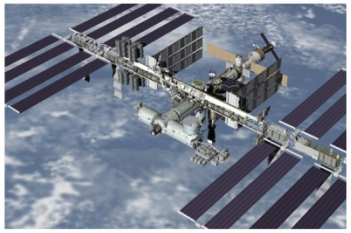
KBRwyle

We Deliver



ZERO HARM 24/7

courage to care

Using Machine Learning to Model Satellite Behavior

Kim Cates

February 27th, 2019

Background

Experience:

- Machine Learning Intern at KBRwyle
- Undergraduate experience in applied research

Education:

- M.S. in Data Analytics at Seton Hall University
  - Background in cognitive neuroscience

Project Summary

Machine Learning (ML) Models:

- Classification models ➔ satellite stability
- Clustering models ➔ characterize movement
- Recurrent neural network ➔ model patterns in mean motion

Project Summary

ML Model Type	Satellite Variables	Models
Supervised Classification	Predictors (x): Visual magnitude (Mv) variance, Mv amplitude, Mv frequency Target (y): stability, rotating or not rotating	Decision trees, random forest, logistic regression, support vector machines (linear, gaussian, and sigmoid kernels)
Unsupervised Clustering	Longitude, latitude, time (hour)	Hierarchical agglomerative clustering, k-means clustering, and density-based spatial clustering with noise (DBSCAN)
Recurrent Neural Networks	Mean motion	Long-short term memory (LSTM)

