Waseda – Kyoto Seminars
September, 2023

- **Waseda Seminar**
  Date：September 1 – 2, 2023
  Venue: Waseda Univ. 55N-1-01 Room 2
  (Access map: https://www.waseda.jp/fsci/en/access/)

- **Kyoto Seminar**
  Date: September 4 – 6, 2023
  Venue: Kyoto Research Park: Building 1, Fourth Floor
  Room C (Access map: https://www.krp.co.jp/access/)

Organizer: Masanobu Taniguchi (Waseda Univ.)

Supported by: JSPS Kiban(S) 18H05290 (Taniguchi,M.)
Partially supported by:
(i) Waseda Univ. Tokutei-Kadai 2023C-094 (Liu, Y.)
(ii) JSPS Early Career Scientists JP23K16851 (Goto,Y.)

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Program

Waseda Seminar

September 1

13:20 – 14:00 : Yan Liu (Waseda Univ.)

A minimum contrast estimation for multivariate time series

14:00 – 14:40: Hiroaki Ogata (Tokyo Metropolitan Univ.)

A transition distribution modeling for Higher-Order Circular Markov Processes

14:40 – 15:20: Junichi Hirukawa (Niigata Univ.)

Rank tests for randomness against time varying MA alternative

15:20 – 15:40 : Coffee break

15:40 – 16:20: Alessandro Casini (Univ. Rome, Tor Vergata)

Theory of Low Frequency Contamination from Nonstationarity and Misspecification: Consequences for HAR Inference

16:20 – 17:00: Thomas Verdebout (Univ. Libre Bruxelles) ZOOM

Asymptotic power of Sobolev tests for uniformity on hyperspheres

September 2

10:00 – 10:40: Yujie Xue (Institute of Statistical Mathematics, Tokyo)

Shrinkage Estimators of BLUE for Time Series Regression Models

10:40 – 11:20: Takayuki Shiohama (Nanzan Univ.)

Complex-valued time series models with generalized cardioid-type spectral distributions

11:20 – 12:00: Chiara Amorino (Univ. Luxembourg)

Locally differentially private parameter estimation for iid paths of diffusion processes

Kyoto Seminar

September 4

13:30 – 14:00: Alessandro Casini (Univ. Rome Tor Vergata)

The Fixed-b Limiting Distribution and the ERP of HAR Tests Under

Nonstationarity

14:00 – 14:30: Chiara Amorino (Univ. Luxembourg)

Minmax rate for multivariate data under componentwise local differential privacy constraints

14:30 – 15:00: Coffeee break

15:00 – 16:00: Special Session

16:20 – 17:00: Thomas Verdebout (Univ. Libre Bruxelles) ZOOM

Detecting the dimension of a signal under weak identifiability

September 5

10:00 – 10:30: Yuichi Goto (Kyushu Univ.)

Test for the existence of residual spectrum

10:30 – 11:00: Yan Liu (Waseda Univ.)

Semiparametric empirical likelihood for circular distribution

11:00- 11:30: Takayuki Shiohama (Nanzan Univ.)

On some topics in complex-valued and circular time series modeling

11:30 – 12:00: Junichi Hirukawa (Niigata Univ.)

The self-weighted LAD estimator for unit root process with locally stationary innovations

17:00 – 19:00: Question and Answer Session

September 6

10:00 – 12:00: Forum on "ChatGPT and Statistics"

Chaired by Yan Liu (Waseda Univ.)

20:00 – 22:00: Brainstorming

Chaired by Masanobu Taniguchi (Waseda Univ.)

Abstract

Waseda Seminar

Yan Liu

Title: A minimum contrast estimation for multivariate time series

Abstract: We propose a minimum contrast estimator for multivariate time series in the frequency domain. This extension has not been thoroughly investigated, although the minimum contrast estimator for univariate time series has been studied for a long time. The proposal in this paper is based on the prediction errors of parametric time series models. The properties of the proposed contrast estimation function are explained in details. We also derive the asymptotic normality of the proposed estimator and compare the asymptotic variance with the existing results. The asymptotic efficiency of the proposed minimum contrast estimation is also considered. The theoretical results are illustrated by some numerical simulations.

Takayuki Shiohama

Title: Complex-valued time series models with generalized cardioid-type spectral distributions

Abstract: This study considers the complex-valued time series models whose spectral density functions are generalized cardioid distribution on the circle. The generalized cardioid distribution can express some important circular distributions including, von Mises, wrapped Cauchy, and cardioid distributions as a special case. However, it is known that the shape parameter of that distribution has a singular point on the parameter space. Hence, it is required to develop some practical estimation procedures in order to cope with such problems. Monte Carlo simulations and real data analysis are conducted to illustrate the proposed estimation procedures and verify the asymptotic results.

