Bitcoin Time Series

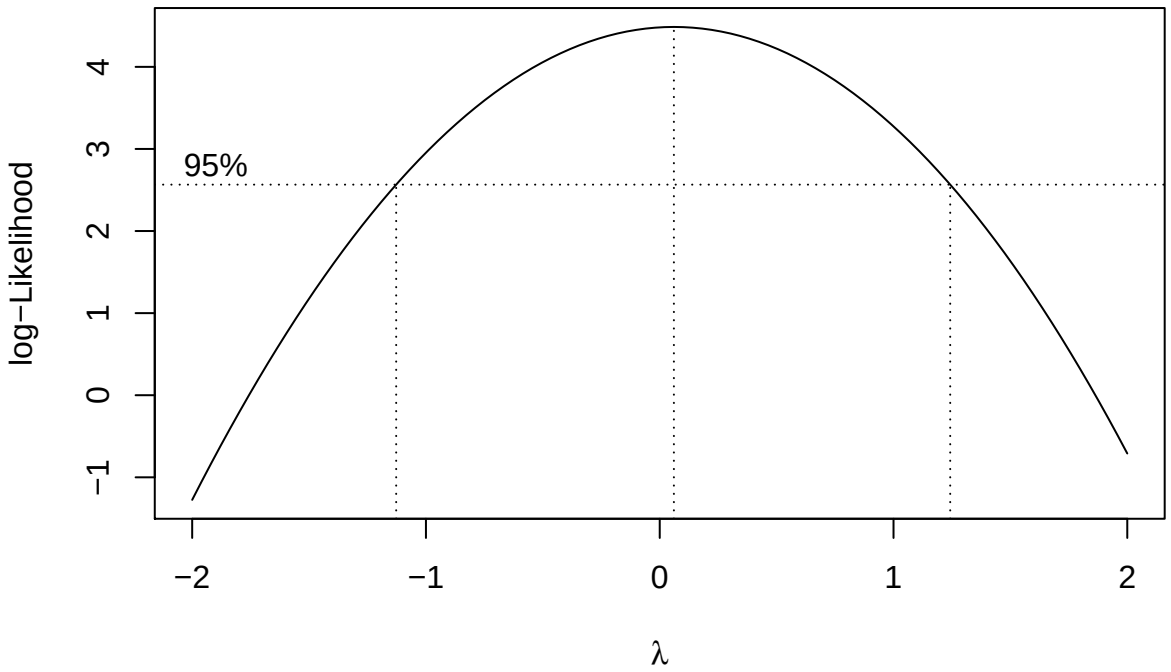
Group Kappa

3/8/2018

```r
#Reading in data
data <- read.csv("crypto.csv", header=TRUE)
```

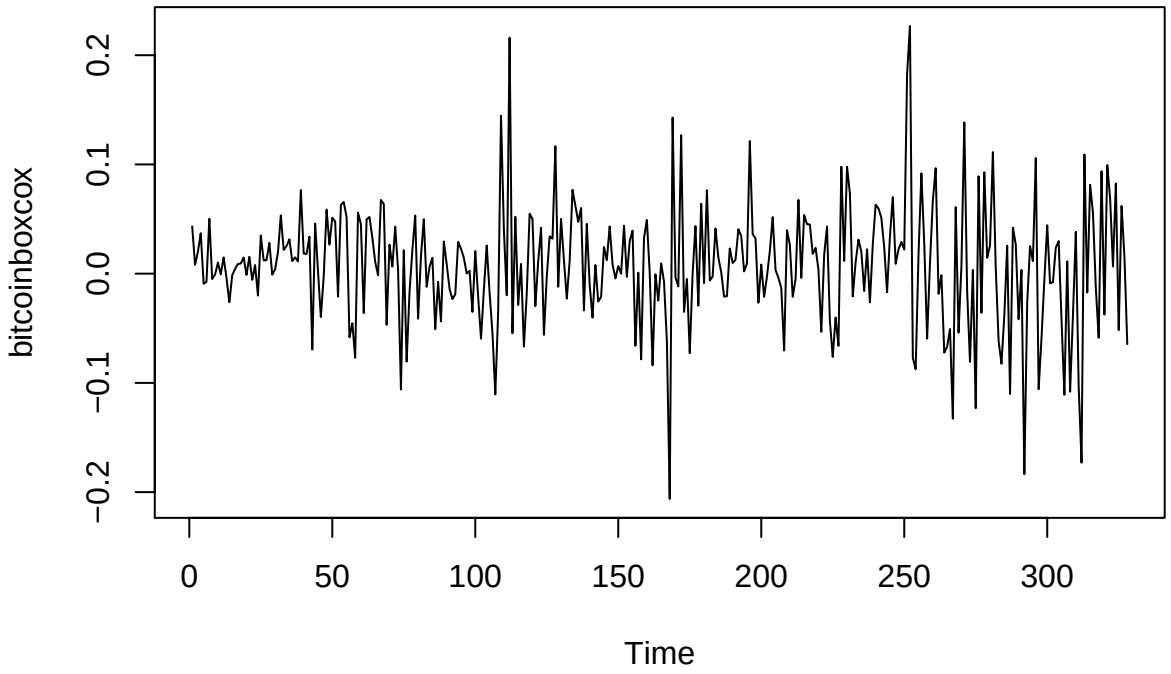
```r
#Choosing only Bitcoin
newdata <- subset(data, symbol=="BTC")

#Choosing the two variables
myvars <- c("date","close")
crypto <- newdata[myvars]

#Changing class of "date"
crypto$date <- as.Date(crypto$date)

#Cutting off dates before 4/1/17
bitcoin <- subset(crypto, date > "2017-03-29")

#Creating the return variable
r.bitcoin = (bitcoin[2:nrow(bitcoin),2] / bitcoin[1:(nrow(bitcoin)-1),2]-1) + 1
```

```r
