Use of the Kernel Support Vector Machine for Prediction of Need for Admission and Time for Disposition among Simulated Emergency Department Patients from the SurgeSim Simulation Database
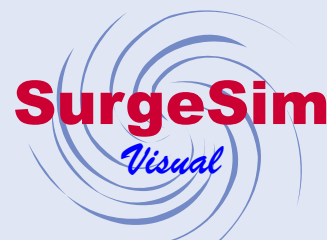
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MedStatStudio

SurgeSim
Visual

emdm

Conflict of Interest

- Simulation Software used in the study (SurgeSim®) is a commercial product owned entirely by the presenter.

- No external funding

- No other conflicts

Introduction

- In times of disaster Emergency Departments need increased surge capacity

- Accurate Predictions of patient flow may be helpful

- Traditional methods based on Triage score are rudimentary

- Computerized machine learning may offer a more precise method

Methods

- Present study investigates two response variables:
  - Need for admission
  - Time to disposition decision
- Compares two types of predictors
  - Simple Predictor based on triage code
  - Machine Learning:
    - Kernel support vector classifier (admission)
    - Kernel support vector regression (disposition time)
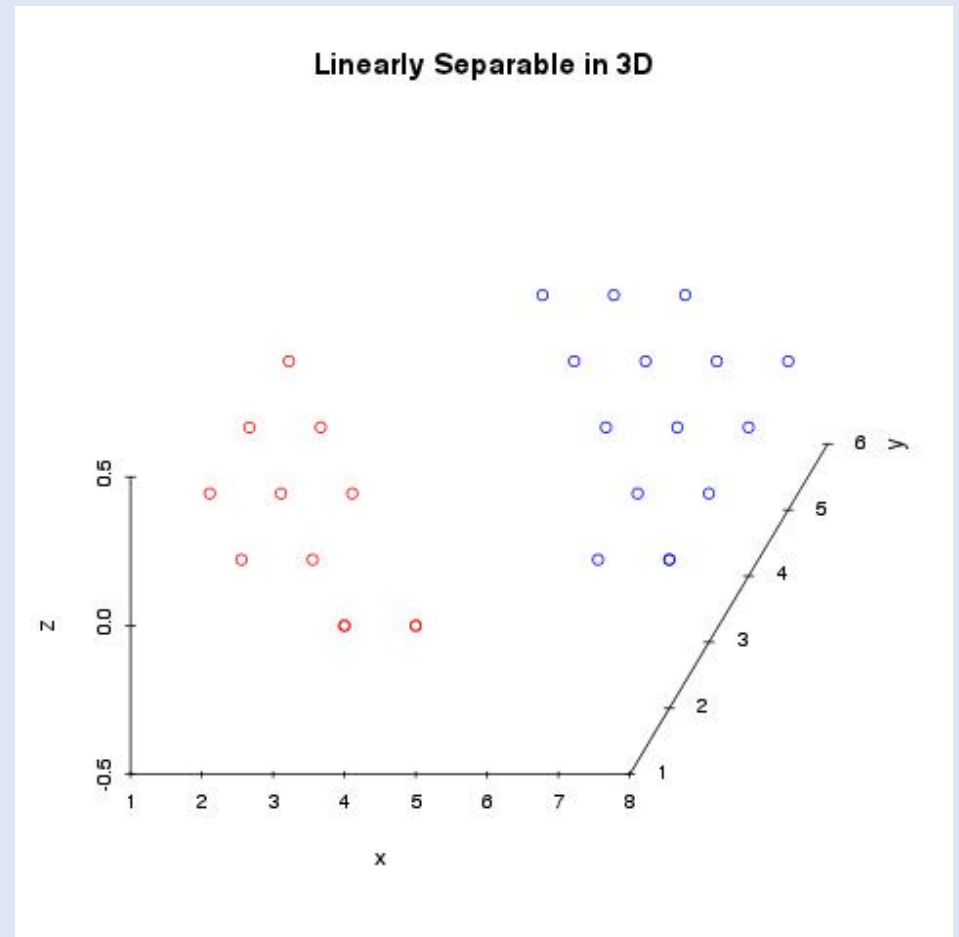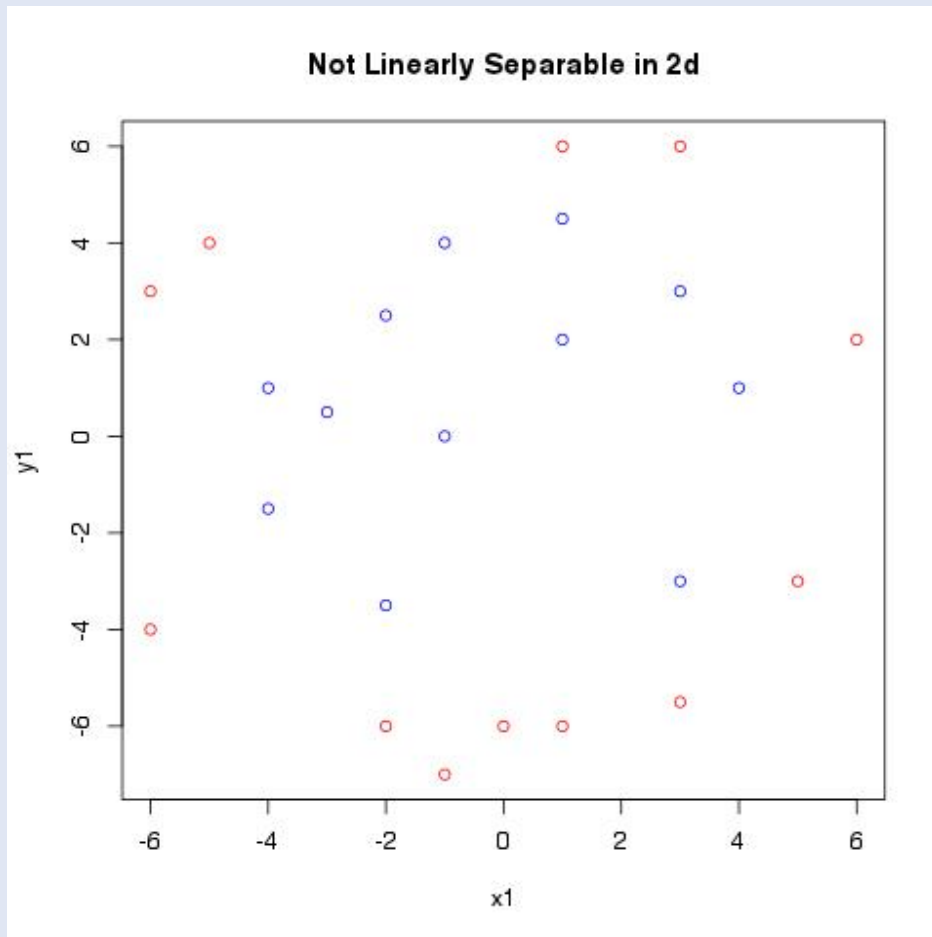
Methods: Data