Junichi Hirukawa

Title: Rank tests for randomness against time varying MA alternative

Abstract: In this talk, we extend the idea of the problem of testing randomness against ARMA

alternative to a class of locally stationary process introduced by Dahlhaus. We use the linear serial rank statistics and apply the notion of the contiguity by LeCam for the testing problem. Under the null hypothesis, the joint asymptotic normality of the proposed rank test statistics and log-likelihood ratio is established by use of the local asymptotic normal property. Then, applying LeCam's third lemma, the asymptotic normality of test statistic under the alternative is automatically derived.

Alessandro Casini

Title: Theory of Low Frequency Contamination from Nonstationarity and Misspecification: Consequences for HAR Inference

Abstract: We establish theoretical results about the low frequency contamination (i.e., long memory effects) induced by general nonstationarity for estimates such as the sample autocovariance and the periodogram, and deduce consequences for heteroskedasticity and autocorrelation robust (HAR) inference. We present explicit expressions for the asymptotic bias of these estimates. We distinguish cases where this contamination only occurs as a small-sample problem and cases where the contamination continues to hold asymptotically. We show theoretically that nonparametric smoothing over time is robust to low frequency contamination. Our results allow a better understanding of long-run variance (LRV) estimation. Existing LRV estimators tend to be inflated when the data are nonstationary. Thus, HAR tests can be undersized and exhibit dramatic power losses. Our theory indicates that long bandwidths or fixed-b HAR tests suffer more from low frequency contamination relative to HAR tests based on HAC estimators, whereas recently introduced double kernel HAC estimators do not suffer from this problem. We present second-order Edgeworth expansions under nonstationarity about the distribution of HAC and DK-HAC estimators and about the corresponding t-test in the regression model. The results show that the low frequency contamination can be induced by time variation in the second moments even when there is no change in the mean.

Thomas Verdebout

Title: Asymptotic power of Sobolev tests for uniformity on hyperspheres

Abstract: One of the most classical problems in multivariate statistics is considered, namely, the problem of testing isotropy, or equivalently, the problem of testing uniformity on the unit hypersphere. Rather than restricting to tests that can detect specific types of alternatives only, we consider the broad class of Sobolev tests. While these tests are known to allow for omnibus

testing of uniformity, their non-null behavior and consistency rates, unexpectedly, remain largely unexplored. To improve on this, we thoroughly study the local asymptotic powers of Sobolev tests under the most classical alternatives to uniformity, namely, under rotationally symmetric alternatives. We show in particular that the consistency rate of Sobolev tests does not only depend on the coefficients defining these tests but also on the derivatives of the underlying angular function at zero. Joint work with García-Portugués, E. and Paindaveine, D.

Yujie Xue

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. Joint work with Taniguchi, M. & Tong Liu.

Hiroaki Ogata

Title: A transition distribution modeling for Higher-Order Circular Markov Processes

Abstract : This study proposes an extension of the higher-order Markov processes on the circle in the sense that an underlying binding density has a non-zero mean direction. The structures for circular autocorrelation functions (CACF), circular partial autocorrelation functions (CPACF), and the spectral density function of the process are investigated. The maximum likelihood estimation for model parameters is considered and its finite sample performances are investigated by numerical simulations.

As a real data analysis, we use time series of wind directions for practical purposes. (joint work

with Takayuki Shiohama).

Chiara Amorino

Title: Locally differentially private parameter estimation for iid paths of diffusion processes

Abstract: We address the problem of parameter drift estimation for N discretely observed iid SDEs, considering the additional constraints that only privatized data can be published and used for inference. In our work, we formally introduce the concept of local differential privacy for a system of stochastic differential equations. Our aim is to estimate the drift parameter by proposing a contrast function based on a pseudo-likelihood approach. We incorporate a suitably scaled Laplace noise to satisfy the privacy requirement. Our main results consist in deriving explicit conditions on the privacy level for which the associated estimator is proven to be consistent and asymptotically normal. This holds true as the discretization step approaches zero and the number of processes N tends to infinity.
The talk is based on a joint work with A. Gloter and H. Halconruy.

Kyoto Seminar

Thomas Verdebout

Title: Detecting the dimension of a signal under weak identifiability

Abstract: We tackle the well-known subsphericity testing problem - i.e. the problem of testing the equality of the $p - q$ smallest eigenvalues of a $p \times p$ scatter matrix. The specificity of our work lies in the fact that we consider scenarios under which the ratio Rq between the qth and $(q + 1)$th largest eigenvalues of the underlying scatter matrix converges to one. Using the Le Cam asymptotic theory, we study the asymptotic properties of the classical Gaussian Likelihood Ratio (LR) test, and derive some optimality properties in scenarios where Rq does not converge too quickly to one. We show that if Rq converges too quickly to one, the Gaussian LR test behaves poorly and we propose some new tests performing better. Based on these new testing procedures, we also propose an estimator of the signal dimension. Joint work with Bernard, G.