#BoxCox Transform
time <- 1:length(r.bitcoin)
fit <- lm(r.bitcoin ~ time)
boxcoxtransform <- boxcox(r.bitcoin ~ time, plotit = T)
```




```r
lamb <- boxcoxtransform$x[which(boxcoxtransform$y == max(boxcoxtransform$y))]
bitcoinboxcox <- (1/lamb)*(r.bitcoin^lamb-1)
```

```r
ts.plot(bitcoinboxcox)
```



White Noise Model

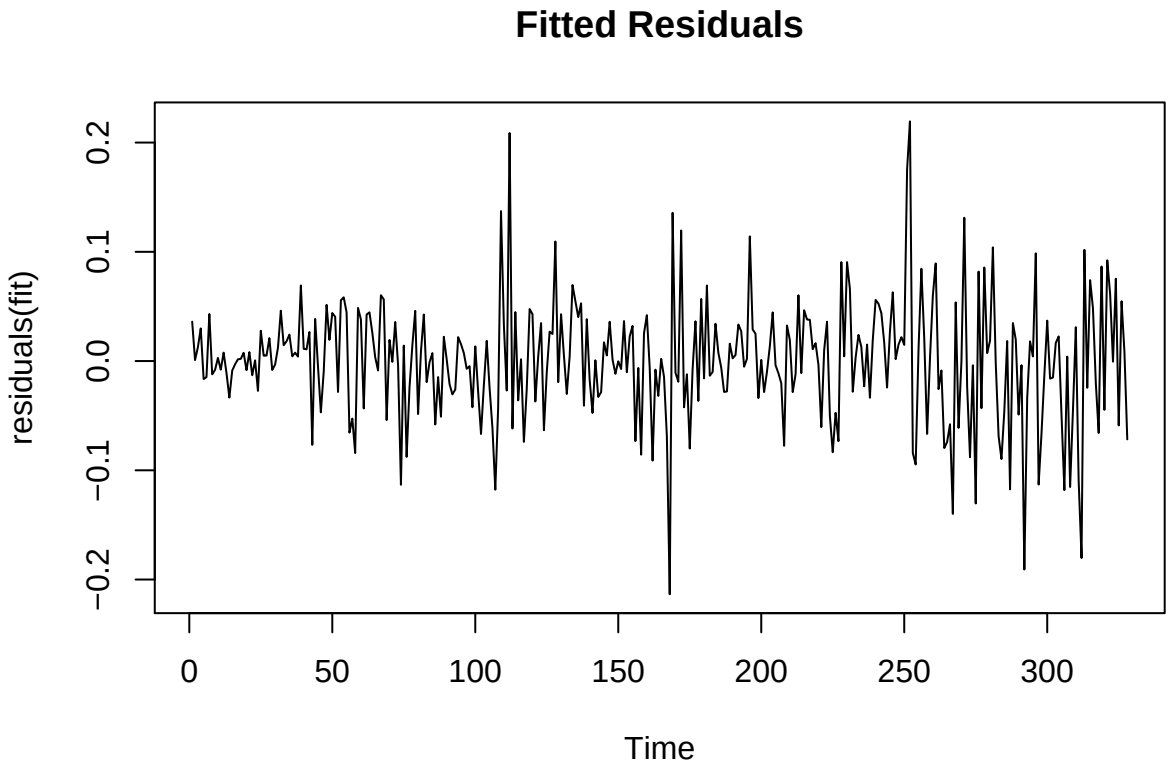
```r
#MA(1) Model
fit = arima(bitcoinboxcox, order=c(0,0,0), method="ML")

#Testing for independence of residuals
Box.test(resid(fit), type="Ljung")
```

```
##
##  Box-Ljung test
##
## data:  resid(fit)
## X-squared = 0.086284, df = 1, p-value = 0.769
```

