

Contents

Acknowledgement	i
Abstract	vii
1 Introduction and Motivation	1
1.1 Introduction	1
1.2 Classical Approaches of Analysis	2
1.2.1 Univariate Analysis	3
1.2.2 Multivariate Analysis	4
1.3 The Case of High Dimensional Data	5
1.4 Motivating Examples	6
1.5 Review of Literature	8
2 The One-sample Statistic	11
2.1 The ANOVA-type Statistic	11
2.2 The Estimators	18
2.3 The Approximating Distribution	20
2.4 Simulation Results	22
2.4.1 Moments of Estimators	22
2.4.2 Level	23
2.4.3 Power	23
2.5 Applications	24
2.5.1 Analysis of Sleep Lab Data	24
2.5.2 Analysis of Amylase Data	26
3 The Two-sample Statistic	29
3.1 The Statistical Model	29
3.1.1 Model and Assumptions	29

3.1.2	Formulation of Hypotheses	30
3.1.3	Formulation of the Test Statistic	31
3.2	The Interaction Effect	31
3.2.1	The Covariance Matrix	32
3.2.2	Defining The Statistic	33
3.2.3	Case I: $n_1 \neq n_2, \Sigma_1 = \Sigma_2$	36
3.2.3.1	The Estimators	36
3.2.3.2	The Approximating Distribution	39
3.2.4	Case II: $n_1 = n_2, \Sigma_1 \neq \Sigma_2$	40
3.2.4.1	The Estimators	40
3.2.4.2	The Approximating Distribution	42
3.2.5	Simulation Results	44
3.2.5.1	Level	44
3.2.5.2	Power	46
3.3	The Time Effect	47
3.3.1	The Covariance Matrix	47
3.3.2	Defining The Statistic	47
3.3.3	Case I: $n_1 \neq n_2, \Sigma_1 = \Sigma_2$	49
3.3.4	Case II: $n_1 = n_2, \Sigma_1 \neq \Sigma_2$	49
3.3.5	Simulation Results	50
3.4	The Group Effect	52
3.5	Applications	55
3.5.1	Analysis of Complete Sleep Lab Data	55
3.5.2	Analysis of Wistar Rats Data	56
4	The Multivariate Case	59
5	Summary and Outlook	61
5.1	Summary and Conclusions	61
5.2	Future Outlook	64
A	Quadratic and Bilinear Forms	67
A.1	Moments of Quadratic Forms	68
A.2	Moments of Bilinear Forms	72
B	Some Miscellaneous Results	77

CONTENTS

xi

C Data Sets	81
C.1 α -Amylase in Saliva	81
C.2 Body Weight of Wistar Rats	82
C.3 Sleep Disorder	83