ARFIMA

Introduction

Apply an ARFIMA model to forecast benzene concentration levels for the next 25 days.

Create ARFIMA Model

```
arfima_model <- create_arfima_model(ts_train_data)
summary(arfima_model)
```

```
##
## Call:
##   arfima(y = ts_data)
##
## Coefficients:
##          Estimate Std. Error z value Pr(>|z|)
## d         0.16810    0.01142  14.714  < 2e-16 ***
## ar.ar1    0.55035    0.05333  10.320  < 2e-16 ***
## ar.ar2   -0.20335    0.05220  -3.895  9.8e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## sigma[eps] = 3.383771
## [d.tol = 0.0001221, M = 100, h = 1.018e-05]
## Log likelihood: -965.6 ==> AIC = 1939.131 [4 deg.freedom]
```
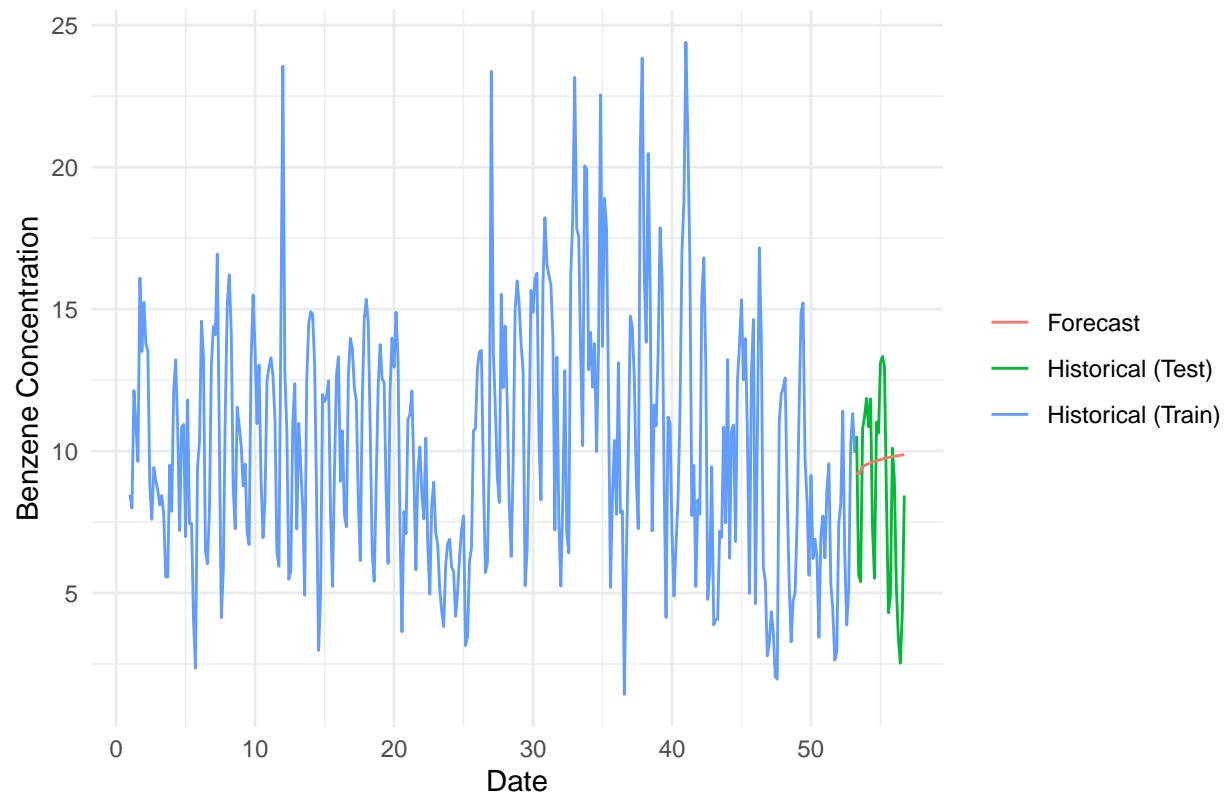
Forecast the Next 25 Days (Test Dataset Length)

```
model_3_forecast_values <- forecast_arfima(arfima_model, forecast_horizon = nrow(ts_test_data))
save(model_3_forecast_values, file = "~/Downloads/model_3_forecast_values.RData")
```

