# Law of large Numbers

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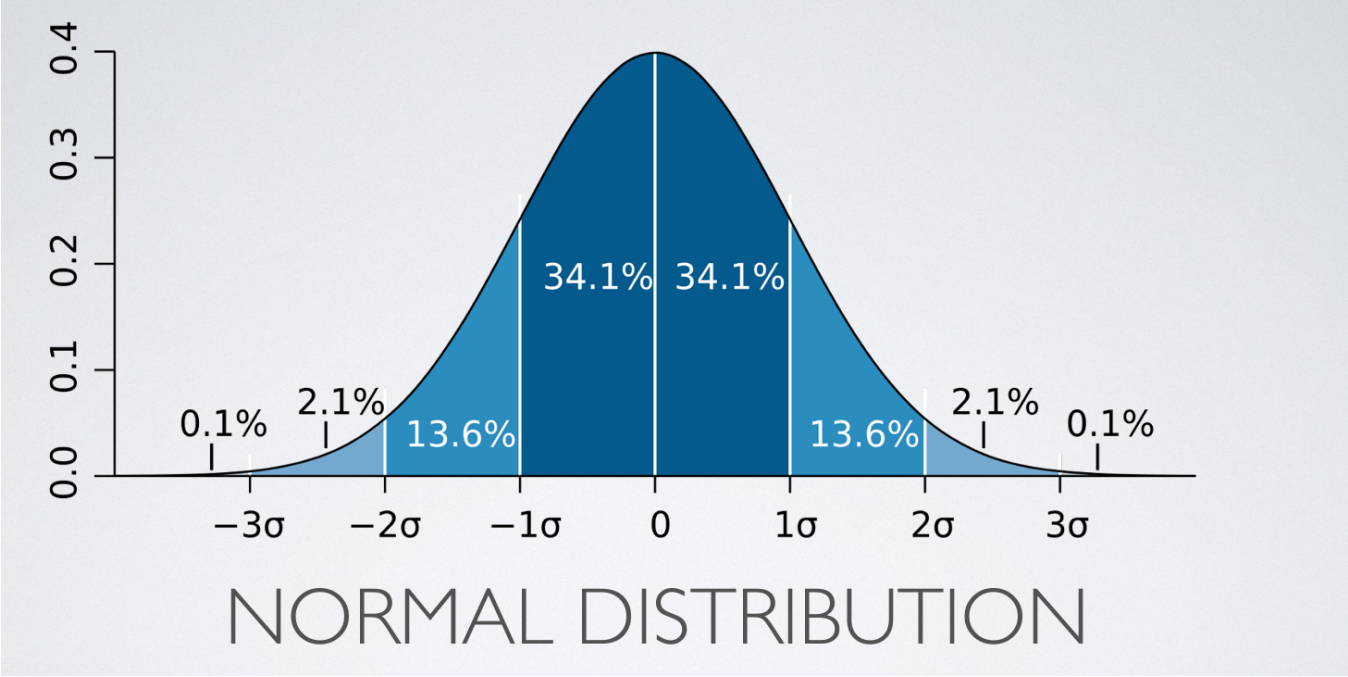
## Law of Large Numbers

As sample size becomes larger , sample mean gets closer to expected value .

## Testing LLN on Standard Normal Distribution

We take a large sample from Standard Normal distribution and check how much percentage of observations fall within different Area of SND.

Expected Area Under Standard Normal Distribution curve is given by as




```
N1<-c(100,1000,10000,100000)
ctm <- matrix(0,nrow=4, ncol=4)
colnames(ctm) <- c("N=100","N=1000","N=10000","N=100000")
rownames(ctm) <- c("-1 to 1","-2 to 2","-3 to 3","-4 to 4")
for(j in 1:length(N1)){
  for(i in rnorm(N1[j])){
    if(i>-1 & i<1){
      ctm[1,j]<-ctm[1,j]+1
    }
    if(i>-2 & i<2){
      ctm[2,j] <- ctm[2,j]+1
    }
    if(i>-3 & i<3){
      ctm[3,j] <- ctm[3,j]+1
    }
    if(i>-4 & i<4){
```

```
      ctm[4,j] <- ctm[4,j]+1
    }
  }
}
for(k in 1:4){
  ctm[,k] <- (ctm[,k]/N1[k])
}
```

Here is Percentage of values between -1 and 1 , -2 and 2 , -3 and 3 and -4 and 4 for different values of sample size.

| | N=100 | N=1000 | N=10000 | N=100000 |
|---|---|---|---|---|
| -1 to 1 | 67 | 66.3 | 68.14 | 68.230 |
| -2 to 2 | 93 | 95.3 | 95.31 | 95.378 |
| -3 to 3 | 100 | 99.7 | 99.67 | 99.725 |
| -4 to 4 | 100 | 100.0 | 99.99 | 99.993 |

It’s obvious from this matrix that values lie under SN Curve as Expected as sample size increases.