Data from previous
  simulations
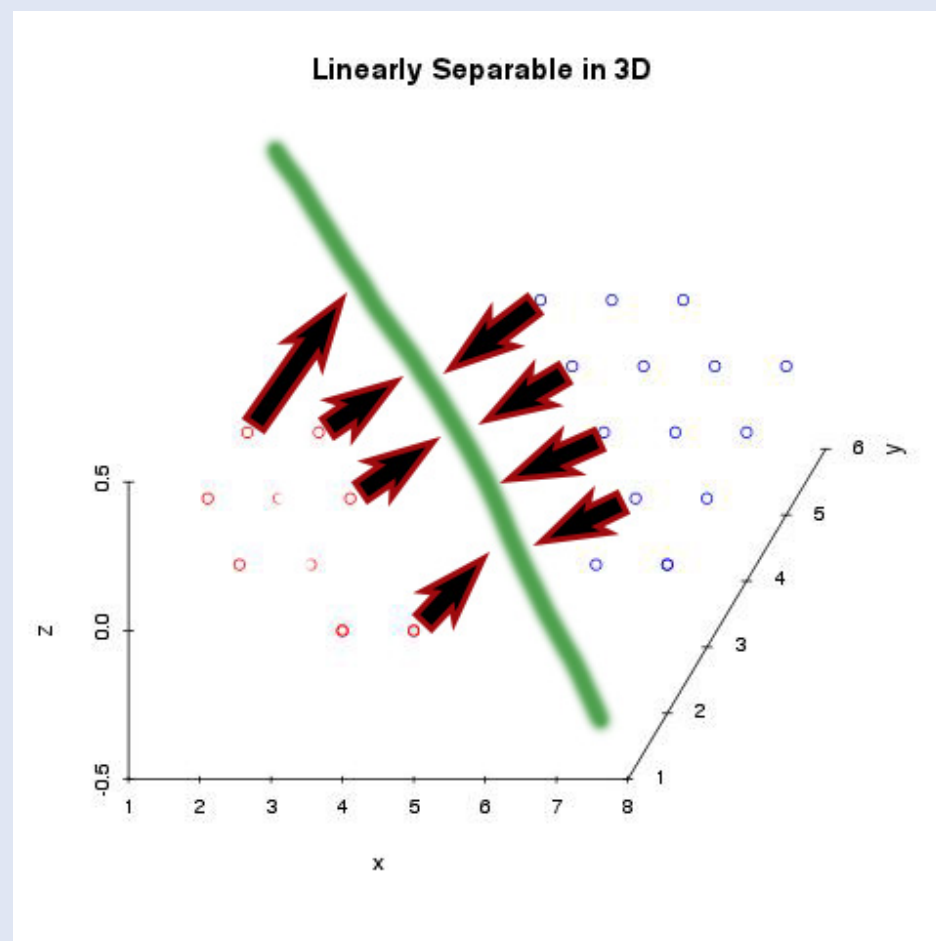
Over 60 simulations

