Reconnect 2009

Educational Module:
Visual Analytics to Explore Probability

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Module: Audience

An undergraduate class studying a unit on probability.

Prerequisite: College Algebra.

Requirements: PC with Windows 2000 or later and appropriate visual analytics software (e.g. Vizit (UVP), GGOBI, R, etc.).
Module: Objectives

- Explore the use of visual analytics to investigate probability.
- Apply visualization tools to real data, so the student can more easily understand fundamental ideas in probability.
- Work with such techniques as scatter plots and parallel coordinates.
- Enable the student to get a hands-on feel for basic concepts in probability.
Module: Attributes

- Three class periods.
- Work with a subset of the Cars1982 Dataset to satisfy probability rules (by hand).
- Explore entire Cars1982 Dataset to discover probability rules (using Vizit).
- Students answer probability questions about the 04Cars Dataset.
Cars1982 Dataset

Visualization in Parallel Coordinates

Note: The 1972 European car that gets 22 MPG
Events / Probability

American Cars with Horsepower over 100
Probability Concepts and Visualization

The Visualization Suggests the Independence of Car type and Year
Probability Concepts and Visualization

The Visualization Suggests the Dependence of Car Type and Horsepower

Selected Records are the Japanese cars with Horsepower > 100
Probability Concepts and Visualization

Independence and Dependence on the same Graph
Other Concepts

Conditional Probability: \( P(A|B) \)

Multiplication Law: \( P(A \cap B) = P(A) \cdot P(B) \) if A and B are independent

Addition Law: \( P(A \cup B) = P(A) + P(B) - P(A \cap B) \)

Event Composition calculating probability using unions, intersections and complements:

Law of Total Probability

Bayes’ Rule
Questions?