Preface

Statistical hypothesis testing is a basic and important branch of mathematical statistics. The classical theory on testing hypothesis is often based on the large sample, such as Pearson's χ^2 test and Fisher's likelihood ratio test, and its decision criterion depends on the p-value. Modern hypothesis testing theory is based on the thoughts of J. Neyman and E. S. Pearson in the 1930's, and especially credites to the systematization and development of Lehmann (1959, 1986). As distinguished from that of the classical hypothesis testing, modern testing theory depends on the idea of optimization: to minimize the Type II error by controlling the Type I error. The experience gained from decades of teaching and research proves that the latter is theoretically perfect but does not provide more methods for constructing new test statistics. As to testing problem, in fact, a feasible principle is to construct a suitable statistic based on both the background of practical problem and the individual statistical intuition. On the basis of the above principle, a further analysis is made on the properties of the test statistic. Therefore, it is the basic idea of this book to combine the two methods mentioned above reasonably. Moreover, as most of current researches about hypothesis testing are aiming at parametric models, so does this book.

The book consists five chapters, which can be divided into three parts. The first part, Chapter 1, discusses some basic properties of statistical space. Although the term, statistical space, is put forward by this book, its concept has been used in common for a long time, *i.e.*, adding a family of probability measures to a measurable space. Thus there is an essential difference between statistical space and usual probability space: for a given measurable set, the usual probability space concerns measuring 'the probability that a random variable may belong to this set'; the statistical space concerns which measure that is used to measure 'the probability that a random variable may belong to this set' would be better. In this chapter the discussion on the properties of the statistical space is expanded under such basic thought. Considering test depends on estimator in essence, the authors also conclude some methods and properties of estimators in this chapter.

The second part, including Chapters 2 and 3, mainly discusses some basic concepts of test statistics. Chapter 2 focuses on the basic idea and the methods of constructing test statistics, including parametric as well as non-parametric ones. Chapter 3 discusses how to judge whether a test statistic is good or bad, including Neyman-Pearson Lemma viewed as a judgement method, besides comparison the power functions and comparison the robustness etc. Moreover, based on the fact that the interval estimation is very important, the last section of Chapter 3 discusses the relation between the test acceptance region and the interval estimation as well as how to construct an interval estimation.

The third part including Chapters 4 and 5, discusses the test of parametric model. Most of the current testing theories and researches aim at parametric model from which the new testing thought and method, including model selection, originate. This part discusses the test on some models, such as ANOVA and AIC, log linear model and contingency tables, regression analysis together with the test of Logistic model and time series *etc*, as well as model selection. Especially in the section of ANOVA, the reason of introducing the tendency term test is not only that the authors of this book are familiar with the related contents but also that tendency test is becoming more and more important with increasingly development of Bioinformatics research.

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