematrix(equalize(example)))  (figure.1)
```

2 Histogram

```
 binwidth_complete <- 2*IQR(vexample$HH)*length(vexample$HH)^(-1/3)
 ggplot(data=vexample, aes(x=HH))
   geom_histogram(aes(y=..density..),
                  binwidth = binwidth_complete)
```
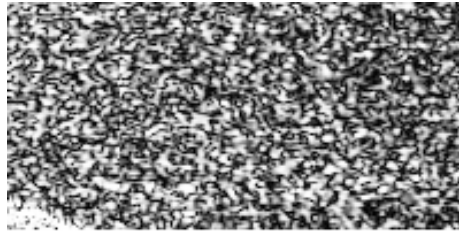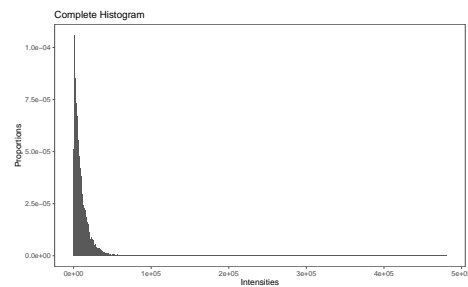
Figure 1: Selected picture.

Figure 2: HistogramExample.

```
xlab("Intensities")
ylab("Proportions")
ggtitle("Complete Histogram")
theme_few()
```

3 HistogramRestricted

```
ggplot(data=vexample, aes(x=HH))
geom_histogram(aes(y=..density..),
               binwidth = binwidth_complete,
               col="white")
xlab("Intensities")
xlim(0, 66666)
ylab("Proportions")
ggtitle("Restricted Histogram")
theme_few()
ggsave(filename = "./HistogramRestrictedExample.pdf")
```
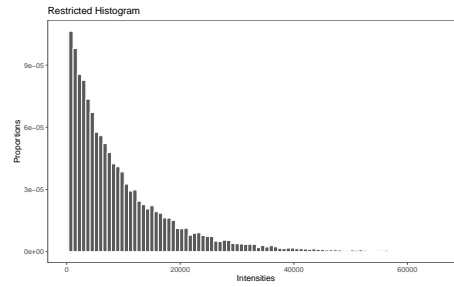
4 LogLikelihood

Figure 3: HistogramRestricted.

```
LogLikelihoodLknown <- function(params) {

  p_alpha <- -abs(params[1])
  p_gamma <- abs(params[2])
  p_L <- abs(params[3])
  n <- length(z)
  return(
    n*(lgamma(p_L-p_alpha) - p_alpha*log(p_gamma) - lgamma(-p_alpha))
      (p_alpha-p_L)*sum(log(p_gamma + z*p_L))
  )
}
```

5 Estimation

```
estim.exampleML <- maxNR(LogLikelihoodLknown,
                         start=c(estim.example$alpha, estim.example$gamma,1),
                         activePar=c(TRUE,TRUE,FALSE))$estimate[1:2]
estim.exampleML
-3.79   28101.39
```

results all above