Over 6000 simulated
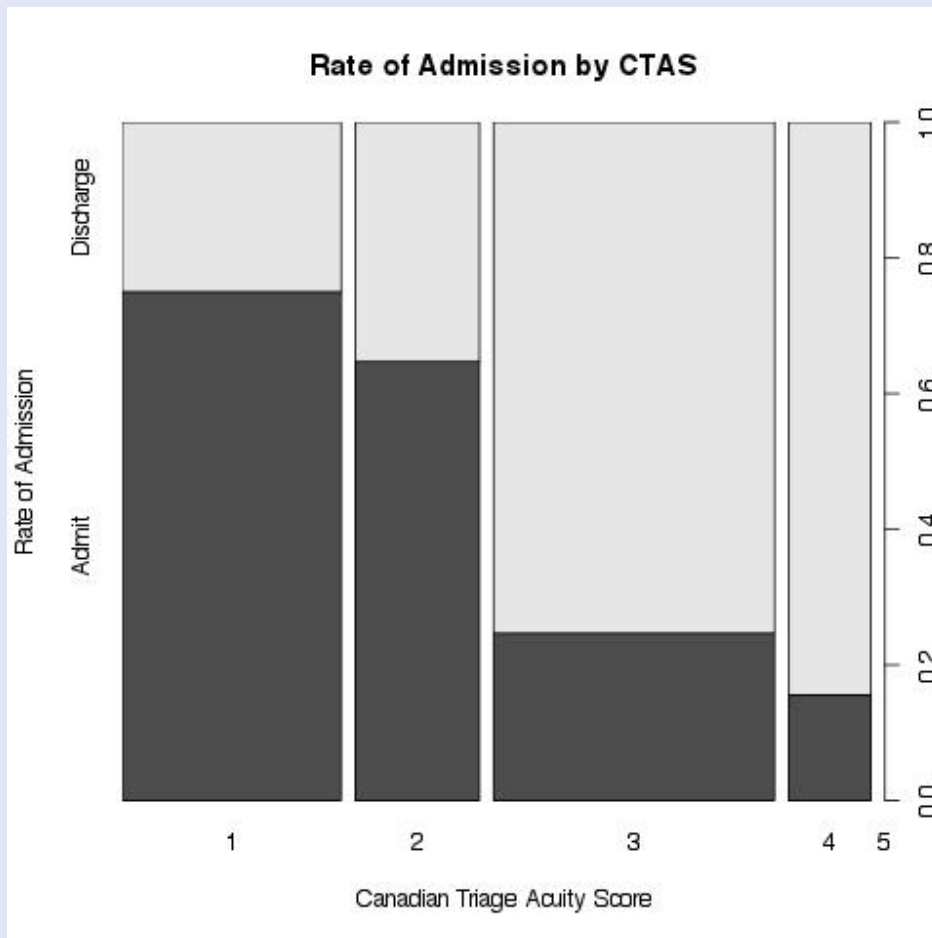 patients

Methods: Kernel

$$K x, x' = ((x, x') + \delta \quad) p$$

Methods: Support Vector

- 6887 Observations (Rows)

- 66 Predictors (Columns)

- 5887 derivation + 1000 Test

- SVM uses only nearest observations to draw line, the rest are used for error

Linearly Separable in 3D
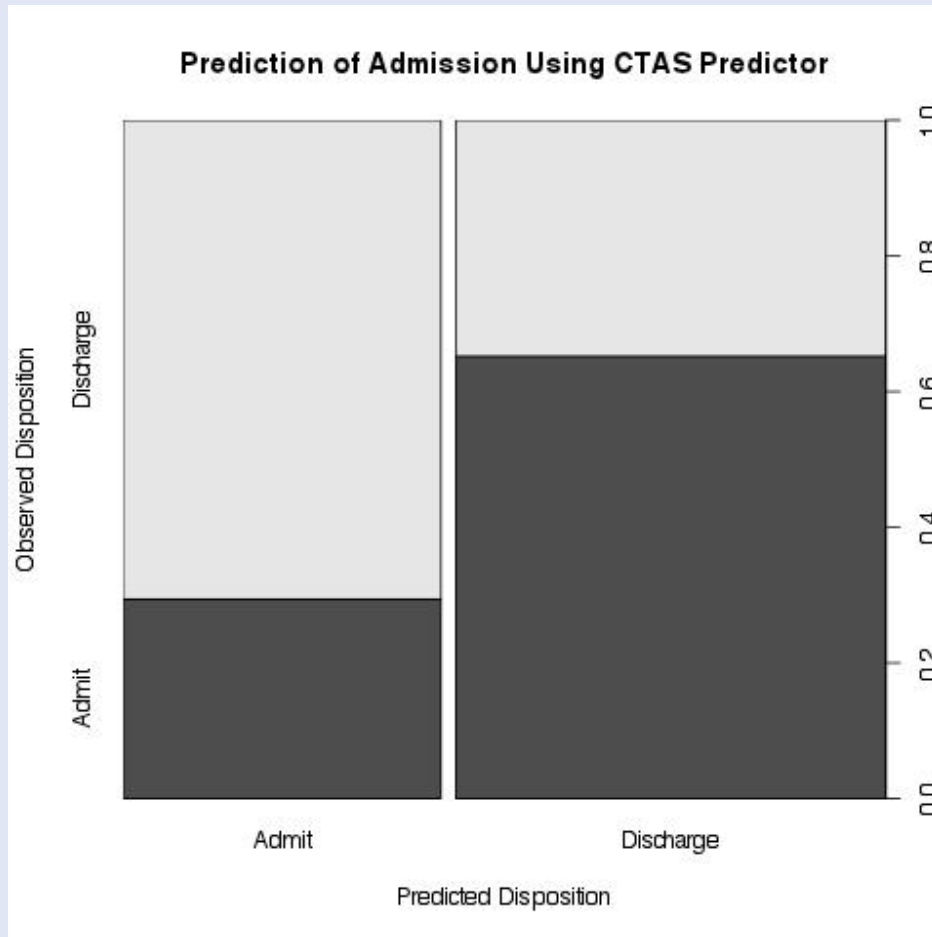
Results: Admission

