Predicting Tenant Churn

For Property Management

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Credentials:

- Data Scientist with 20 + years of IT consulting experience.
- Holds an Engineering degree and and MBA.
- Experience in handling data analysis for multi-billion dollar capital development projects
  - Burj Khalifa tower in Dubai
  - Pentagon Renovation project, Arlington Virginia.

Agenda

- Problem Statement
- Bird's eye view
- Market overview
- Findings
  - Data overview - EDA
  - Feature Engineering
  - Model evaluation
- Conclusions and recommendations

Problem Statement

Business Objective

To help Property Managers run their business effectively by predicting whether a Tenant is Churned or a Non-Churned tenant.

Challenges

With the thin margins and lots of pro-tenant regulations in place Property Management companies need to have a clear insights on the expected vacancy (tenant churn) to plan their cash flow

Desired Outcome

- Use date from Property Management System to engineer data
- Train the models to predict Churned Tenant.
- Evaluate the model using Accuracy as the criteria

Property Management - Stats

The property management industry is extremely lucrative and is becoming more and more popular with the rise of renters. Let's take a look at some of the top statistics from 2018 below.

280K+

total property management companies in US

$76B+

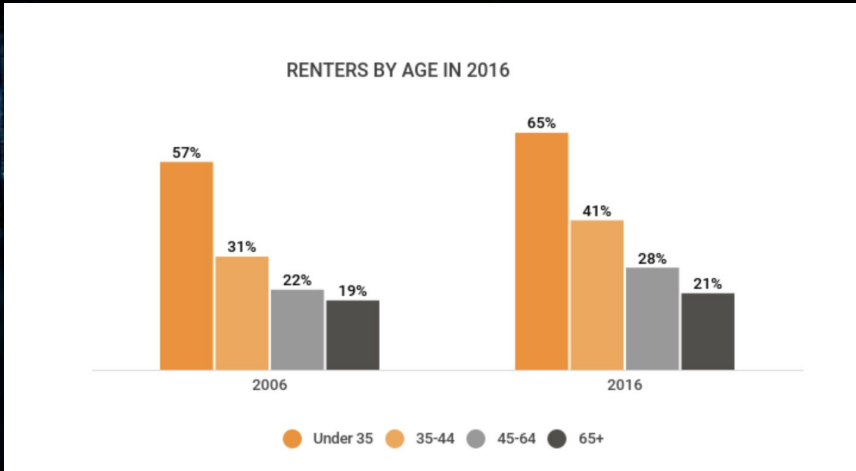
property management industry revenue

13%

percentage of US GDP made up by real estate

67%

percentage of US renters aged 35 and under



- **Property management is a multi-billion dollar industry, with plenty of growth opportunities for those companies that are willing to dive head-first into technology and embrace the Millennial market.**

- **With renting at a high not seen in decades, and demand up due to lower inventory, the property management industry is expected to continue to grow for the next several years.**

- New innovations in technology, including the use of AI to increase availability and efficiency are streamlining the industry like never before, making it easier to take care of client needs, and keep property owners up-to-date on the day-to-day operations of their properties.

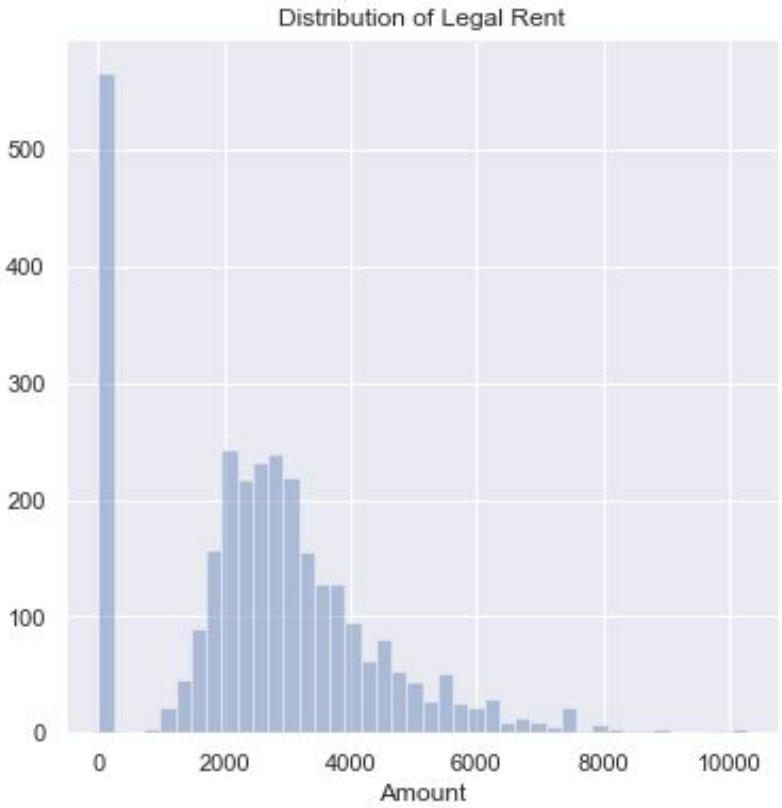
- All signs point to it being a good time to be a property manager.

