Comparison of KNN vs Linear Regression

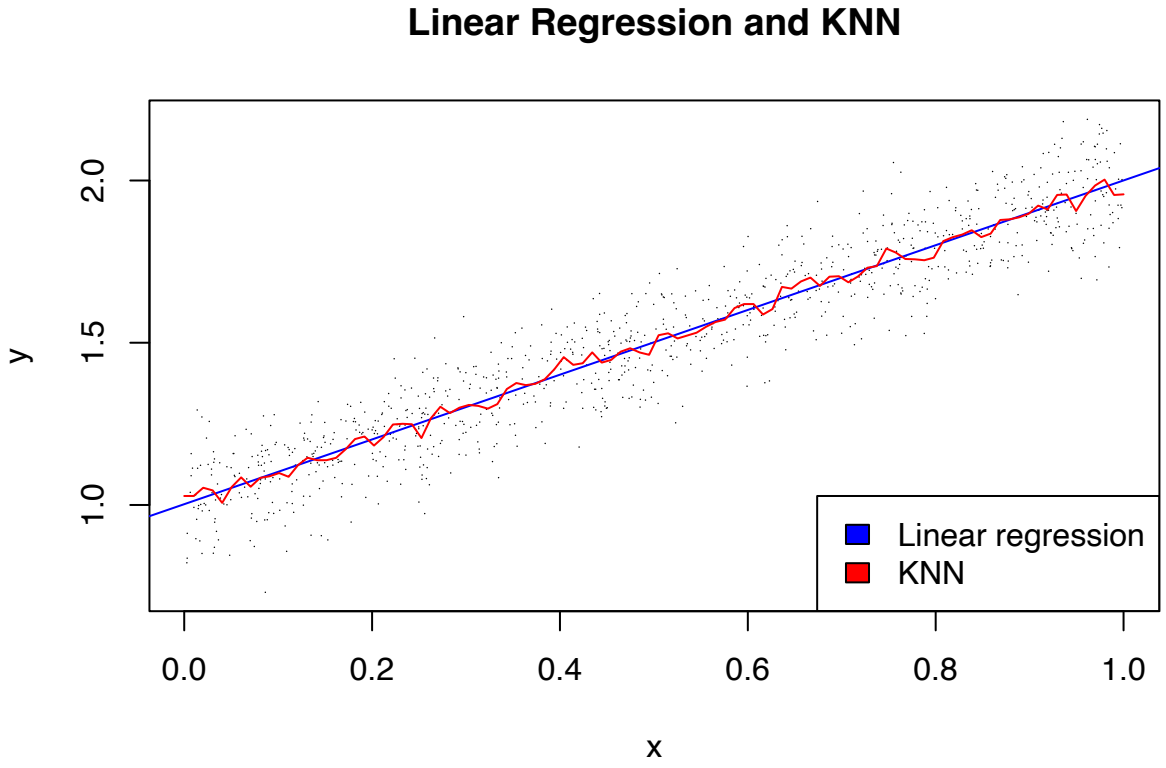
Linear case

```
n = 1000
set.seed(4320)
x = runif(n, 0, 1)
epsilon = rnorm(n, 0, 0.1)
y = 1 + x + epsilon

# linear regression
reg = lm(y ~ x)

# knn
# note that k=5 is much rougher than k=20
k = 20
X = matrix(x, nrow = n, ncol = 1)
l = 100
x_poss = seq(0, 1, length.out = l)
fit_knn = numeric(l)
for (i in 1:l){
  fit_knn[i] = knn.reg(X, y, k, x_poss[i])
}

# compare
plot(x, y, cex = 0.1, pch = 16, main = "Linear Regression and KNN")
abline(reg, col = "blue")
lines(x_poss, fit_knn, col = "red")
legend("bottomright",
       legend = c("Linear regression", "KNN"),
       fill = c("blue", "red"))
```



Log case

```
n = 1000
set.seed(4320)
x = runif(n, 0, 1)
epsilon = rnorm(n, 0, 0.1)
y = 1 + log(x) + epsilon

# linear regression
reg = lm(y ~ x)
reg_2 = lm(y ~ poly(x, 2))

# knn
# note that k=5 is much rougher than k=20
k = 20
X = matrix(x, nrow = n, ncol = 1)
l = 100
x_poss = seq(0, 1, length.out = l)
fit_knn = numeric(l)
for (i in 1:l){
  fit_knn[i] = knn.reg(X, y, k, x_poss[i])
}

# compare
plot(x, y, cex = 0.1, pch = 16, main = "Linear Regression and KNN")
abline(reg, col = "blue")
lines(x_poss, predict(reg_2, data.frame(x = x_poss)), col = "purple")
lines(x_poss, fit_knn, col = "red")
legend("bottomright",
       legend = c("Degree 1 regression", "Degree 2 regression", "KNN"),
```

```
       fill = c("blue", "purple", "red"))
```