

# R Notebook

```
library(tidyverse)
```

```
## -- Attaching packages ----- tidyverse 1.2.1 --
```

```
## v ggplot2 3.2.1    v purrr   0.3.3
## v tibble  2.1.3    v dplyr   0.8.4
## v tidyr   1.0.2    v stringr 1.4.0
## v readr   1.3.1    v forcats 0.3.0
```

```
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()
```

```
library(FNN) ## knn.reg
```

## The Key Functions

You need a function to compute the MSE, Variance, Bias, and Noise for the kNN Regression function.

Note it depends on the function buildData

```
biasVarT03.knn <- function(kVal,func,sizeDS,numDS,x0){
  allVals <- matrix(ncol=2,nrow=numDS)
  for(m in 1:numDS){
    ##the
    train.df <- buildData(func,sizeDS,sig)
    train.X <- as.matrix(train.df[,c("x")])
    test.X <- as.matrix(x0)
    train.Y <- as.matrix(train.df[,c("y")])
    mod.knn <- knn.reg(train.X,test.X,train.Y,k=kVal)
    allVals[m,1] <- mod.knn$pred
  }
  allVals[,2] <- func(x0)+rnorm(numDS,0,sig)
  allVals.df <- data.frame(pred=allVals[,1],true=allVals[,2])
  mse <- with(allVals.df,mean((pred-true)^2))
  var0 <- with(allVals.df,var(pred))
  bias2 <- with(allVals.df,mean(pred-true))^2
  noise <- sig^2
  c(mse,var0,bias2,noise)
}
```

The buildData Function

```
buildData <- function(func,sizeDS,sig,xMin = -1, xMax = 1){
  ##predictor
  x<-runif(sizeDS,xMin, xMax) # inputs
  ## Repsonse
```

```

y<-func(x)+rnorm(sizeDS,0,sig) #realized values f(x)+noise
## Put in a data frame
data.frame(x,y)
}

```

## Example

```

f3 <- function(x) x*(x-1)*(x+1)
sizeDS <- 100
sig <-0.5
numReps <- 25

```

```

kVal <- 20
x0 <- 0.5
vals <- biasVarT03.knn(kVal,f3,sizeDS,numReps,x0)

```

```

vals <- round(vals,3)
sprintf("MSE=%s, Var=%s, Bias^2=%s, Noise=%s",vals[1],vals[2],vals[3],vals[4])

```

```

## [1] "MSE=0.163, Var=0.015, Bias^2=0.022, Noise=0.25"

```