



## Multivariate statistics

### Lecture 04:

### Two-sample inference for MVN mean vectors

Literature and Problems: See course schedule

#### Agenda (preliminary):

**SLIDE: Review of 1D paired comparison of normal population means**

MVN two-sample paired comparison of mean vectors  $\mu_1$  and  $\mu_2$

- model and difference model
- hypothesis
- point-estimators for  $\mu_1 - \mu_2$  and  $\Sigma_{\text{diff}}$
- Hotelling T<sup>2</sup> test-statistic and its distribution
- hypothesis-test
- confidence region for  $\mu_1 - \mu_2$
- simultaneous and Bonferroni CI's for  $\mu_{1i} - \mu_{2i}$ ,  $i = 1, 2, \dots, p$

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**SLIDE: Review of 1D non-paired comparison of normal population means**

**Case 1: equal population variances**

MVN two-sample non-paired comparison of mean vectors  $\mu_1$  and  $\mu_2$

**Case 1: equal population covariance matrices,  $\Sigma_1 = \Sigma_2$**

- model
- hypothesis
- point-estimators for  $\mu_1$  and  $\mu_2$
- point-estimator for  $\Sigma$  using “pooling” of sample covariance matrices  $S_1, S_2$
- Hotelling T<sup>2</sup> test-statistic and its distribution
- hypothesis-test
- confidence region for  $\mu_1 - \mu_2$
- simultaneous and Bonferroni CI's for  $\mu_{1i} - \mu_{2i}$ ,  $i = 1, 2, \dots, p$

**SLIDE: Case 2: un-equal population variances**

**MVN Case 2: un-equal population covariance matrices,  $\Sigma_1 \neq \Sigma_2$**

- Hotelling T<sup>2</sup> test-statistic and its approximate distribution

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**Bartlett test for equal population covariance matrices,  $\Sigma_1 = \Sigma_2$**

- model and hypothesis
- LR-test-statistic (derivation --> Problem 4.1)
- finite population correction factor
- approximate distribution of test-statistic