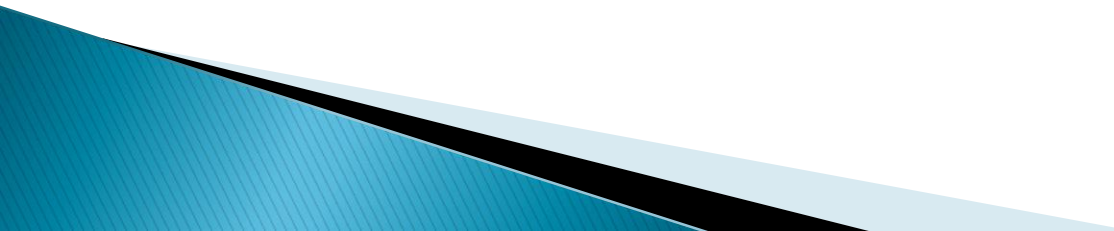


Tests for white noise

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Non-Linear Time Series Analysis
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Introduction

- ▶ After fitting a model, one needs to verify different aspects of the assumption. This is done by both graphical tools and statistical tests. A good statistical model is one that at least the residuals from the fitting, behave like a white noise process. So it is important to develop formal procedures for testing whether a series is white noise or not. For this we have some simple and powerful nonparametric tests.

Assumptions

- ▶ Time series $\{x_t\}$ is stationary.
- ▶ $g(\omega)$ be its spectral density.
- ▶ $\{x_t\}$ will be white noise iff its spectral density is constant. We need to test the hypothesis
- ▶ $H_0 : g(\omega) = \sigma^2/2\pi$ $H_1 : g(\omega) \neq \sigma^2/2\pi$
- ▶ One important thing is that the observed significance level depends on sample size.

Fisher's Test

- ▶ Fisher's test is based on the fact that under H_0 the max. of spectral density and its average should be same. Based on available data, Fisher's test statistic is

$$T_{n,F} = \frac{\max_{1 \leq k \leq n} I(W_k)}{n^{-1} \sum_{k=1}^n I(W_k)}$$

We will reject null hypothesis when test statistic is too large.

Generalized Likelihood test

$$Y_k = m(\omega_k) + Z_k + R_k \quad \text{where } k=1,2,3,\dots,n$$

The basic idea of generalized likelihood ratio test statistic is to find a suitable estimate for $m(\omega)$ in the given eq. Under both hypothesis.

The generalized likelihood ratio statistic is

$$\begin{aligned} \lambda_n &= \log L(H_1) - \log L(H_0) \\ &= \sum_{k=1}^n \{ \exp(Y_k - m_0) - \exp(Y_k - \hat{m}_{lk}(\omega_k)) + m_0 - \hat{m}_{lk}(\omega_k) \} \end{aligned}$$

Adaptive Neyman Test

- ▶ Neyman test is adaptively optimal test in the sense that it achieves adaptively the optimal rate of convergence for non parametric hypothesis testing with unknown degree of smoothness.
- ▶ Adaptive Neyman test statistic is as follows:

$$T_{AN^*} = \frac{\max_{1 \leq m \leq aT} T_m - m}{\sqrt{2m}}$$

THANKS FOR ATTENTION