Waseda Statistical Seminar

Statistical Inference for Time Series and Non-Euclidean Data

Date: March 17~18, 2026

Venue: Building 62, Conference Room A (62W-1-07A),
Nishi-Waseda Campus, Waseda University
(Access map: https://www.waseda.jp/top/en/access/nishiwaseda-campus)

Organizer: Yan Liu (Waseda University)

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Program

March 17, 2026

13:00 – 13:10 Opening

13:10 – 13:50 Rinka Sagawa (Waseda Univ.)
Prediction error matrix decomposition in multivariate harmonic regression models

13:50 – 14:30 Shi Chen (Waseda Univ.)
Portmanteau test for copula time series

14:30 – 14:50 Coffee Break

14:50 – 15:30 Takayuki Shiohama (Nanzan Univ.)
Maximum Likelihood Estimation and Testing for the Parameters of Flexible Distributions on the Circle

15:30 – 16:10 Shogo Kato (Inst. of Mathematical Statistics)
An interpretable family of projected normal distributions and a related copula model for Bayesian analysis of hypertoroidal data

16:10 – 16:30 Coffee Break

16:30 – 17:10 Ching-Kang Ing (National Tsing Hua Univ.)
Model Selection and Prediction under Conditional Heteroscedasticity

17:10 – 17:50 Masanobu Taniguchi (Waseda Univ.)
Higher-order investigation of general time series divergences

18:30 – Dinner

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13:10 – 13:50 Yujie Xue (Inst. of Mathematical Statistics)
Shrinkage Estimators of BLUE for Time Series Regression Models

13:50 – 14:30 Kou Fujimori (Shinshu Univ.)
Two-step estimations via the Dantzig selector for models of stochastic processes with high-dimensional parameters

14:30 – 14:50 Coffee Break

14:50 – 15:30 Fumiya Akashi (Univ. Tokyo)
Rank-based estimator for autoregressive models with no moment assumptions

15:30 – 16:10 Hiroaki Ogata (Tokyo Metropolitan Univ.)
Pair circula modelling for multivariate circular time series

Abstract

Akashi, Fumiya

Title: Rank-based estimator for autoregressive models with no moment assumptions

Abstract: This talk introduces a robust rank-based estimation method for autoregressive (AR) models that does not require finite moments of the error term. The rank-based estimator (R-estimator) is known for its robustness and asymptotic relative efficiency compared to least squares and least absolute deviations estimators. However, most existing research imposes moment conditions on the error term, which limits applicability to infinite-variance AR models. To overcome this drawback, we apply weighted empirical process theory and a self-weighting approach to robustify the empirical distribution function. As a result, the limit distribution of the new R-estimator is derived. Additionally, the estimation method for the optimal score-generating function in the R-estimator is examined, and an adaptive R-estimator is constructed to address the limitations of existing methods.

Chen, Shi

Title: Portmanteau test for copula time series

Abstract: We propose two portmanteau tests for copula time series. Copula time series capture the nonlinear dependence structure independently of marginal distributions. We consider portmanteau tests by a residual-based approach and a probability integral transform-based approach to avoid effects of the nonlinear dependence structure inherent in copula time series. The asymptotic distributions of proposed test statistics are obtained under the null hypothesis. The finite sample performance of our approaches is illustrated through numerical simulations. This is a joint work with Yan Liu.

Fujimori, Kou

Title: Two-step estimations via the Dantzig selector for models of stochastic processes with high-dimensional parameters

Abstract: We propose a two-step estimation procedure for stochastic process models with high-dimensional sparse parameters under heteroskedasticity. In classical low-dimensional

settings, an asymptotically efficient estimator is available once the conditional variance is consistently estimated. However, this principle does not directly extend to high-dimensional models, where variable selection and nuisance estimation interact in a nontrivial way. To address this issue, we first perform variable selection using the Dantzig selector. Then, by combining it with consistent estimation of the conditional variance, possibly including infinite-dimensional nuisance parameters, we construct a Z-estimator restricted to the selected variables. We show that the resulting estimator is asymptotically normal, where the high-dimensional sparse parameter can be viewed as an element in an infinite-dimensional Hilbert space $¥ell^2$. The framework is applicable to a wide range of stochastic process models, including ergodic time series and continuous-time settings. This is a joint work with Koji Tsukuda.

Ing, Ching-Kang

Title: Model Selection and Prediction under Conditional Heteroscedasticity

Abstract: This talk studies model selection and prediction for time series models with conditional heteroscedasticity and complex dependence structures. I first consider order selection for ARFIMA models with a real-valued memory parameter d, covering short-memory, long-memory, and nonstationary regimes. A BIC-type criterion is shown to consistently identify the true autoregressive and moving-average orders even under time-varying volatility, despite non-identifiability issues in over-parameterized models.

I then present negative moment bounds for sample autocovariance matrices of stationary processes driven by conditionally heteroscedastic errors. These results enable model selection and prediction analysis under model misspecification, providing a theoretical basis for MSPE-based criteria in the presence of volatility clustering. I conclude with brief remarks on possible extensions.

