Rensselaer

Predicting Hospital Utilization Rates as a Function of Socio-Demographic Factors

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OPTUM Labs™

deFacto PERFORMANCE MANAGEMENT
THE NEW STANDARD

Background & Objectives

For some

- Hospitals efficiently used
- Patients efficiently treated
- Greater access
- Updated facilities

…for others

- Hospitals INefficiently used
- Patients INefficiently treated
- Limited access
- Legacy facilities

Socioeconomic Status ⟷ **Hospital Utilization**

Model Output – Health care resources in hospitals

Three main character resources in a hospital:

- Inpatient
  - Short term
  - Long term
- Outpatient
  - Lab analysis
  - Imaging
  - ER
- Operating rooms
  - Surgery

Model Output – effective utilization rate of medical resources

- **Inpatient**

$$\frac{\text{\# Inpatient days}}{\text{(\# Beds x 365)}}$$

- **Outpatient**

$$\frac{\text{\# Outpatient Visits}}{\text{(\# Doctors x 365)}}$$

- **Operating rooms**

$$\frac{\text{\# Surgeries(In/Outpatient)}}{\text{(\# Surgery Rooms x 365)}}$$

Utilization

Model Input

Population

- Age, Gender, Race
- Cause of Death
- Government Assistance
- Insurance Access

Household

Utilization

- Employment Rate
- Education Level
- Local Industry

Workforce

Education

437 dim input

Combined Random Forest

Inpatient

Outpatient

OR

Utilization

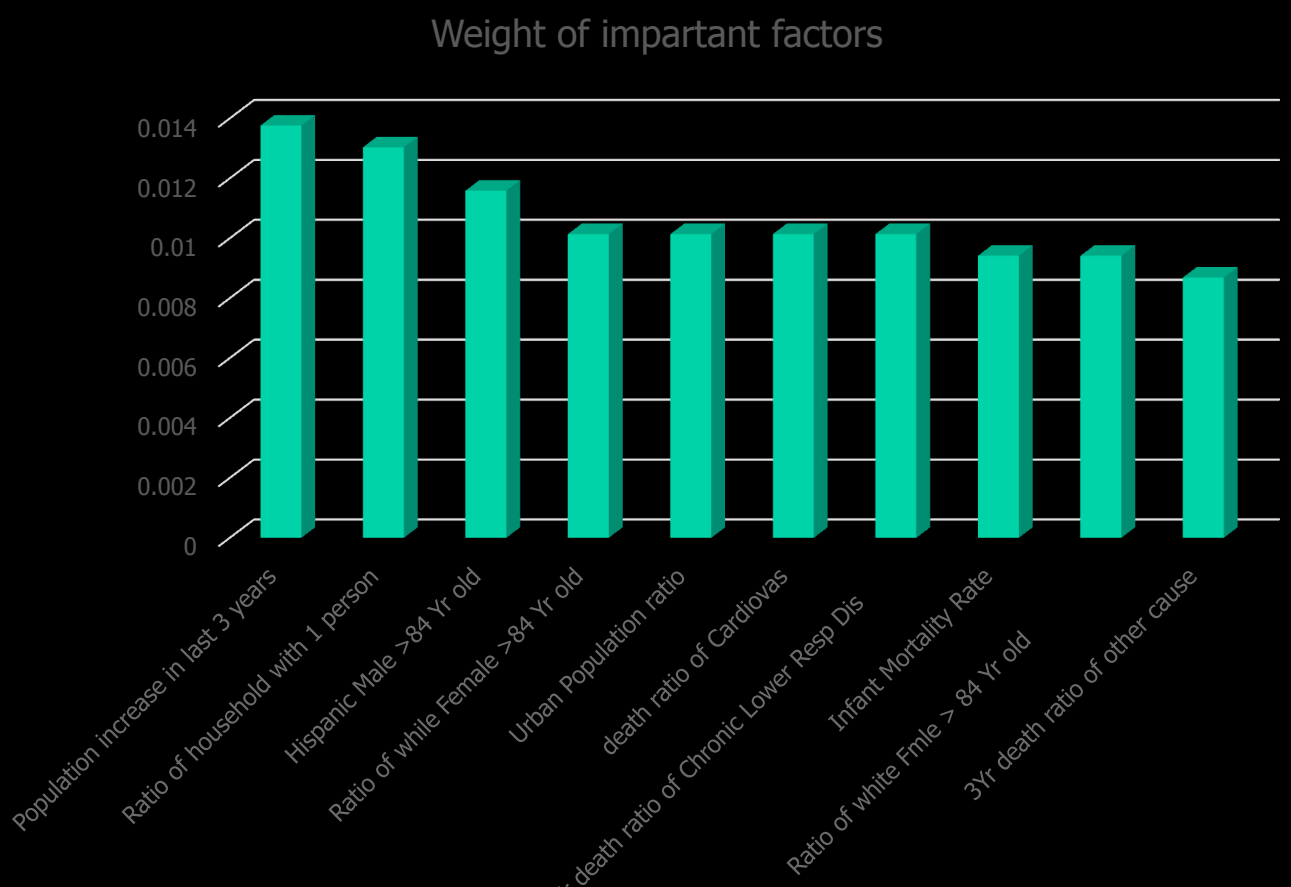
3 Random Forests using XGBoost

Results

- **Model fit:**

Inpatient Training R^2: 0.76	**Test R^2: 0.43**
Outpatient Training R^2: 0.48	**Test R^2: 0.03**
OR Training R^2: 0.59	**Test R^2: 0.26**
Combined R^2: 0.75	**Test R^2: 0.26**

Results


Weight of impartant factors
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
Population increase in last 3 years
Ratio of household with 1 person
Hispanic Male >84 Yr old
Ratio of while Female >84 Yr old
Urban Population ratio
death ratio of Cardiovas
3Yr death ratio of Chronic Lower Resp Dis
Infant Mortality Rate
Ratio of white Fmle > 84 Yr old
3Yr death ratio of other cause

Results

- Unimportant Features
  - White Non-Hispanic Female 60-64
  - Non-White 5 yr Infant Mortality Rate
  - 3-Yr White Male Infant Death
  - 3-Yr White Female Infant Death
  - 3 Yr Black Male Infant Death
  - National Hawaiian Male 75-84 Pop

Thank You!

QUESTIONS?