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Will. Power.
Data Analytics for YRBS (Youth Risk Behavior Survey) Data using Machine Learning and Data Mining Techniques

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Computer Science Advisory Board Meeting
May 5, 2017
Overview

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• Research Goal
• YRBSS (CDC)
• YRBS Data Mart (WPU)
• Client/Server Architecture
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Project Description

• An inter-disciplinary research project:
  - Department of Public Health (WPU) – Dr. Corey H. Basch and Dr. Alex Kecojevic
  - Department of Computer Science (WPU) – Dr. Cyril S. Ku and Ms. Ana K. Ocampo (Research Assistant)
  - Department of Health and Behavior Studies (Columbia University) – Dr. Charles E. Basch

• Data Warehouse:
  - YRBSS (Youth Risk Behavior Surveillance System) from CDC (Centers for Disease Control and Prevention)

• Data Analytics Environment at WPU:
  - MySQL Server (YRBS Data Mart)
  - MySQL Workbench
  - R Studio (R Console/RGui)
  - WEKA (Waikato Environment for Knowledge Analysis)
Research Goal

• The goal of the research is to use knowledge discovery approach instead of the traditional statistics-based approach to find interesting or hidden relationships, including anomaly detection and data prediction
  ➢ Collaborate with the Public Health Department (William Paterson) and Health and Behavior Studies (Columbia) on their behavioral research in terms of data collection, analysis, and prediction
  ➢ Correlate the results from statistics and the results from machine learning
YRBSS (CDC)

- Developed in 1990 to monitor priority health risk behaviors that contribute to the leading causes of death, disability, and social problems among youth and young adults in the U.S.
  - Behaviors that contribute to unintentional injuries and violence
  - Sexual behaviors related to unintended pregnancy and sexually transmitted infections, including HIV infection
  - Alcohol and other drug use
  - Tobacco use
  - Unhealthy dietary behaviors
  - Inadequate physical activity
  - Monitors the prevalence of obesity and asthma and other health-related behaviors plus sexual identity and sex of sexual contacts

- From 1991 through 2015, the YRBSS has collected data from more than 3.8 million high school students in more than 1,700 separate surveys
YRBS Data Mart (WPU)

- Aggregated subsets of YRBSS from CDC and survey data from New York City and Pennsylvania
  - New Jersey (2011, 2013)
  - Pennsylvania (2015)
  - Philadelphia (Pending)
Client/Server Architecture

- PA
- CDC YRBSS
- NYC
- WPU YRBS DM

Automated ETL Process (2 Year Cycle) – SQL, R Scripts

Data Mining

Machine Learning

Data Visualization
Preliminary Studies

• Used a subset of the New York dataset (2015)
• Focused on machine learning algorithms to explore relationships and patterns between variables in the dataset
• Performed association mining rule to discover frequent co-occurring associations among variables (focused on two variables: bullied at school, electronic bullying)
• The following slide shows the association scatter plot generated after running the Apriori Algorithm, showing only association rules with confidence > 0.75
**Metrics for Association Rule**

- **Support** – how frequently the items in the rule occur together
- **Confidence** – probability of both the antecedent and the consequent appearing together
  
  *the conditional probability of the consequent given the antecedent*
- **Lift** – strength of a rule over the random co-occurrence of the antecedent and the consequent, given their individual support
Graph for 6 rules

<table>
<thead>
<tr>
<th>antecedent</th>
<th>consequent</th>
<th>support</th>
<th>confidence</th>
<th>lift</th>
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<td>0.040616246</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Example of strong association rules

Graph for 7 rules

- \{sex=F, bullying_at_school=Yes, electronic_bullying=Yes, considered_suicide=Yes\}
- \{electronic_bullying=Yes, sad_or_hopeless=Yes, considered_suicide=Yes\}
- \{sex=F, electronic_bullying=Yes, sad_or_hopeless=Yes, considered_suicide=Yes\}
- \{bullying_at_school=Yes, sad_or_hopeless=Yes, considered_suicide=Yes\}
- \{made_suicide_plan=Yes\}
- \{sex=F, bullying_at_school=Yes, considered_suicide=Yes\}
- \{bullying_at_school=Yes, electronic_bullying=Yes, sad_or_hopeless=Yes, considered_suicide=Yes\}
- \{bullying_at_school=Yes, electronic_bullying=Yes, considered_suicide=Yes\}
Preliminary Studies

- Used classification to indicate if a student is bullied at school based on their race, and their answer from the question of being electronically bullied (yes/no)
- The following decision tree was generated to show the results
Each node shows:
- Predicted class (not bullied or bullied)
- Predicted probability of being bullied
- Percentage of observations in the node
Future Research Plan

• The goal of the research is to use knowledge discovery approach instead of the traditional statistics-based approach to find interesting or hidden relationships, including anomaly detection and data prediction
  ➢ Use various data mining and machine learning (neural network algorithms) techniques of classification, association, and clustering analyses on the YRBS data
  ➢ Summer 2017: extending tanning trending to 2015 using current statistical method; using machine learning algorithm (e.g., decision tree) for prior years to predict and correlate 2015 results; establish criteria to predict future tanning trending
Acknowledgement

• This research was supported in part by the ART (Assigned Released Time for Research) program, Office of the Provost; and in part by the Student Research Funds of the College of Science and Health, William Paterson University.
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