Alessandro Casini

Title: The Fixed-b Limiting Distribution and the ERP of HAR Tests Under Nonstationarity

Abstract: We show that the limiting distribution of HAR test statistics under fixed-b asymptotics is not pivotal when the data are nonstationarity. It takes the form of a complicated function of Gaussian processes and depends on the second moments of the relevant series (e.g., of the regressors and errors for the case of the linear regression model). Hence, existing fixed-b inference methods based on stationarity are not theoretically valid in general. The nuisance parameters entering the fixed-b limiting distribution can be consistently estimated under small-b asymptotics but only with nonparametric rate of convergence. We show that the error in rejection probability (ERP) is an order of magnitude larger than that under stationarity and is also larger than that of HAR tests based on HAC estimators under conventional asymptotics. These theoretical results reconcile with recent finite-sample evidence showing that fixed-b HAR tests can perform poorly when the data are nonstationary. They can be conservative under the null hypothesis and have non-monotonic power under the alternative hypothesis irrespective of how large the sample size is.

Chiara Amorino

Title: Minmax rate for multivariate data under componentwise local differential privacy constraints

Abstract: Our research delves into the balance between maintaining privacy and preserving statistical accuracy when dealing with multivariate data that is subject to *componentwise local differential privacy* (CLDP). With CLDP, each component of the private data is made public through a separate privacy channel. This allows for varying levels of privacy protection for different components or for the privatization of each component by different entities, each with their own distinct privacy policies. We develop general techniques for establishing minimax bounds that shed light on the statistical cost of privacy in this context, as a function of the privacy levels $\alpha_1, \dots, \alpha_d$ of the d components. We demonstrate the versatility and efficiency of these techniques by presenting various statistical applications. Specifically, we examine nonparametric density and covariance estimation under CLDP, providing upper and lower bounds that match up to constant factors, as well as an associated data-driven adaptive procedure. Furthermore, we quantify the probability of extracting sensitive information from one component by exploiting the fact that, on another component which may be correlated with the first, a smaller degree of privacy protection is guaranteed.
The talk is based on a joint work with A. Gloter.

Yuichi Goto

Title: Test for the existence of residual spectrum

Abstract: Coherence is a similarity measure between two time series and takes the form of the time series extension of Pearson's correlation. However, only a linear relationship between time series can be measured by coherence. In this talk, we introduce a residual spectrum in order to measure non-linear relationships and show the existence and uniqueness of the residual spectrum by decomposing the time series regression model we consider into orthogonal processes. We also propose a test for the existence of the residual spectrum and apply our test to economic data. Cowork with Xuze Zhang (Univ. of Maryland), Benjamin Kedem (Univ. of Maryland) and Shuo Chen (Univ. of Maryland).

Yan Liu

Title: Semiparametric empirical likelihood for circular distribution

Abstract: We consider the empirical likelihood of the data coming from the circular distribution. Many circular distributions have probability densities proportional to ones among the ARMA spectra family. However, many parameters of interest do not have explicit forms. We propose a semiparametric empirical likelihood method for circular distributions. The empirical likelihood ratio has a chi-squared limiting distribution. The theoretical results are justified by numerical simulations and real data analysis. Cowork with Lan U. & Taniguchi, M.

Takayuki, Shiohama

Title: On some topics in complex-valued and circular time series modeling

Abstract: Since angular-valued time series is expressed as a time series on a unit circle on the complex plane, the technics of parameter estimation share some well-known methods in complex-valued data analysis. Recently, several fundamental properties of higher-order circular time series models are developed, while it remains several problems in the parameter estimation for such data. This study introduces some topics among circular and/or complex-valued time series modeling.

Junichi Hirukawa

Title: The self-weighted LAD estimator for unit root process with locally stationary innovations

Abstract: In most cases, the limiting distributions of the integrated time series are given by

certain functionals of Brownian motion. The main stream of this research area is based on the least squares estimators and those resutls on unit root estimator can be found in Phillips (1987a, 1987b), Perron (1988), Phillips and Durlauf (1986), and references therein. Phillips (1990) and Chan and Tran (1989) extended it for infinite variance innovation cases, in which the limiting distributions are given by the functionals of Lévy processes. The least absolute deviations (LAD) estimation of the autoregressive parameter in unit root processes with infinite variance innovations are considered in Knight (1989, 1991) and Davis, Knight and Liu (1992). The limiting distribution of the LAD estimators are functionals of a bivariate Brownian motion or a bivariate with Brownian motion and Lévy process. Herce (1996) derived the limiting distribution of LAD estimator of the unit root process when the innovation process is given by the general linear (MA(∞)) processes. To undertake statistical inference for infinite variance autoregressive models, Ling (2005) proposed a self-weighted least absolute deviation estimator and showed that this estimator is asymptotically normal. Although the unit root inferences under stationary assumption on the innovation processes are well established, empirical studies show that the innovation processes are not constant in time. One of the most important classes of nonstationary processes has been formulated in a rigorous asymptotic framework by Dahlhaus (1996a,b, 1997 and 2000), called locally stationary processes. Locally stationary processes have time-varying spectral densities whose spectral structures smoothly change in time. In this talk, we derive the asymptotic distribution of the self-weighted LAD estimator of the first-order autoregressive parameter under the unit root hypothesis with locally stationary and α-stable innovation processes.