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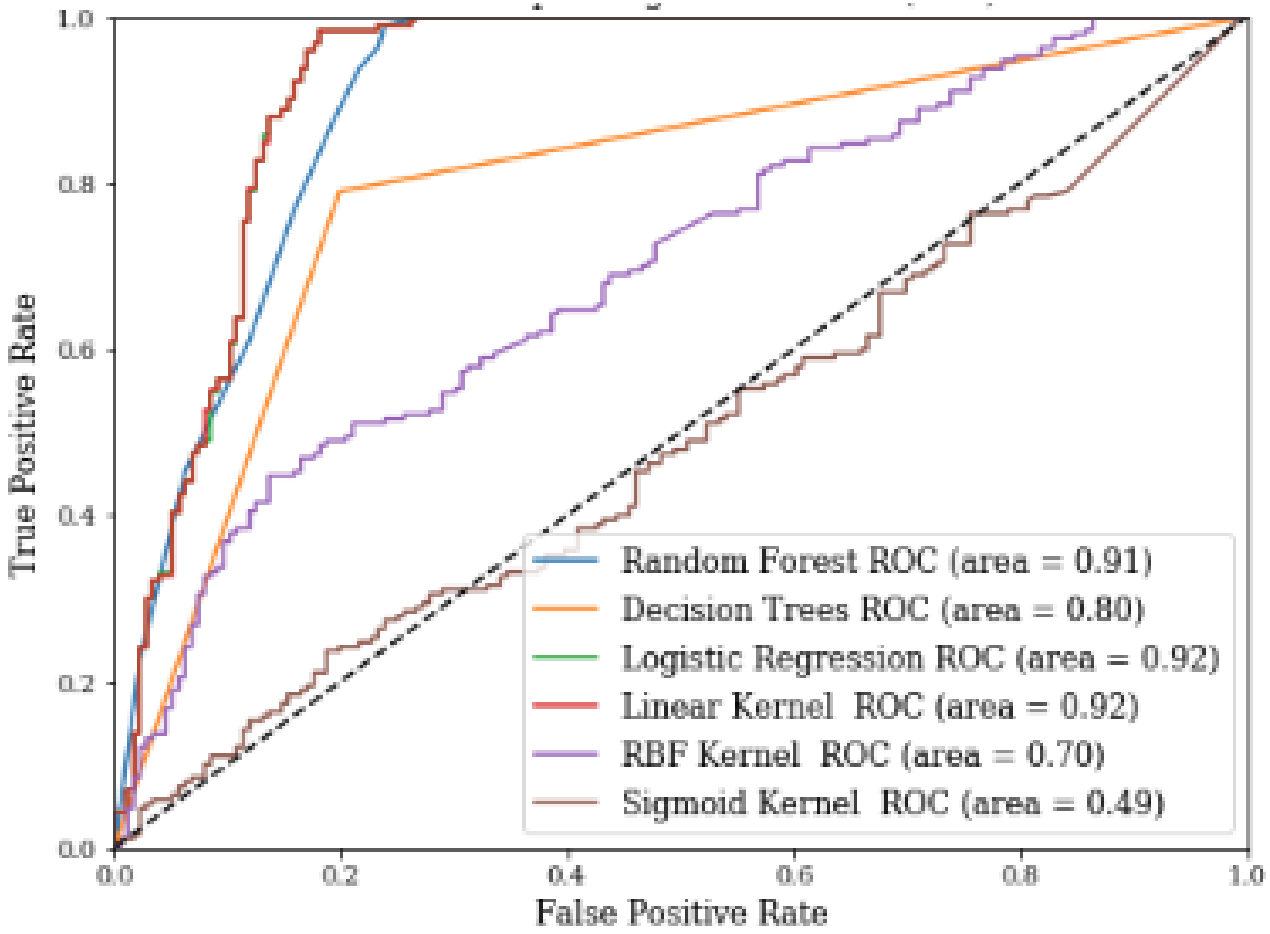
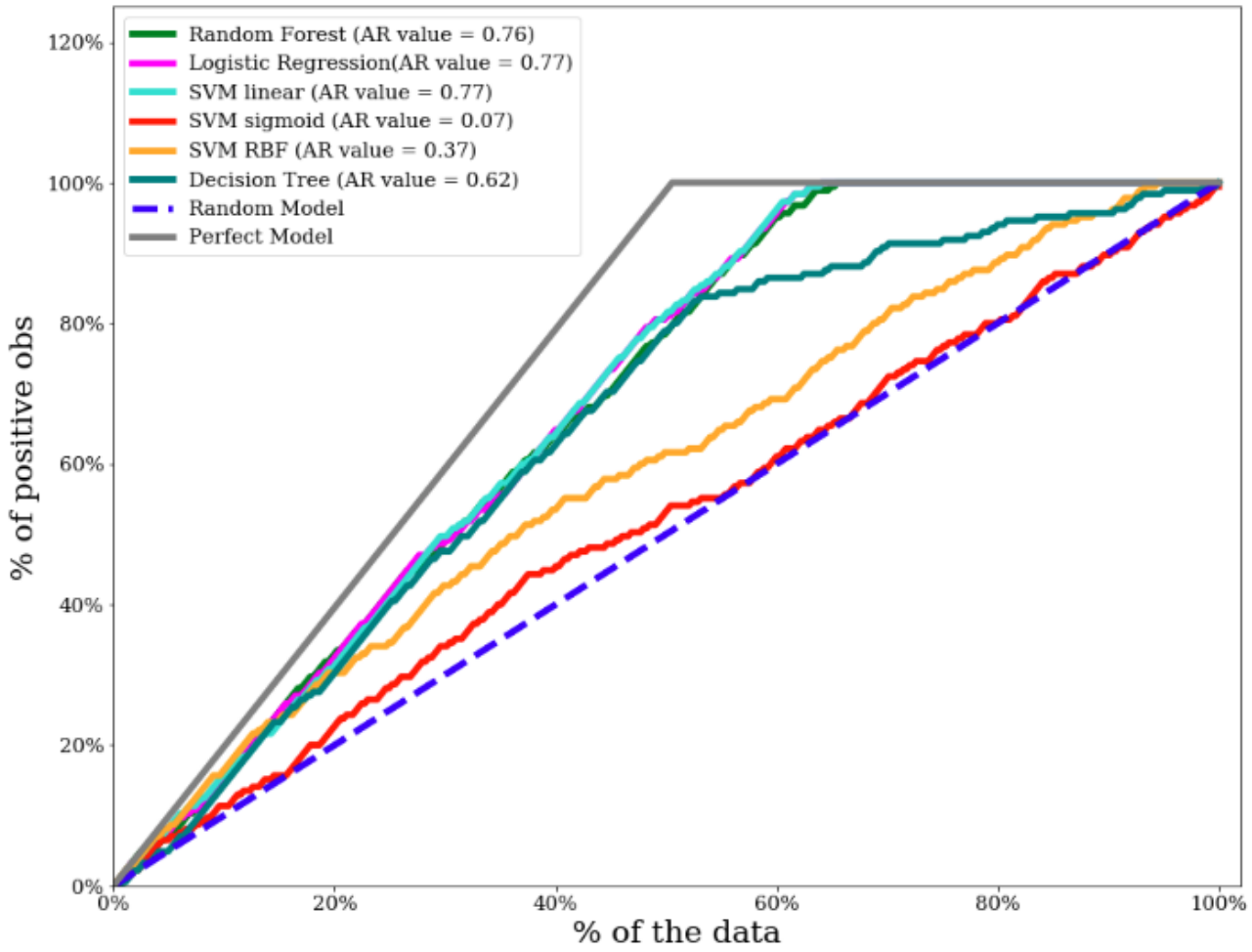
Classification Results