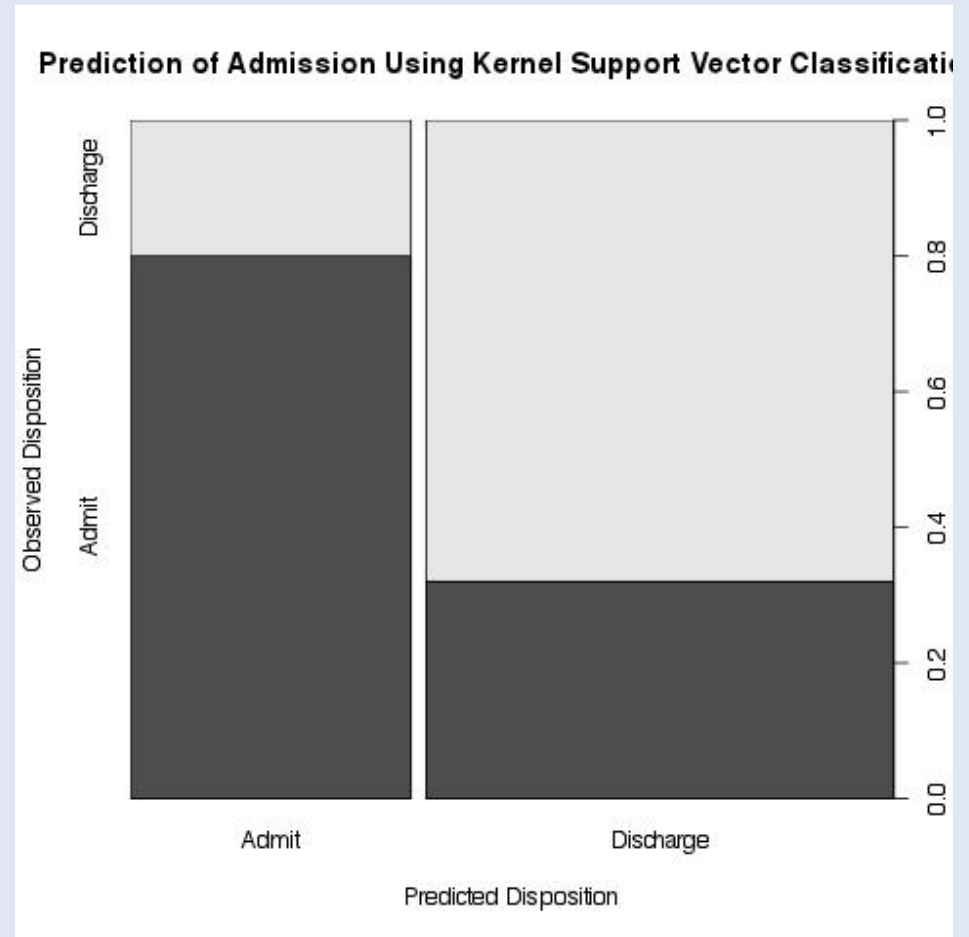

Simple Classifier:

CTAS 1 or 2: ADMIT

CTAS 3 or 4: DISCHARGE

Results: Admission Predictors
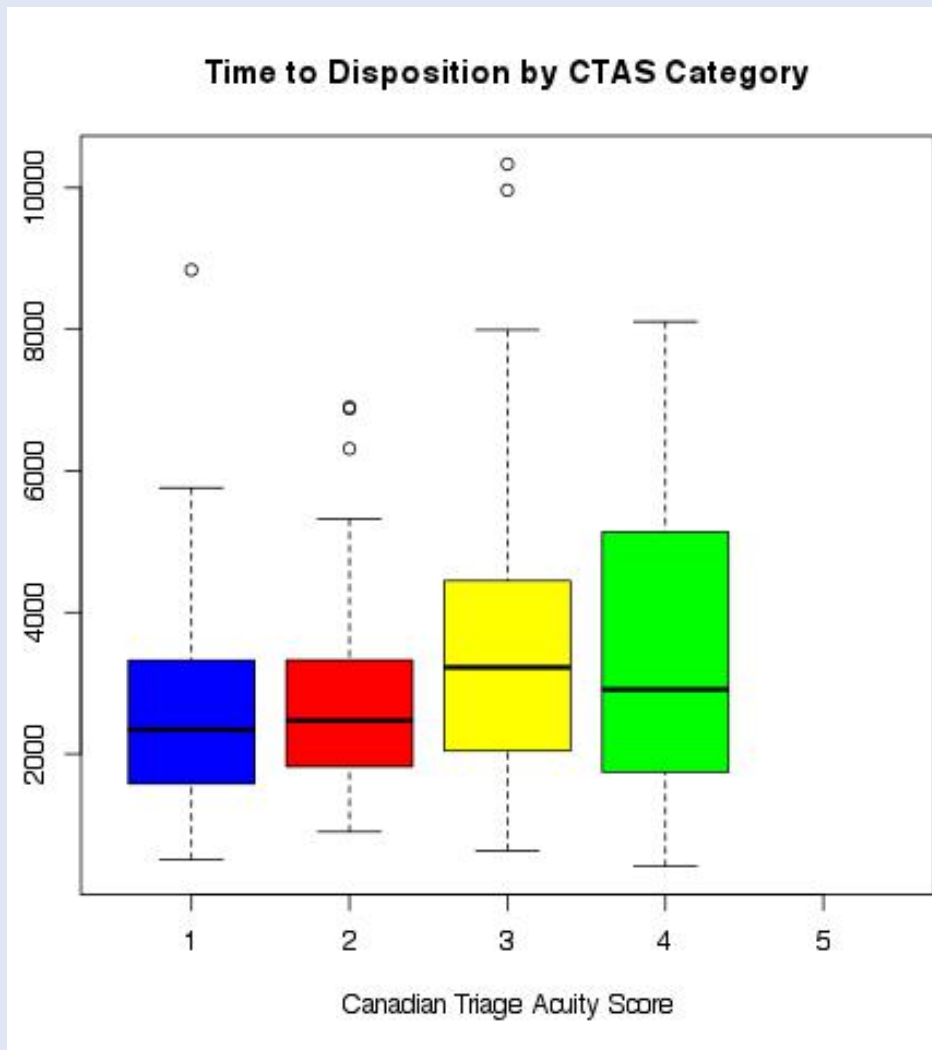

Overall Accuracy: 0.325
Recall: 0.25
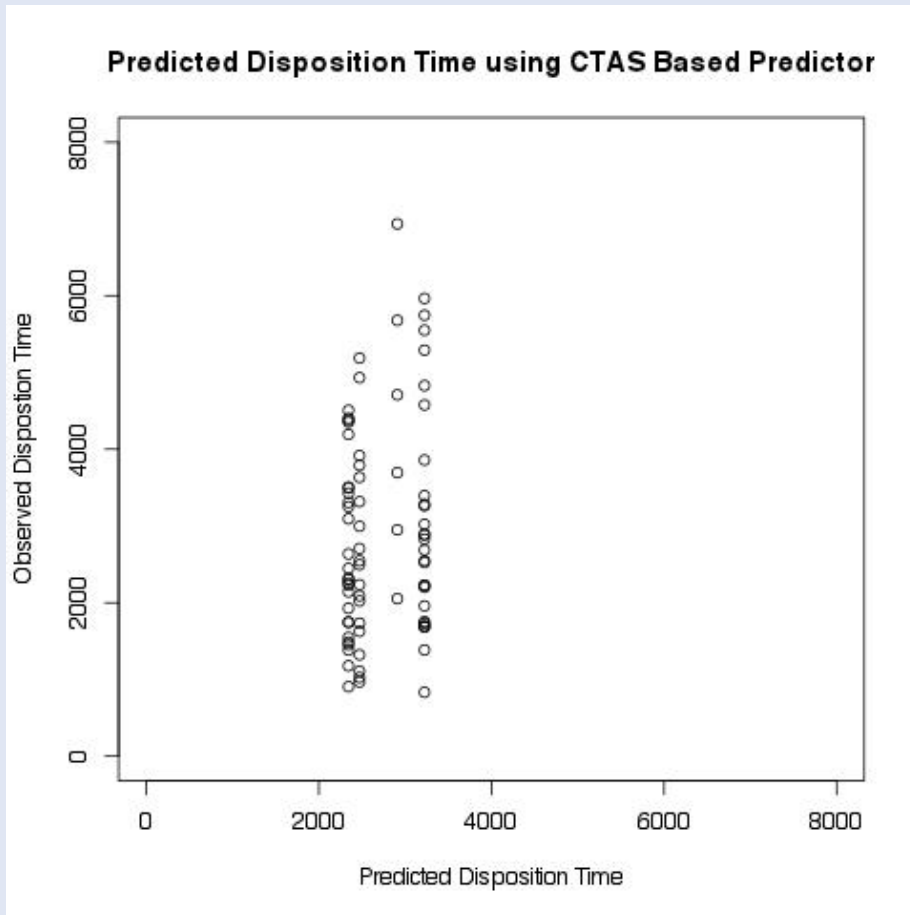
Overall Accuracy: 0.725
Recall: 0.6

