# Operational Statistics for SAR Imagery Report

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## 1 sample Image

The main purpose of this section is to sample from the original image. The area [1200:1299,3900:3959] in the original image was selected.

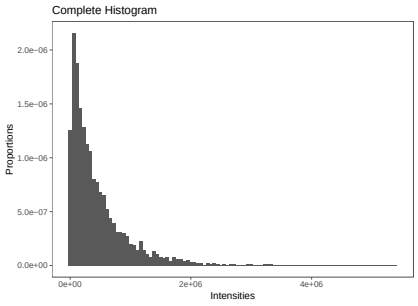
```
> imagepath <- "../SAR/"

> HH_Complex <- myread.ENVI(paste(imagepath,
"ESAR97HH.DAT", sep = ""),
paste(imagepath, "ESAR97HH.hdr", sep = ""))
> HH_Intensity <- (Mod(HH_Complex))^2
> example <- HH_Intensity[1200:1299,3900:3959]
> vexample <- data.frame(HH=as.vector(example))
> summary(vexample)
       HH
 Min.   :     116
 1st Qu.: 114391
 Median : 296345
 Mean   : 473365
 3rd Qu.: 618983
 Max.   :5365861
```

## 2 Histogram

Displaying a histogram of the statistics of the selected area in this section.

```
> 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) +
+   xlab("Intensities") +
+   ylab("Proportions") +
+   ggtitle("Complete Histogram") +
```

(a) example.




(b) HistogramExample.

```
+    theme_few()
> ggsave(filename = "./HistogramExample.pdf")
```

# 3 Estimation

Analogy estimation and maximum likelihood estimation for selected regions.

## 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))
+ }
```

```
> result <- GI0.Estimator.m1m2(example, 1)
> result
$alpha
[1] -2.844684

$gamma
[1] 1346574
```

## 3.2 Likelihood

```
> LogLikelihoodLknown <- function(params) {
+
+   p_alpha <- -abs(params[1])
+   p_gamma <- abs(params[2])
+   p_L <- abs(params[3])
+   n <- length(vexample$HH)
+    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))
+   )
+ }
```

```
> likelihood_result <- maxNR(LogLikelihoodLknown,
+                            start=c(result$alpha, result$gamma,1),
+                            activePar=c(TRUE,TRUE,FALSE))$estimate[1:2]
> likelihood_result
[1] -3.740095e+00  1.346314e+06
```