Receiver Operating Characteristic (ROC) Curve Results

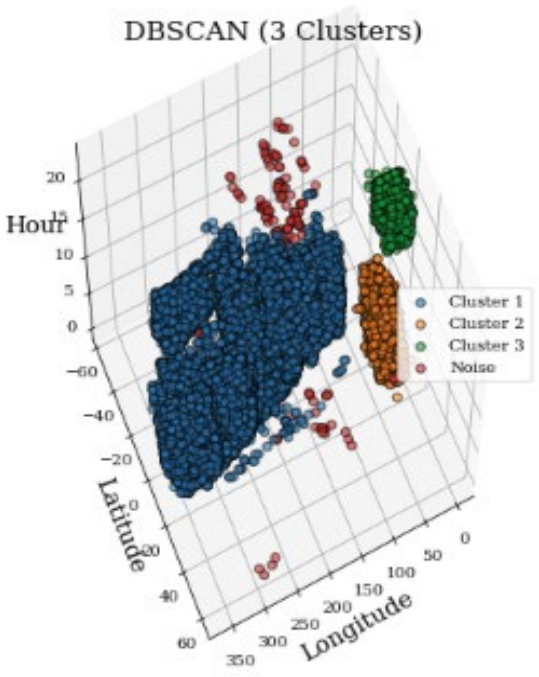


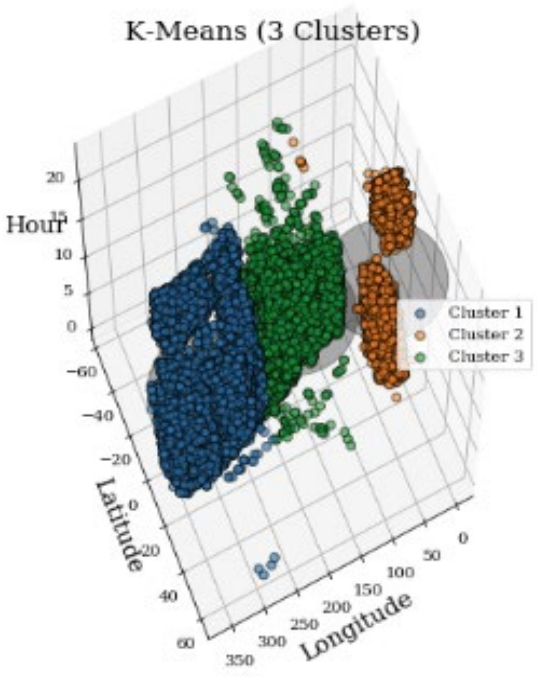
Classification Results

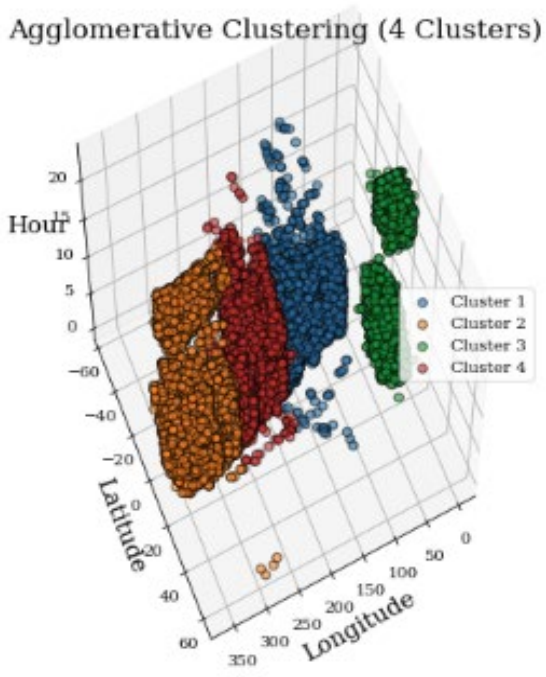
Cumulative Accuracy Profile (CAP) Curve Results