Results:
Simple Disposition Time Rule
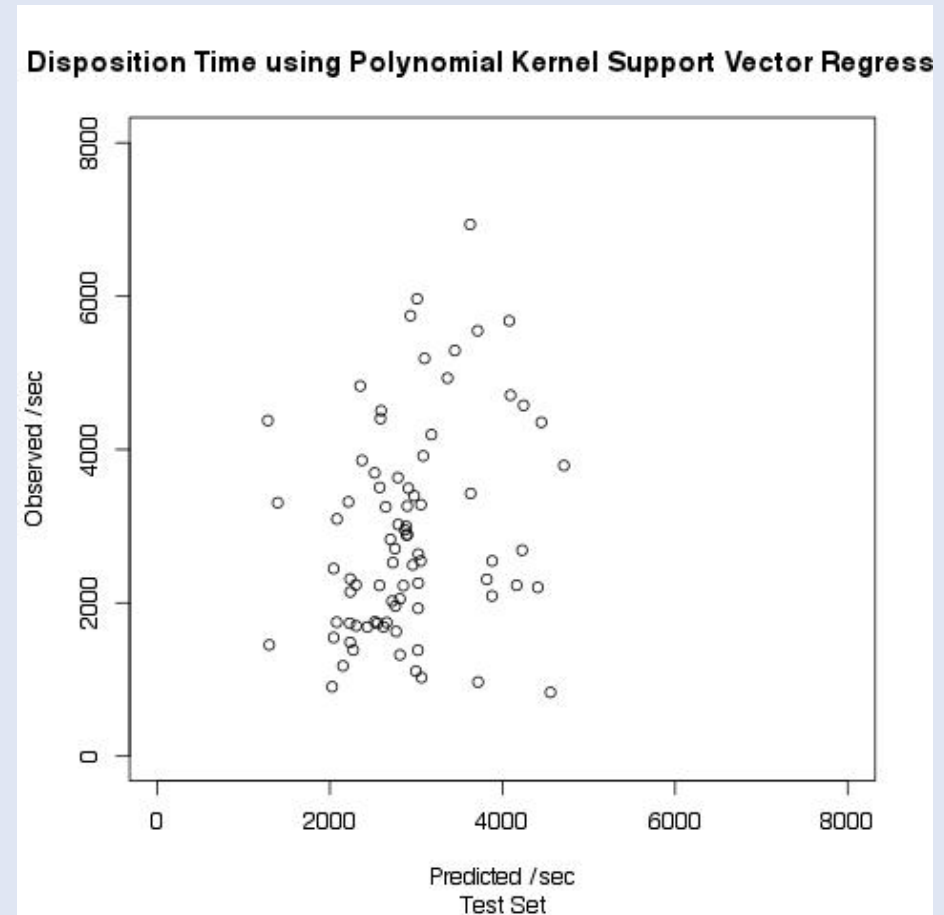

Time to Disposition by CTAS Category
Canadian Triage Acuity Score

- Considerable overlap in disposition times

- May explain why Triage predictors may be inaccurate

CTAS	Predicted Disposition /s
1	2344
2	2472
3	3224
4	2910
5	N/A

Results:
Disposition Time

P<0.13
Correlation: 0.17

P<0.03
Correlation: 0.25

Limitations

- Patient data based on simulation
- Although superior, KSVM does not account for all variability
- Cannot interpret the parameters
  - (Limitation of Machine Learning Methods)
  - Requires electronic data to use in real time

Conclusions

- Prediction rules for need for admission and time to disposition decision based on the kernel support vector machine appear to be superior to simple decision rules based on triage code

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