# Operational Statistics for SAR Imagery Report

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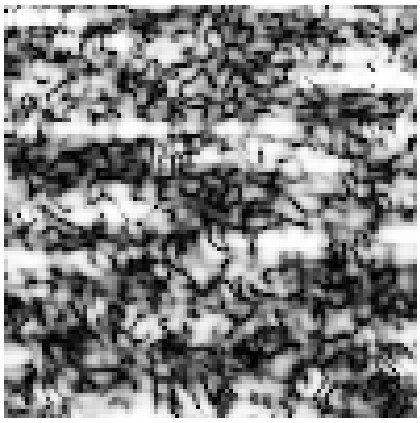
## 1 sample Image

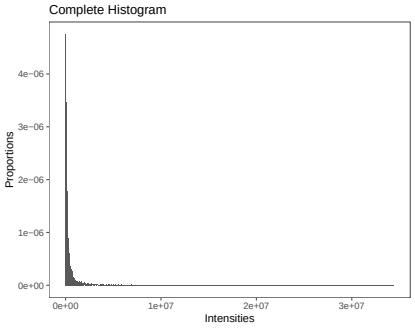
```
> imagepath <- "../Data/Images/ESAR/"

> HH_Complex <- myread.ENVI(paste(imagepath,
"ESAR97HH.DAT", sep = ""),
paste(imagepath, "ESAR97HH.hdr", sep = ""))
> HH_Intensity <- (Mod(HH_Complex))^2
> example <- HH_Intensity[256:356,256:356]
> vexample <- data.frame(HH=as.vector(example))
> summary(vexample)
       HH
 Min.   :      107
 1st Qu.:    97227
 Median :   269012
 Mean   :   516138
 3rd Qu.:   624278
 Max.   :10068006
> plot(imagematrix(equalize(example))) (figure.a)
```

## 2 Histogram

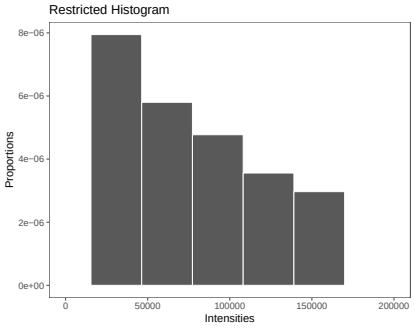
```
> ggplot(data=vexample, aes(x=HH)) +
+   geom_histogram(aes(y=..density..),
+                  binwidth = binwidth_complete) +
+   xlab("Intensities") +
+   ylab("Proportions") +
+   ggtitle("HistogramExample") +
+   theme_few()
```



(a) example.




(b) HistogramExample.




(c) HistogramRestrictedExample.

# 3 Estimation

## 3.1 analogy

```
> GI0.Estimator.m1m2 <- function(z, L) {
+   m1 <- mean(z)
+   m2 <- mean(z^2)
+   m212 <- m2/m1^2
+
+   a <- -2 - (L+1) / (L * m212)
+   g <- m1 * (2 + (L+1) / (L * m212))
+
+   return(list("alpha"=a, "gamma"=g))
+ }
```

```
> estim.example <- GI0.Estimator.m1m2(example, 1)
> estim.example
$alpha
[1] -2.653035

$gamma
[1] 1369331
```

## 3.2 Likelihood

```
> 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))
+   )
+ }
```

```
> estim.exampleML <- maxNR(LogLikelihoodLknown,
+                          start=c(estim.example$alpha,
+                          estim.example$gamma,1),
+                          activePar=c(TRUE,TRUE,FALSE))$estimate[1:2]
> estim.exampleML
[1] -3.687864e+00  1.369304e+0
```

# 4 Screenshots of Program Running

some program Running Screenshots

```
> source("myread.ENVI.R")
> source("imagematrix.R")
> require(ggplot2)
载入需要的程辑包：ggplot2
> require(reshape2)
载入需要的程辑包：reshape2
> require(ggthemes)
载入需要的程辑包：ggthemes
> imagepath <- "./Statistics-SAR-Intensity-master/Statistic
s-SAR-Intensity-master/Data/Images/ESAR/"
> HH_Complex <- myread.ENVI(paste(imagepath,
+                                 "ESAR97HH.DAT", sep =
 ""),
+                           paste(imagepath, "ESAR97HH.hd
r", sep = ""))
> HH_Intensity <- (Mod(HH_Complex))^2
> example <- HH_Intensity[256:512,512:1024]
> vexample <- data.frame(HH=as.vector(example))
> ## Now we select a region
> plot(imagematrix(equalize(example)))
> imagematrixPNG(name = "./example.png", imagematrix(equali
ze(example)))
```

Figure 1: data

```
> summary(vexample)
       HH
 Min.   :     107
 1st Qu.:   97227
 Median :  269012
 Mean   :  516138
 3rd Qu.:  624278
 Max.   :10068006
```

Figure 2: image message

```
> estim.exampleML
[1] -3.687864e+00  1.369304e+06
```

Figure 3: results

```
> estim.example
$alpha
[1] -2.653035

$gamma
[1] 1369331
```

Figure 4: results