Clustering Results

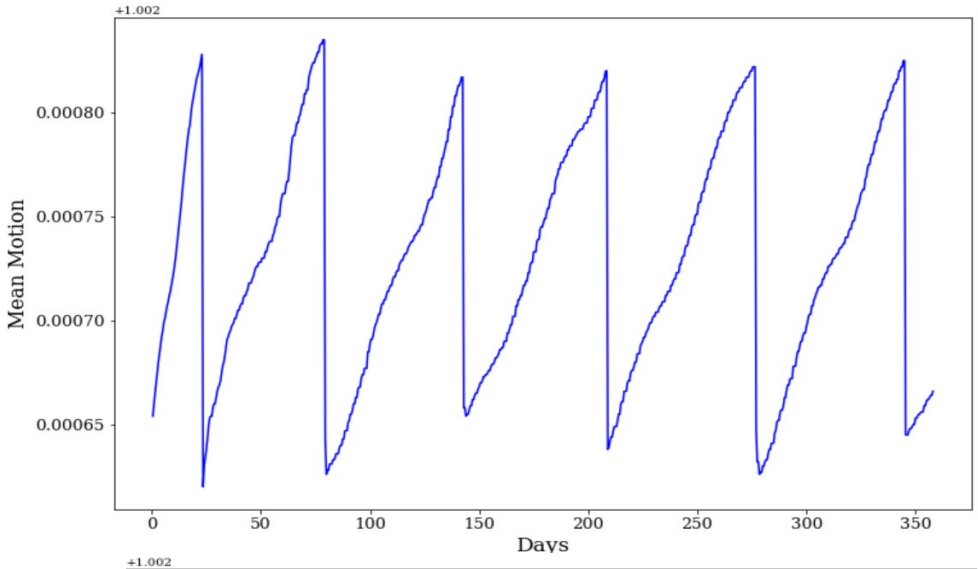




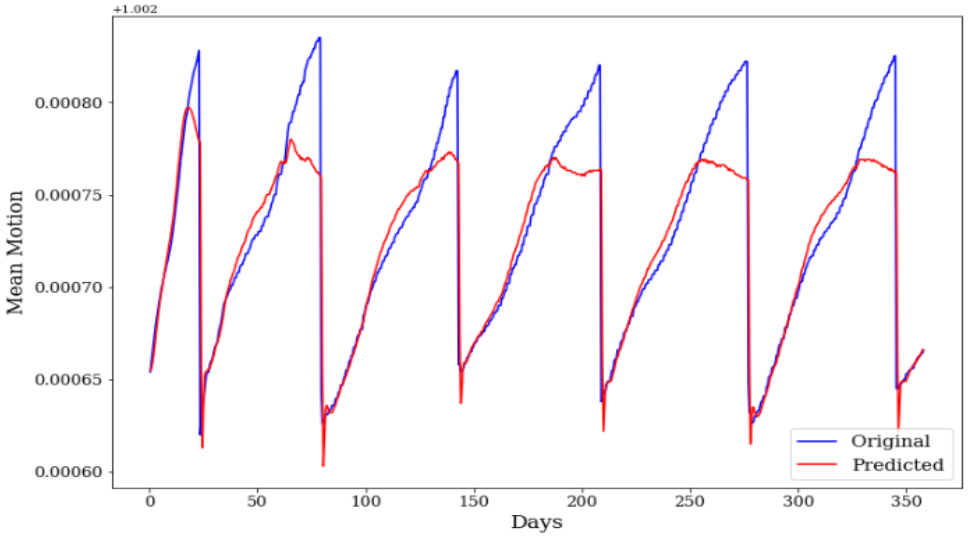


LSTM Results

Actual ➔



Predicted ➔



Professional Development

Topic	Challenges	Benefits
Collaboration	Communication	Exposure to novel approaches; teamwork
Constructive Feedback	Discouragement	Improve areas of weakness; resilience
Setbacks	Frustration	Trouble shooting future problems
Advisor Relationships	Patience	Networking; future colleagues

Questions