Application

Yiye Zhang, Carnegie Mellon

Contact Information

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Courses

My major course of study is Information Systems, specifically focusing on the applications of information technology (IT) on healthcare. I have taken a variety of courses on quantitative methods to improve my data analytics skill, and also courses on healthcare to increase my domain knowledge. I am currently in my 4th year, and have completed all required courses in my PhD program. Please see below for the list of courses that I have taken.

Area	Courses
Social Sciences	Microeconomics, Organizational Theory
Quantitative methods	Econometrics, Stochastic Optimization, Continuous Multivariate Analysis, Applied Bayesian Methods, Machine Learning, Process Mining, Linear and Generalized Linear Regression, Probability, Statistical Inference, Categorical Data Analysis, Survival Analysis, Mixed Membership/Longitudinal Models
Technical	Programming in Java, Advanced Database Management
Electives	Computer Application on Healthcare, Health Information Systems, Principles of Epidemiology, Design of Medical Experiment

Research Interests

My research interests have been on the *consumability* of healthcare IT systems components. Specifically, I utilize data analytics and process-mining methods to evaluate the value added from health IT system components on user satisfaction and health outcomes. Another aspect of my research focuses on developing efficient and scalable algorithms for clinical decision support.

Past projects

1. Evaluation of the cognitive and physical cost of using Computerized Provider Order Entry (CPOE) in a pediatric inpatient setting

I explored the interaction of technology and humans in healthcare settings. Specifically, I examined the cost from cognitive and physical workload imposed on healthcare providers by Computerized Provider Order Entry (CPOE). I found that there is overwhelming amount of information, lack of clear summarization of data, and mistrust against health IT systems. To improve order efficiency I developed a

medical order placement algorithm that uses two-stage optimization embedded with clustering algorithm, to be incorporated in hospital's CPOE system.

Related publication and Awards:

- Zhang Y, Padman R, Levin JE. Paving the COWpath: data-driven design of pediatric order sets. Journal of American Medical Informatics Association. 2014 Apr 1.
- Finalist for Student Paper Competition at the 14th World Congress on Health and Biomedical Informatics

2. Practice-based clinical pathway development: exploring the relationship between treatment and outcomes

Retrospectively analyzing patients' clinical and treatment history, I developed efficient and scalable algorithms for mining clinical pathways for chronic conditions from highly granular patient data extracted from Electronic Health Records. Practice-based clinical pathways summarize the common patterns in the actual treatment decisions made by clinicians during their daily management of many patients over many years. The approaches integrate Markov models, clustering algorithms, multi-dimensional similarity metrics and graph visualization methods to cluster patients into distinct types and learn clinical pathways using a 4-year time-series data on chronic kidney disease treatments.

Related publication and Awards:

- Zhang Y, Padman R, Wasserman L. On Learning and Visualizing Practice-based Clinical Pathways for Chronic Kidney Disease. 2014 AMIA Annual Symposium. Washington DC. Nov 2014. (2nd place in Knowledge Discovery and Data Mining Student Paper Competition)
- Best Paper Runner Up Award at the 2nd International Conferences on Big Data and Analytics in Healthcare

Potential thesis topic

Continuing with my 2nd project on clinical pathway development, my thesis research will focus on 1) improving the methods to cluster patients and develop clinical pathways, and 2) evaluating the clinical pathways in terms of health outcomes and cost. As a decision support tool, clinical pathways will be deployed to a web-based platform, to be used for clinicians as practice review tool and for patients as education tool. Further, the medical cost along each clinical pathway will be measured, such that healthcare organizations can use it as cost analysis tool. I hypothesize that, through using clinical pathways, clinicians can minimize care variations and improve care efficiency, and patients can stay informed on their conditions and treatment options. Moreover, health organization can engage in cost reduction through identifying duplicate services, etc. Evaluation of the clinical pathway will be carried out via experiments.