Plot Forecast vs Historical Data

```
plot_arfima_forecast(model_3_forecast_values$mean, ts_train_data, ts_test_data)
```
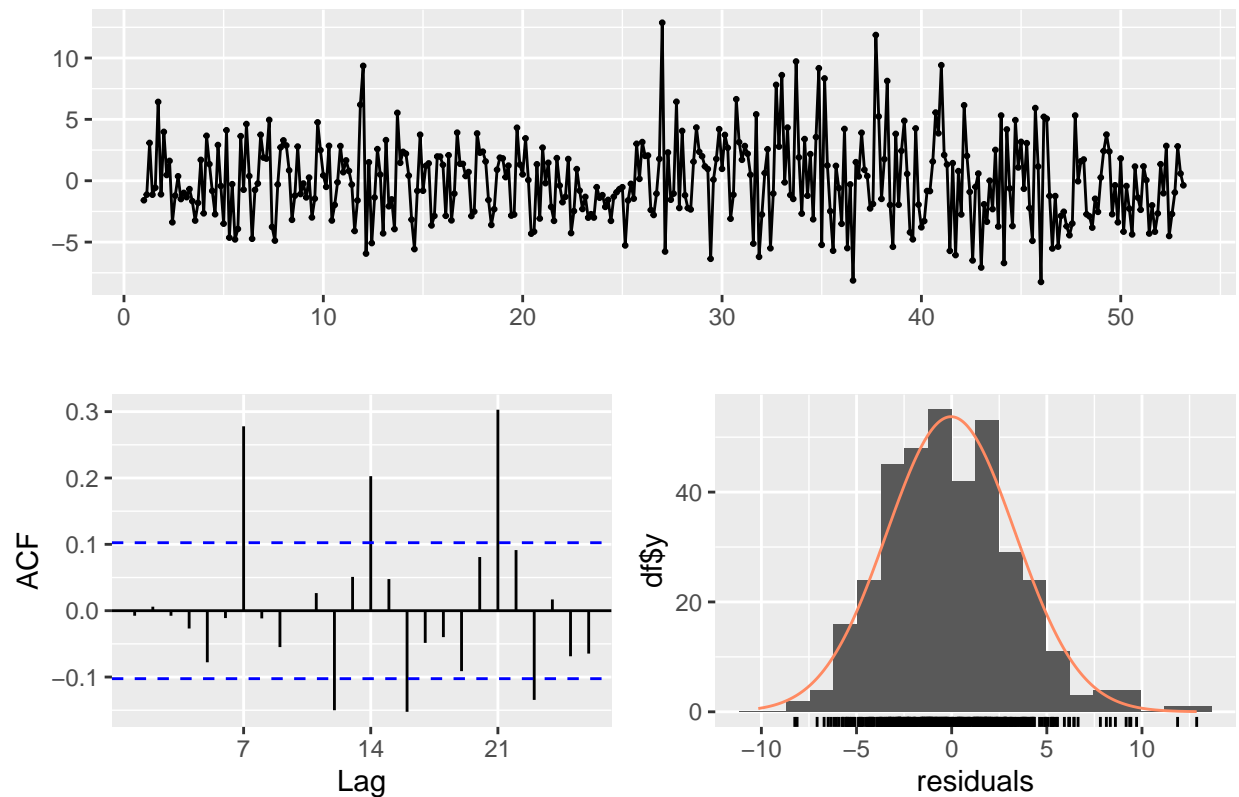
ARFIMA Model Forecast vs Historical Data