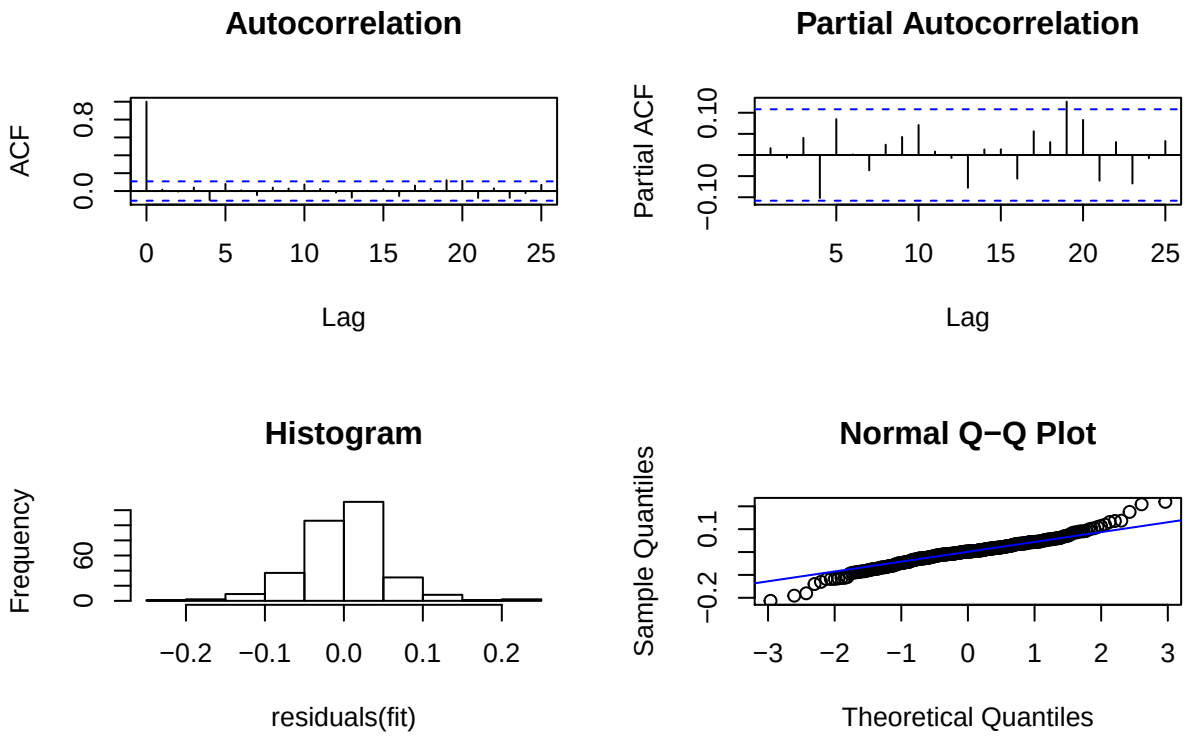
```r
#Test for normality of residuals
shapiro.test(residuals(fit))
```

```
##
##  Shapiro-Wilk normality test
##
## data:  residuals(fit)
## W = 0.96744, p-value = 1.004e-06
```

```r
#Plotting Residuals of Fit
ts.plot(residuals(fit),main = "Fitted Residuals")
```

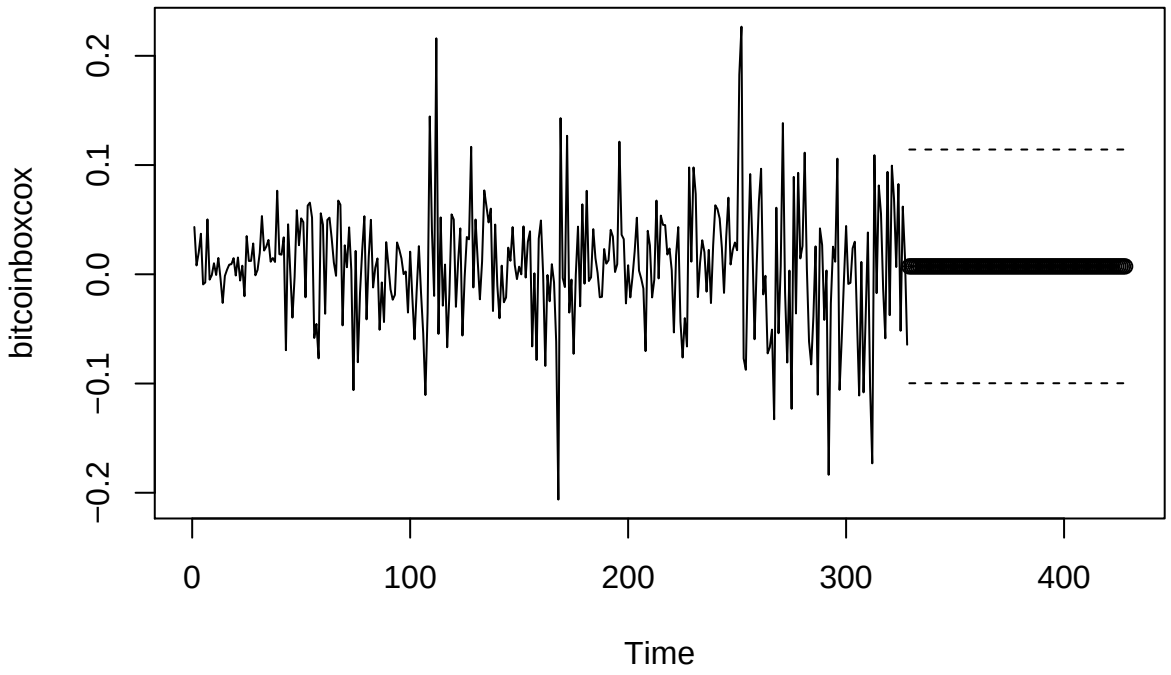



```
par(mfrow=c(1,2),oma=c(0,0,2,0))
# Plot diagnostics of residuals
op <- par(mfrow=c(2,2))
# acf
acf(residuals(fit),main = "Autocorrelation")
# pacf
pacf(residuals(fit),main = "Partial Autocorrelation")
# Histogram
hist(residuals(fit),main = "Histogram")
