

【Grant-in-Aid for Scientific Research (S)】

Broad Section J



Title of Project : Introduction of general causality to various observations and the innovation for its optimal statistical inference

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Research Project Number : 18H05290 Researcher Number : 00116625

Keyword : Causality, Statistical Optimal Inference, Time-spatial data, Topological data, Medical Image

【Purpose and Background of the Research】

Professor Granger, a Nobel laureate, introduced a causality for two econometric time series. Granger causality has been applied to graph, network, gene, and epidemiology etc.

In this research we will introduce a very general causality, which is applicable to a variety of data, and detects a new hidden factor. The observations are diverse from the usual data to spatio-time observation, discrete time observation from continuous time models, graph, network, high dimensional observation, topological data, gene sequence etc.

The theme of this research to develop the optimal statistical inference for the generalized causality, and applications of the theoretical results to detect a new hidden factor from a variety of fields.

We also deal with a lot of statistical methods, e.g., empirical likelihood, estimation of circular distribution, distribution on manifolds etc.

This will contribute a prediction, factor analysis, control of risk in various phenomena.

【Research Methods】

To develop our research, Taniguchi (Waseda University) will arrange seminars, workshops at Waseda University to exchange researches, and matching related coworkers.

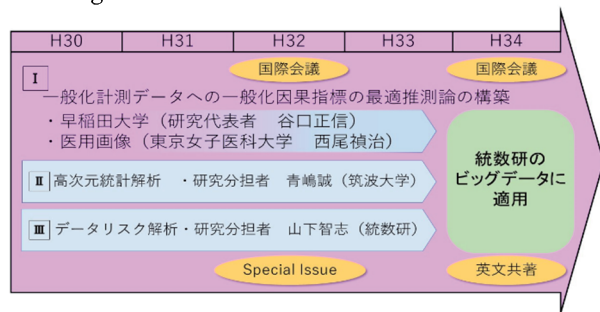


Figure 1 (Road map)

Waseda group will introduce a very general causality, and develop the statistical optimal inference. We apply the theoretical results to analyze medical images to detect a future disease (Figure 2). Aoshima (Tsukuba University) will develop the theory of high-dimensional statistical data, and arrange seminars and workshops on

high-dimensional statistical analysis. Yamashita (Institute of Statistical Mathematics) develops the analysis of financial risk by use of the new causal index to detect a hidden factor, and arrange its related workshops at the Institute of Statistical Mathematics.

【Expected Research Achievements and Scientific Significance】

Our new causality is a very general new one which includes the case when the classical causality was not defined, and is applicable to a variety of fields. We will establish the statistical optimal inference to estimate the causality for spatio-time observations, high-dimensional observations, graph & network, topological observations, which opens a new paradigm in causality analysis.



Figure 2 (Medical Image Analysis)1

【Publications Relevant to the Project】

- Granger,C.W.J., Investigating causal relations by econometric models and cross-spectral methods. *Econometrica* 37 424-439, (1969).
- Taniguchi,M. and Kakizawa,Y. *Asymptotic Theory of Statistical Inference for Time Series Analysis*, Springer-Verlag, 661pages, (2000).

【Term of Project】 FY2018-2022

【Budget Allocation】 140,600 Thousand Yen

【Homepage Address and Other Contact Information】

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