Model Residuals

```
checkresiduals(arfima_model)
```
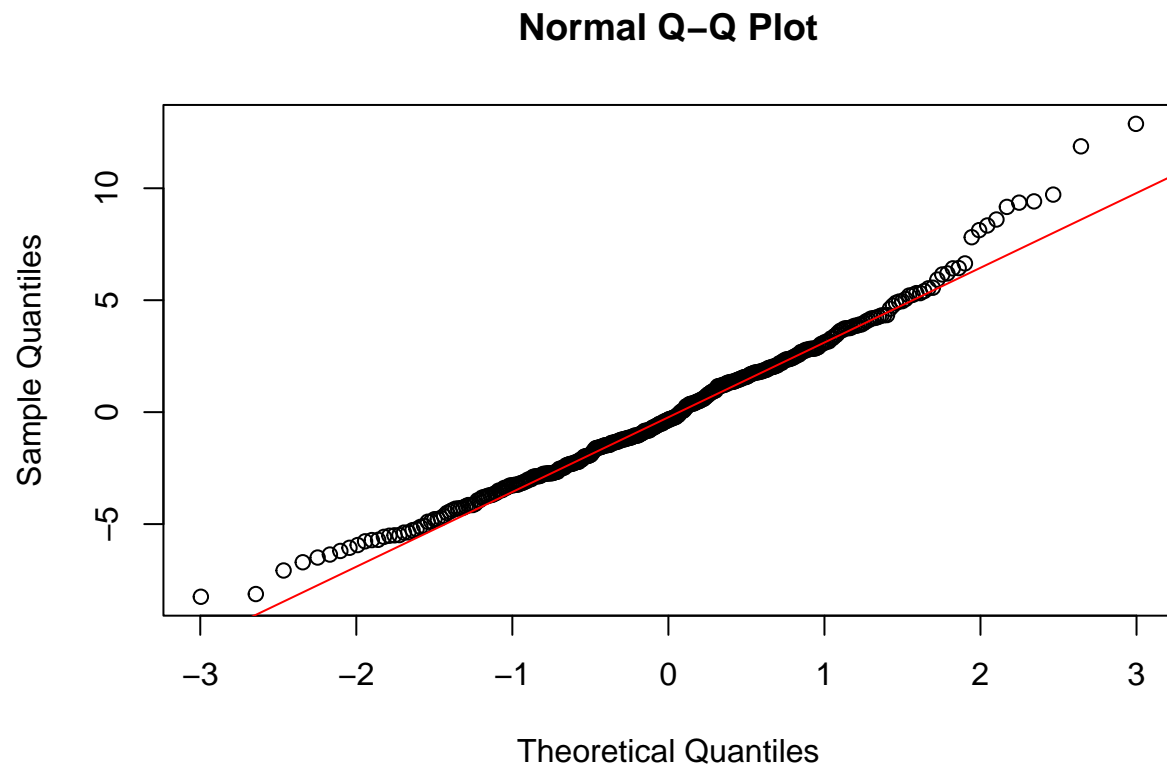
Residuals


```
##
##  Ljung-Box test
##
## data:  Residuals
## Q* = 58.356, df = 14, p-value = 2.274e-07
##
## Model df: 0.   Total lags used: 14
```

Model Residuals Test

```r
arfima_residuals <- residuals(arfima_model)
residuals_test(arfima_residuals)
```

```
##
##  Box-Ljung test
##
## data:  residuals
## X-squared = 31.613, df = 7, p-value = 4.791e-05
##
##
##  Shapiro-Wilk normality test
##
```

```
## data:  residuals
## W = 0.98482, p-value = 0.0006857
```

Normal Q–Q Plot

Evaluation Metrics

```
evaluation_metrics(as.numeric(ts_test_data), model_3_forecast_values$mean)
```

```
## [1] "MRE: 0.559492696711991"
## [1] "MAE: 2.99711875122069"
## [1] "MSE: 12.4901565582249"
## [1] "RMSE: 3.53414155888314"
```