

Fall 2016 MSAN 604: Quiz 3

Thursday November 10th, 2016

Question 1

Suppose $\{x_1, x_2, \dots, x_n\}$ are observed data points from a stationary, zero-mean, time series $\{X_t\}$ which can be modeled by an ARMA(p, q) process. One may estimate the parameters of this model using either a Maximum Likelihood approach, or a Least Squares approach. Briefly discuss one advantage and one disadvantage of each of these methods of estimation.

MLE

- Advantage: we obtain a maximized log-likelihood function and hence various goodness of fit metrics that are useful for model selection.
- Disadvantage: the method implicitly assumes the time series is Gaussian (Normal), which may not be valid.

LSE

- Advantage: it doesn't require a distributional assumption for the time series data.
- Disadvantage: without a formal likelihood function we miss out on goodness of fit metrics such as AIC, AICC, BIC which makes model selection more difficult.

* other valid points can be made.

* we can make CI's and HT's with LSE approach too.

Name:

Question 2

Listed below are a series of hypothesis tests that may be used to investigate the residuals of a time series model. For each test please provide the following information:

- Give a brief description of the model assumption being assessed;
- In plain language (i.e., no symbols/notation), state the null and alternative hypotheses;
- Name a plot of the residuals that can be used to informally evaluate the same assumption.

(a) Ljung-Box Test

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- ✓ The Ljung-Box test formally evaluates whether or not the residuals are correlated.
 - ✓ H_0 : Residuals are 0-correlated for all lags
vs.
 H_A : Residuals separated by some lag are correlated.

- ✓ ACF plot of residuals
or
Residuals vs. t

(b) One sample t -test

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- ✓ A one sample t -test of the residuals determines whether or not the residuals have zero mean
 - ✓ H_0 : Residuals have zero mean
vs.
 H_A : Residuals do not have zero mean
 - ✓ Scatterplot of residuals over time or ACF
or
Histogram of residuals²

Name:

(c) Shapiro-Wilk Test

- ✓ • The Shapiro-Wilk test formally evaluates whether the residuals are normally distributed
- ✓ • H_0 : Residuals are normally distributed
vs,
 H_A : Residuals are not normally distributed

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- ✓ • QQ-Plot of residuals .
or
Histogram of Residuals

(d) Bartlett Test

- ✓ • The Bartlett test formally evaluates whether the residuals are homoscedastic or not.
- ✓ • H_0 : Residuals are homoscedastic
vs,
 H_A : Residuals are heteroscedastic
- ✓ • Scatterplot of residuals over time.

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