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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.
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

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

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

\[
\lambda n = \log L(H_1) - \log L(H_0)
\]

\[
= \sum_{k=1}^{n} \left\{ \exp(Y_k - m_0) - \exp(Y_k - m_{lk}(\omega_k)) + m_o - m_{lk}(\omega_k) \right\}
\]
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:

\[ T_{AN^*} = \max_{1 \leq m \leq aT} \frac{T_m - m}{\sqrt{2m}} \]
THANKS FOR ATTENTION