# Dipartimento di Statistica "Giuseppe Parenti"

**Universita' di Firenze**

**Florence, November 29 - December 3, 1999**

# A Course on Mixture Models: Outline

**Dankmar Böhning, Free University of Berlin**

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## Program

- **Monday, November 29**: Introduction
  - 09:30 - 12:30
    - Population heterogeneity: the natural genesis of mixture models
    - Some examples
    - Parametric or nonparametric mixture models?
  - 14:00 - 16:30
    - Connection to empirical Bayes estimation
    - Classification using posterior Bayes
    - Missing covariates and mixture models

- **Tuesday, November 30**: Theory of nonparametric mixture models
  - 09:30 - 12:30
    - The likelihood and its properties
    - The directional derivative and the gradient function
    - The general mixture maximum likelihood theorem
    - Applications of the theorem
  - 14:00 - 16:30
    - Existence and number of support points of the NPMLE
    - A case study on the Simar's accident data
    - Exercises on real data sets: homogeneity or heterogeneity? (Tutored by Tan Böhning)
    - Diagnostic tests for heterogeneity
    - Testing the number of components with the likelihood ratio

- **Wednesday, December 1**: Algorithms
  - 09.30 - 12.30
    - Finding the number of components
    - The vertex direction method (VDM)
    - The vertex exchange method (VEM)
    - Step-length choices
    - Introducing C.A.MAN
  - 14:00 - 16:30
    - Number of components known

        - The EM algorithm for mixture models
        - Mixing normls with different variance components
        - Exercises with C.A.MAN (Tutored by Tan Böhning)

- **Thursday, December 2**: Applications of Mixtures: Meta-Analysis
    - 09:30 - 12:30
        - The conventional approach
        - Strategies of optimal pooling and a likelihood approach
        - Heterogeneity
        - Classification of studies using posterior Bayes
    - 14:00 - 16:30
        - Introducing META
        - Exercises with META (Tutored by Tan Böhning)
        - Adjusting for heterogeneity using DerSimonian-Laird
        - Adjusting for heterogeneity using Sarol-Böhning

- **Friday, December 3**: Applications of Mixtures: Disease Mapping
    - 09:30 - 12:30
        - The conventional approach
        - Empirical Bayes estimators and their maps
        - Estimating map heterogeneity - estimating the prior
        - Heterogeneity in perinatal mortality for the North West Thames Health Region - data: a case study
    - 14:00 - 16:30
        - Introducing DISMAP
        - Exercises with DISMAP (Tutored by Tan Böhning)
        - Adjusting for heterogeneity using DerSimonian-Laird

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The course will give a state-of-the-art introduction into the area and various field appliactions. The course will use the book by the author on mixture models:
Dankmar Böhning (1999) *Computer-Assisted Analysis of Mixtures with Applications: Meta-Analysis, Disease mapping and Others*. Chapman & Hall /CRC, Boca Raton.


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