Construction of Statistical Models for Hospital Management

Yuko Tsumoto and Shusaku Tsumoto
Shimane University, School of Medicine
Izumo, Japan
tsumoto@computer.org

Overview

- Data in Hospital Information Systems (HIS)
  - HIS introduced in 1980's
  - Even the storage of text data (prescription/labo data) exceeds 10GB per year in a large hospital.
- Reuse of Stored Large Data
  - Decision Support for Clinical Decision Making
    - Evaluation of Diagnosis, Therapy
    - Preprocessing for "Evidence-based Medicine"
  - Decision Support for Hospital Management

Overview (5)

- This paper shows:
  - Which factors determine the income of large scale hospitals ?
  - Discover a model of the hospital income and expenditure
  - Discover the characteristics of a hospital using statistics
- Using R
  - Free tools for Statistical Computing
  - Visualization / Statistical Modelling

Data for Analysis

- Data extracted from Hospital Information Systems of Chiba University
  - Data from 1978 to 1999 (Chart Summary)
    - Records: 157636, # of Attributes :20
  - Data from 1997 to 1999 (Chart Summary+ Payments)
    - Records:20164, # of Attributes: 21
  - Here, we mainly use Data from 1997 to 1999.

Analysis: Hypothesis

- Is Averaged Length of Stay an indicator ?
  - Distribution Analysis
- Hospital income is dependent on the length of stay. (Averaged Length of Stay ?)
  - Multi-Regression (GLM)
- Degree of Dependence ?
  - Correlation and Uni-regression

Summary: Evaluation of Hypothesis

- Hospital income is dependent on the length of stay. (Averaged Length of Stay ?)
  - Yes
- Degree of Dependence ?
  - Highly. Length of Stay is a primary determinant of conventional hospital incomes.
- Is Averaged Length of Stay an indicator ?
  - No, median should be

Conclusions

- Validations of Empirical Rules on Hospital Income
- Does R-based data mining play an important role in model construction ?
  - Interactive Environment
  - Programmable Environment

Future Work

- Close Examinations on Distribution of Length of Stay
  - Log-normal ?
  - Inverse-normal ?
  - Or other
- Can Length of Stay be viewed as a indicator from Stochastic Process ?
  - If normal, random-walk process may fit.
  - If log-normal, similar process for radiological functions may fit.
- Decision Support for Hospital Management ?
  - Close examinations of Statistical Models
  - Outliers from Regression Models