# q-q plot
qqnorm(residuals(fit))
qqline(residuals(fit),col ="blue")
# Add overall title
title("Fitted Residuals Diagnostics for White Noise", outer=TRUE)
```

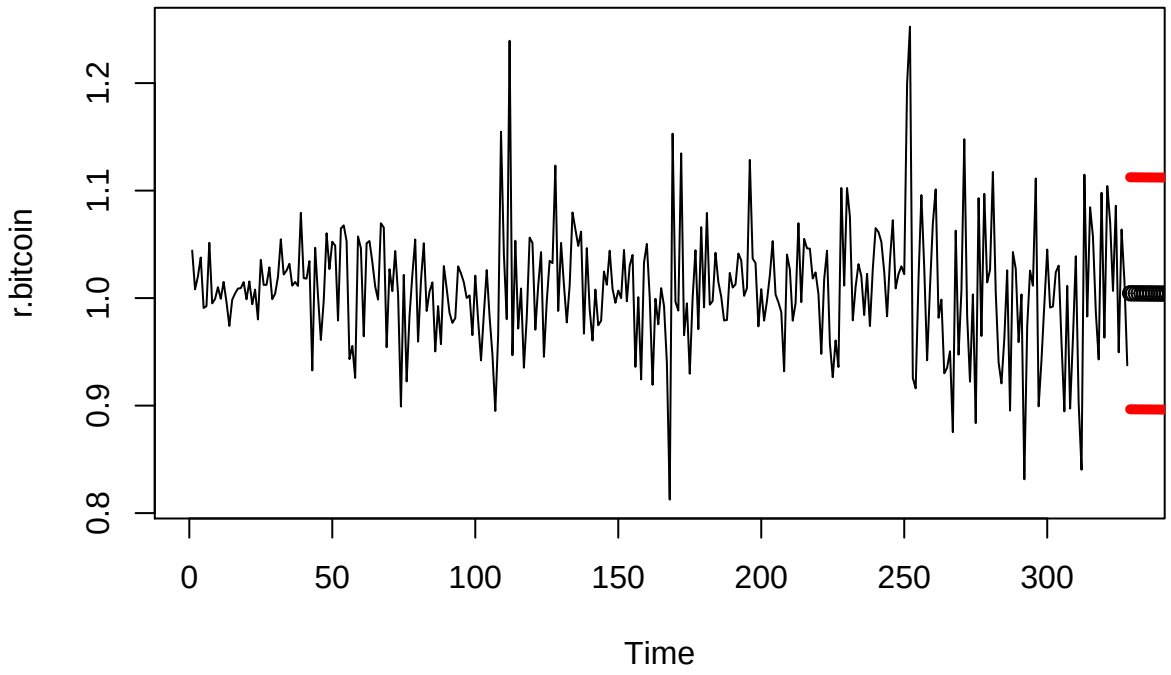



```
par(op)
```

```
##Forecasting on bitcoinboxcox dataset with 100
mypred = predict(fit, n.ahead=100)
ts.plot(bitcoinboxcox, xlim=c(0,429))
points(x = 329:428, y = mypred$pred)
lines(329:428,mypred$pred+1.96*mypred$se,lty=2)
lines(329:428,mypred$pred-1.96*mypred$se,lty=2)
```




```
#Forecasting on original
unboxcoxed<-((bitcoinboxcox*lamb)+1)^(1/lamb)