Kato, Shogo

Title: An interpretable family of projected normal distributions and a related copula model for Bayesian analysis of hypertoroidal data

Abstract: We introduce two families of probability distributions for the Bayesian analysis of hypertoroidal data. The first family consists of symmetric distributions derived from the projection of multivariate normal distributions under specific parameter constraints. This family is closed under marginalization, and hence any marginal distribution belongs to a

lower-dimensional case of the same family. In particular, the univariate marginal of the family is the unimodal case of the projected normal distribution on the circle. The second family is a flexible extension of the copula case of the first family, which can accommodate arbitrary univariate marginal distributions. Unlike existing models derived via projection, both families share the common advantage that their parameters possess a clear and intuitive interpretation. The use of latent variables simplifies Bayesian estimation using Markov chain Monte Carlo algorithms. The usefulness of the proposed families is demonstrated through the analysis of a meteorological dataset. This is a joint work with Gianluca Mastrantonio (Polytechnic of Turin, Italy), Masayuki Ishikawa (Mitsui Sumitomo Insurance Co., Ltd., Japan).

Ogata, Hiroaki

Title: Pair circula modelling for multivariate circular time series

Abstract: This study focuses on modelling multivariate circular time series. The cross-sectional and serial dependences are described by circulas, which are analogous to copulas for circular distributions. To obtain a straightforward expression of the dependence, we decompose a multivariate circula density into a product of several pair circula densities. Moreover, strictly stationary multi-order Markov processes are assumed to reduce the number of pair circula densities. We present an analysis with real data, in which the proposed model is fitted to wind direction measurements observed at multiple locations over a specified period.

Sagawa, Rinka

Title: Prediction error matrix decomposition in multivariate harmonic regression models

Abstract: Identifying periodic structures in multivariate time series is known to be a challenging problem. One reason is that, in the frequency domain, periodic components often exhibit behavior similar to that of long-memory models, making them difficult to distinguish. As a result, models with an excessive number of periodic components may be selected. In this presentation, we theoretically investigate how the one-step-ahead prediction error matrix behaves in multivariate harmonic regression models when the number of fitted periodic components exceeds the true number. In particular, we show that, under model misspecification, the prediction error matrix can be decomposed into a component arising from an autoregressive model and an additional term corresponding to periodic components

characterized by the spectral density function. This decomposition enables an explicit, component-wise evaluation of the impact of over-specifying the number of periodic components on the prediction error structure. In the data analysis, we apply the proposed decomposition with estimated parameters to the temperature data, leading to a basis for constructing an information criterion for selecting periodic components.

Shiohama, Takayuki

Title: Maximum Likelihood Estimation and Testing for the Parameters of Flexible Distributions on the Circle

Abstract: Directional statistics is the branch of statistics that deals with angular data defined on the unit circle. Several flexible distributions are available for estimating and testing parametric models on the circle for practical purposes. For example, the Jones-Pewsey distribution and the generalized t distributions are well-known for their tractability and flexibility, as they include the von Mises distribution, the cardioid distribution, and the wrapped Cauchy distribution as special cases. This study addresses the singularity at $¥psi = 0$ in the maximum likelihood estimation of the Jones-Pewsey and generalized t distributions. Additionally, the one-step estimator is defined, and its finite-sample performance is verified through numerical simulations. The theoretical results obtained are applied to data analysis.

Taniguchi, Masanobu

Title: Higher-order investigation of general time series divergences

Abstract: The paper considers general divergences between a spectral density and a parametric spectral density, and investigates first- and second-order robustness through the influence functions. All divergences are proved to be first-order robust. Second-order robustness is investigated with reference to the Whittle, the log-squares, the α-power, the α-entropy and the Hellinger divergence. The paper shows that the α-power divergence and the α-entropy divergence with α = 1/3 are the most second-order robust, and the α-power divergence with α = 1/3 is also second-order efficient. Numerical studies at the end of the paper support the theoretical results. This is a joint work with Anna Clara Monti and Yujie Xue.

Xue, Yujie

Title: Shrinkage Estimators of BLUE for Time Series Regression Models

Abstract: The least squares estimator (LSE) seems the natural estimator of a linear regression model. Whereas, if the dimension of the vector of regression coefficients is greater than 1 and the residuals are dependent, the best linear unbiased estimator (BLUE) which includes the information of the covariance matrix of residual process has a better performance than LSE in the sense of mean square error. Whereas, as we know the unbiased estimators are generally inadmissible, such as Stein and James (1961) proposed a shrinkage estimator of sample mean. Senda and Taniguchi (2006) introduced a James-Stein type shrinkage estimator for the regression coefficients based on LSE, when the residual process is a Gaussian stationary process. In this talk, we propose a shrinkage estimator based on BLUE. The sufficient conditions for this shrinkage estimator to improve BLUE are given. Since the covariance matrix is infeasible, we introduced a feasible version of that shrinkage estimator with replacing the covariance matrix by an estimator of it, which is introduced in Toyooka (1986). We also give the sufficient conditions where the feasible version improves BLUE. Besides, the result of a numerical study is shown. This is a joint work with Masanobu Taniguchi and Tong Liu.