SpringerBriefs in Statistics
JSS Research Series in Statistics

Taka-aki Shiraishi

Multiple Comparisons for Bernoulli Data

Springer

SpringerBriefs in Statistics

JSS Research Series in Statistics

The current research of statistics in Japan has expanded in several directions in line with recent trends in academic activities in the area of statistics and statistical sciences over the globe. The core of these research activities in statistics in Japan has been the Japan Statistical Society (JSS). This society, the oldest and largest academic organization for statistics in Japan, was founded in 1931 by a handful of pioneer statisticians and economists and now has a history of about 80 years. Many distinguished scholars have been members, including the influential statistician Hirotugu Akaike, who was a past president of JSS, and the notable mathematician Kiyosi Itô, who was an earlier member of the Institute of Statistical Mathematics (ISM), which has been a closely related organization since the establishment of ISM. The society has two academic journals: the Journal of the Japan Statistical Society (English Series) and the Journal of the Japan Statistical Society (Japanese Series). The membership of JSS consists of researchers, teachers, and professional statisticians in many different fields including mathematics, statistics, engineering, medical sciences, government statistics, economics, business, psychology, education, and many other natural, biological, and social sciences. The JSS Series of Statistics aims to publish recent results of current research activities in the areas of statistics and statistical sciences in Japan that otherwise would not be available in English; they are complementary to the two JSS academic journals, both English and Japanese. Because the scope of a research paper in academic journals inevitably has become narrowly focused and condensed in recent years, this series is intended to fill the gap between academic research activities and the form of a single academic paper. The series will be of great interest to a wide audience of researchers, teachers, professional statisticians, and graduate students in many countries who are interested in statistics and statistical sciences, in statistical theory, and in various areas of statistical applications.

More information about this subseries at https://link.springer.com/bookseries/13497

Taka-aki Shiraishi

Multiple Comparisons for Bernoulli Data

Springer

Taka-aki Shiraishi
Faculty of Science and Technology
Nanzan University
Nagoya, Aichi, Japan

ISSN 2191-544X ISSN 2191-5458 (electronic)
SpringerBriefs in Statistics
ISSN 2364-0057 ISSN 2364-0065 (electronic)
JSS Research Series in Statistics
ISBN 978-981-19-2707-2 ISBN 978-981-19-2708-9 (eBook)
https://doi.org/10.1007/978-981-19-2708-9

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Preface

Multiple tests and simultaneous confidence intervals specify differences in means. Tukey (1953), Miller (1981), Hochberg and Tamhane (1987), Hsu (1996), and Shiraishi et al. (2018), (2019) are some technical books on multiple comparisons for continuous random variables. Multiple comparisons for discrete random variables have been discussed a little. The present book focuses on progressive multiple comparisons of proportions in multi-sample models with Bernoulli responses.

In Chap. 1, we give theoretical basics in one-sample and two-sample models. We state regurarity conditions of exact confidence limit using F-distribution. We introduce asymptotic theory based on variance-stabilizing transformation. In Chap. 2, we give simultaneous inference for all proportions in multi-sample models by using the exact confidence limit and the asymptotic theory. In Chap. 3, we discuss all-pairwise multiple comparison tests of proportions. Closed testing procedures based on maximum absolute values of some two-sample test statistics and based on χ^2-test statistics are introduced in multi-sample models. The results suggest that the multi-step procedures are more effective than single-step procedures and the Ryan–Einot–Gabriel–Welsch (REGW) type tests. In Chap. 4, we give multiple comparison test procedures with a control. In Chap. 5, we propose simultaneous confidence intervals for difference of proportions, odds ratio, and ratio of proportions. By the theory of this intervals, we are able to obtain all-pairwise multiple comparison tests of odds ratio. In Chaps. 6 and 7, under simple ordered restrictions of proportions, we also discuss closed testing procedures based on maximum values of two-sample one-sided test statistics and based on Bartholomew's $\bar{\chi}^2$-statistics. Although single-step multiple comparison procedures are utilized in general, the closed testing procedures stated in the present book are fairly more powerful than the single-step procedures. Bretz et al. (2011) discuss serial gatekeeping methods based on Bonferroni inequality.

In Chaps. 8 and 9, we propose serial gatekeeping methods based on the closed testing procedures stated in Chaps. 3, 4, 6 and 7. It is shown that the proposed serial gatekeeping methods are much superior to the serial gatekeeping methods based on Bonferroni tests.

Nagoya, Japan Taka-aki Shiraishi
March 2022

References

Bretz F, Hothorn T, Westfall P (2010) Multiple comparisons using R. Chapman & Hall
Hochberg Y, Tamhane AC (1987) Multiple comparison procedures. Wiley
Hsu JC (1996) Multiple comparisons-theory and methods. Chapman & Hall
Miller RG (1981) Simultaneous statistical inference, 2rd edn. Springer
Shiraishi T, Sugiura H (2018) Theory of multiple comparison procedures and its computation. Kyoritsu-Shuppan Co., Ltd. (in Japanese)
Shiraishi T, Sugiura H, Matsuda S (2019) Pairwise multiple comparisons-theory and computation. SpringerBriefs. Springer International Publishing
Tukey JW (1953). The problem of multiple comparisons. The Collected Works of John W. Tukey (1994), Volume VIII: Multiple Comparisons. Chapman & Hall

Acknowledgements

The authors are grateful to two referees for valuable comments. This research was supported in part by a Grant-in-Aid for Co-operative Research (C) 18K11204 from the Japanese Ministry of Education. This research was also supported in part by Nanzan University Pache Research Subsidy I-A-2 for 2021 academic year.

Contents