fitma1unboxcoxed<-arima(unboxcoxed,order=c(0,0,0),method="ML",xreg=1:length(unboxcoxed))
predtrans1<-predict(fitma1unboxcoxed,n.ahead=100,newxreg=(length(unboxcoxed)+1)
                    :(length(unboxcoxed)+100))
ltrans1<-predtrans1$pred-1.96*predtrans1$se

utrans1<-predtrans1$pred+1.96*predtrans1$se

ts.plot(r.bitcoin)
points(x = 329:428,predtrans1$pred,pch=1)
lines(329:428,ltrans1,col="red",lwd=5)
lines(329:428,utrans1,col="red",lwd=5)
```



AR(18) Model

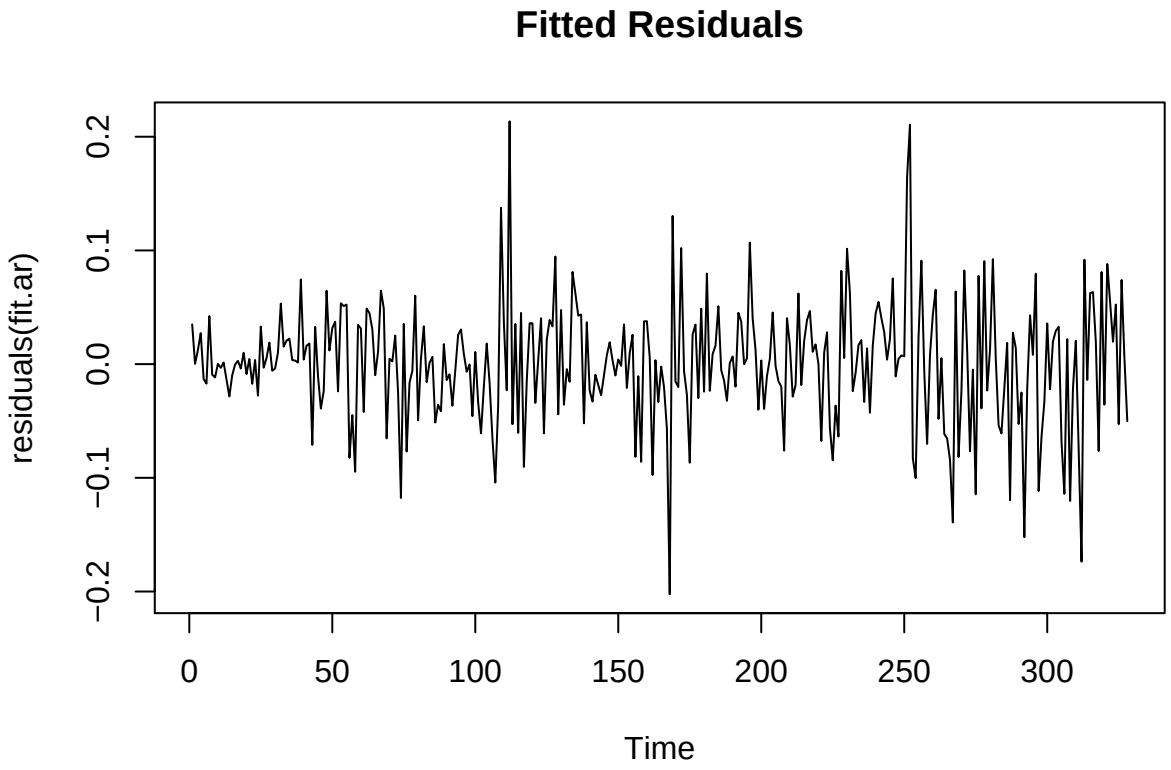
```
#AR(18) Model
fit.ar = arima(bitcoinboxcox, order=c(19,0,0), method="ML")

#Testing for independence of residuals
Box.test(resid(fit.ar), type="Ljung")
