Multivariate Conditional Outlier Detection and Its Clinical Application

Charmgil Hong  Milos Hauskrecht

{charmgil, milos}@cs.pitt.edu

Department of Computer Science
University of Pittsburgh
An eye opening survey reported in 2013
Medical errors that correspond to preventable adverse events are estimated to be up to 440k patients each year [James 2013]

(This is the third leading cause of death in America)
We want to develop a **clinical decision support** system that automatically detects erroneous decisions.
Clinical errors do not conform with past decision patterns (outliers)
Statistical outliers in patient care patterns

Cases requiring reconsideration

Data-driven
Our Approach

Electronic Medical Records → Data Modeling → Statistical Model → Outlier Detection → New Clinical Decision
Multivariate, Conditional, & Correlational

E.g., medication order
E.g., medication order

Multivariate, Conditional, & Correlational
Probabilistic model of clinical decision

\[ P(\text{Data} | \text{Modeling}) \]
Our Approach

Electronic Medical Records → Data Modeling → Probabilistic Clinical Decision Model → Outlier Detection → New Clinical Decision
Outlier Detection

Probabilistic model of clinical decision

Clinical decisions that we want to test

Based on model, how those decisions are likely/unlikely?
Outlier Detection

Probabilistic model of clinical decision

Clinical decisions that we want to test

Probabilistic analysis

\[ P(Y_2|X) \]

\[ P(Y_1|X) \]
In the Poster…

• More detailed information
• More precise description
• Preliminary experimental results on real-world clinical data