```

```
##
##  Box-Ljung test
##
## data:  resid(fit.ar)
## X-squared = 0.035084, df = 1, p-value = 0.8514
```

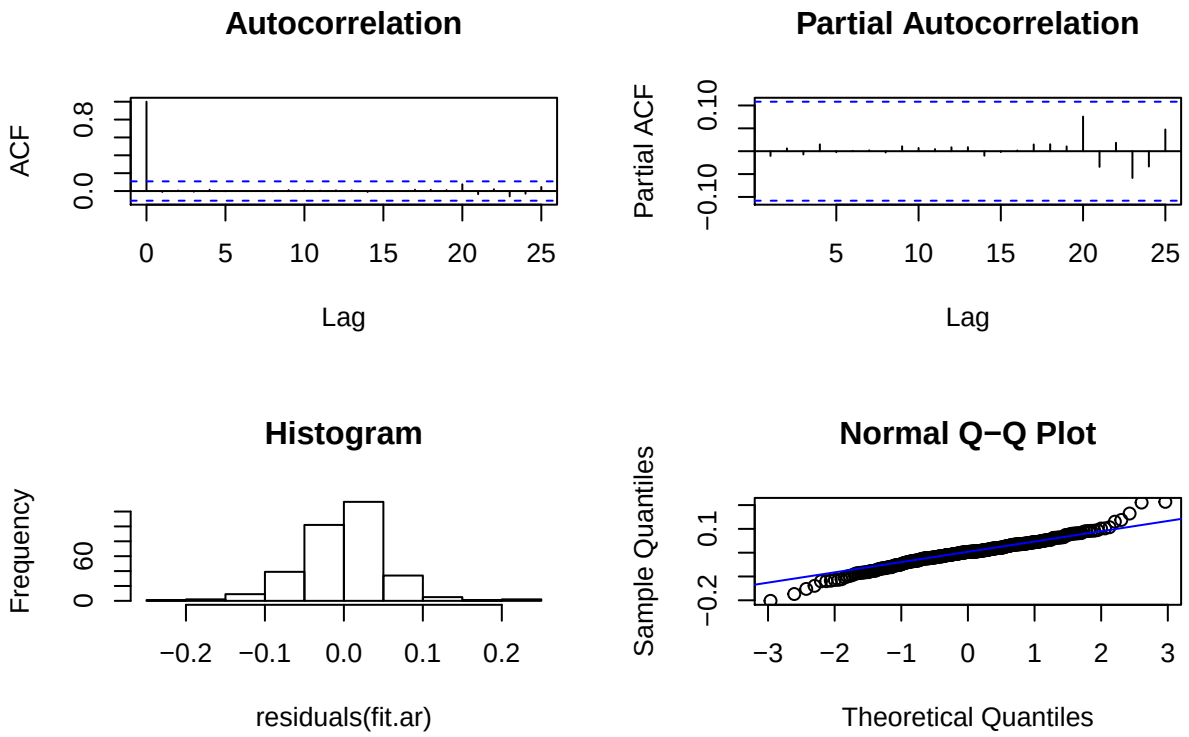
```
#Test for normality of residuals
shapiro.test(residuals(fit.ar))
```

```
##
##  Shapiro-Wilk normality test
##
## data:  residuals(fit.ar)
## W = 0.97412, p-value = 1.271e-05
```

```
#Plotting Residuals of Fit
ts.plot(residuals(fit.ar),main = "Fitted Residuals")
```

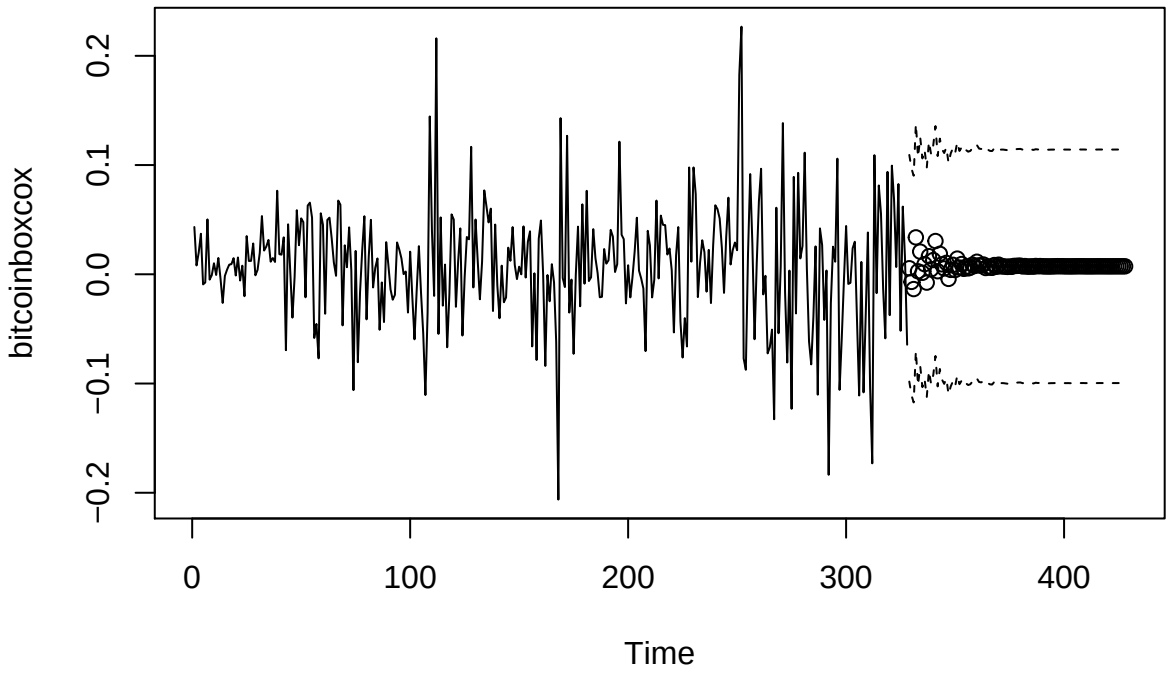



```r
par(mfrow=c(1,2),oma=c(0,0,2,0))
# Plot diagnostics of residuals
op <- par(mfrow=c(2,2))
# acf
acf(residuals(fit.ar),main = "Autocorrelation")
# pacf
pacf(residuals(fit.ar),main = "Partial Autocorrelation")
# Histogram
hist(residuals(fit.ar),main = "Histogram")
# q-q plot
qqnorm(residuals(fit.ar))
qqline(residuals(fit.ar),col ="blue")
# Add overall title
title("Fitted Residuals Diagnostics For AR", outer=TRUE)
```

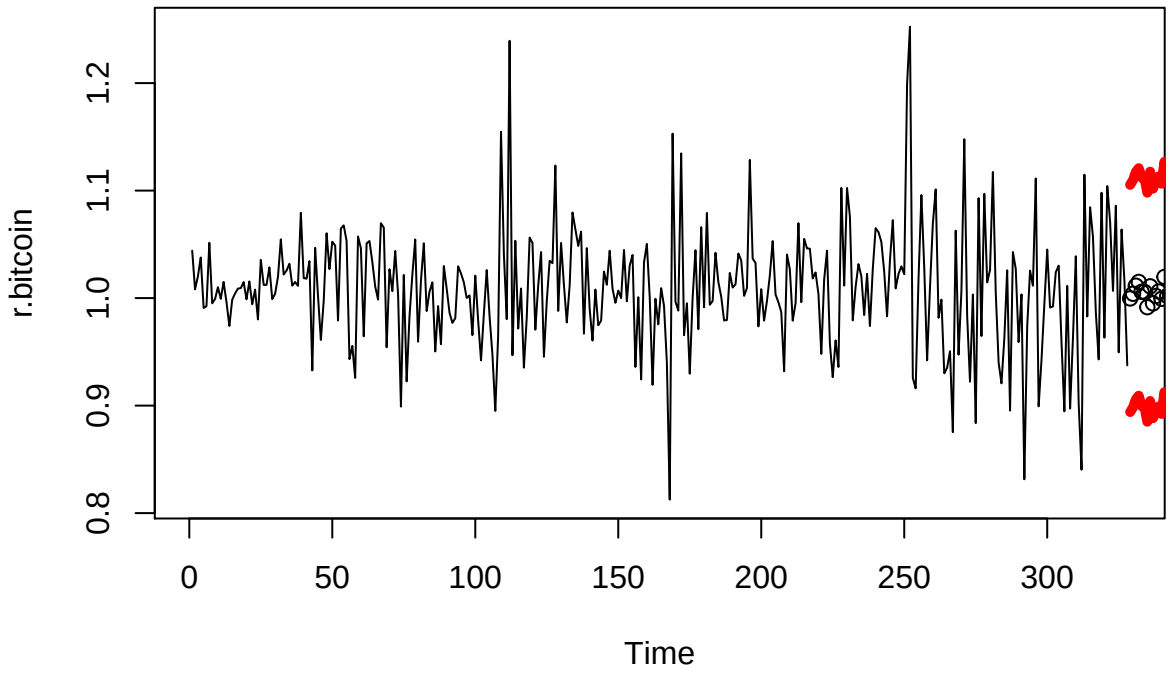



```
par(op)
```

```
##Forecasting AR Model on bitcoinboxcox dataset with 100
mypred = predict(fit.ar, n.ahead=100)
ts.plot(bitcoinboxcox, xlim=c(0,429))
points(x = 329:428, y = mypred$pred)
lines(329:428,mypred$pred+1.96*mypred$se,lty=2)
lines(329:428,mypred$pred-1.96*mypred$se,lty=2)
```




```
#Forecasting on original for AR
unboxcoxed<-((bitcoinboxcox*lamb)+1)^(1/lamb)
fitma1unboxcoxed<-arima(unboxcoxed,order=c(18,0,0),method="ML",xreg=1:length(unboxcoxed))
predtrans1<-predict(fitma1unboxcoxed,n.ahead=100,newxreg=(length(unboxcoxed)+1)
                    :(length(unboxcoxed)+100))
ltrans1<-predtrans1$pred-1.96*predtrans1$se

utrans1<-predtrans1$pred+1.96*predtrans1$se

ts.plot(r.bitcoin)
points(x = 329:428,predtrans1$pred,pch=1)
lines(329:428,ltrans1,col="red",lwd=5)
lines(329:428,utrans1,col="red",lwd=5)
```


r.bitcoin
0.8
0.9
1.0
1.1
1.2
0
50
100
150
200
250
300
Time