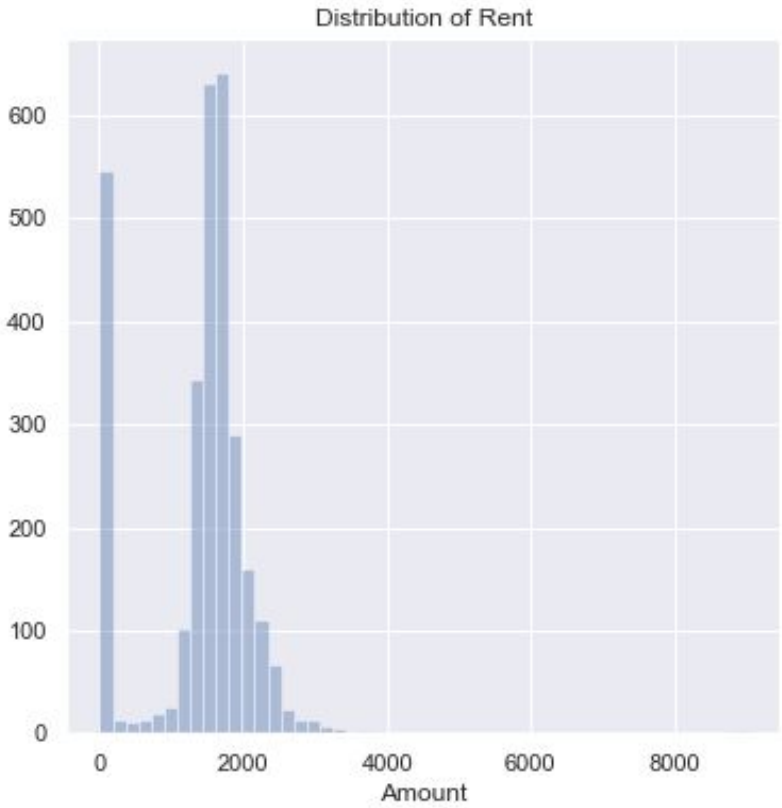
Birds eye view

Qualitative data 1	• Real Estate Data sets ▪ Resident history from Property Management System
Qualitative data 2	• Time scale ○ Five years of Resident data
Qualitative data 3	• Baseline Score ○ 0.67
Qualitative data 4	• Models / Classifiers Explored ○ Logistic Reg, Random Frst, Extra trees.

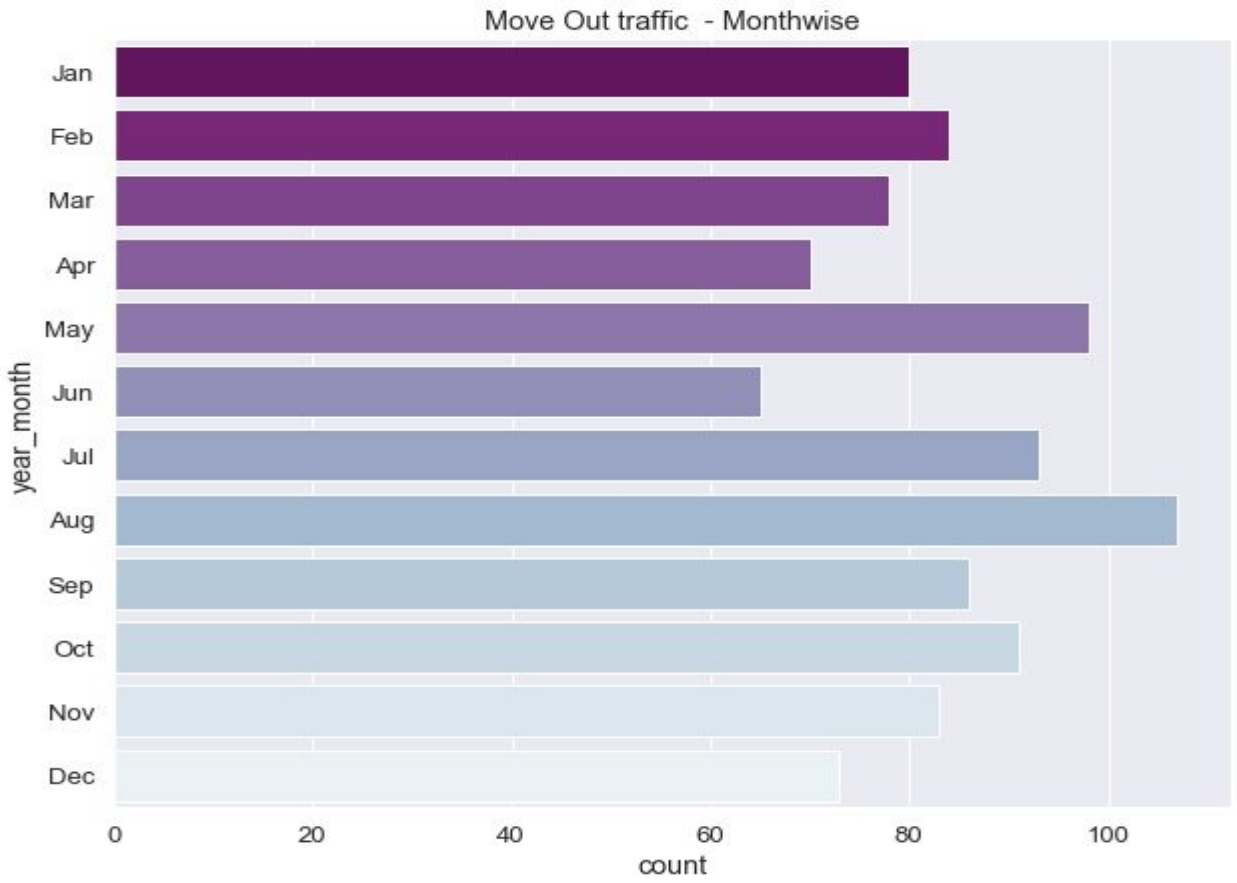
Data Overview - EDA

EDA - Rent fields





EDA - Move-Out Monthwise



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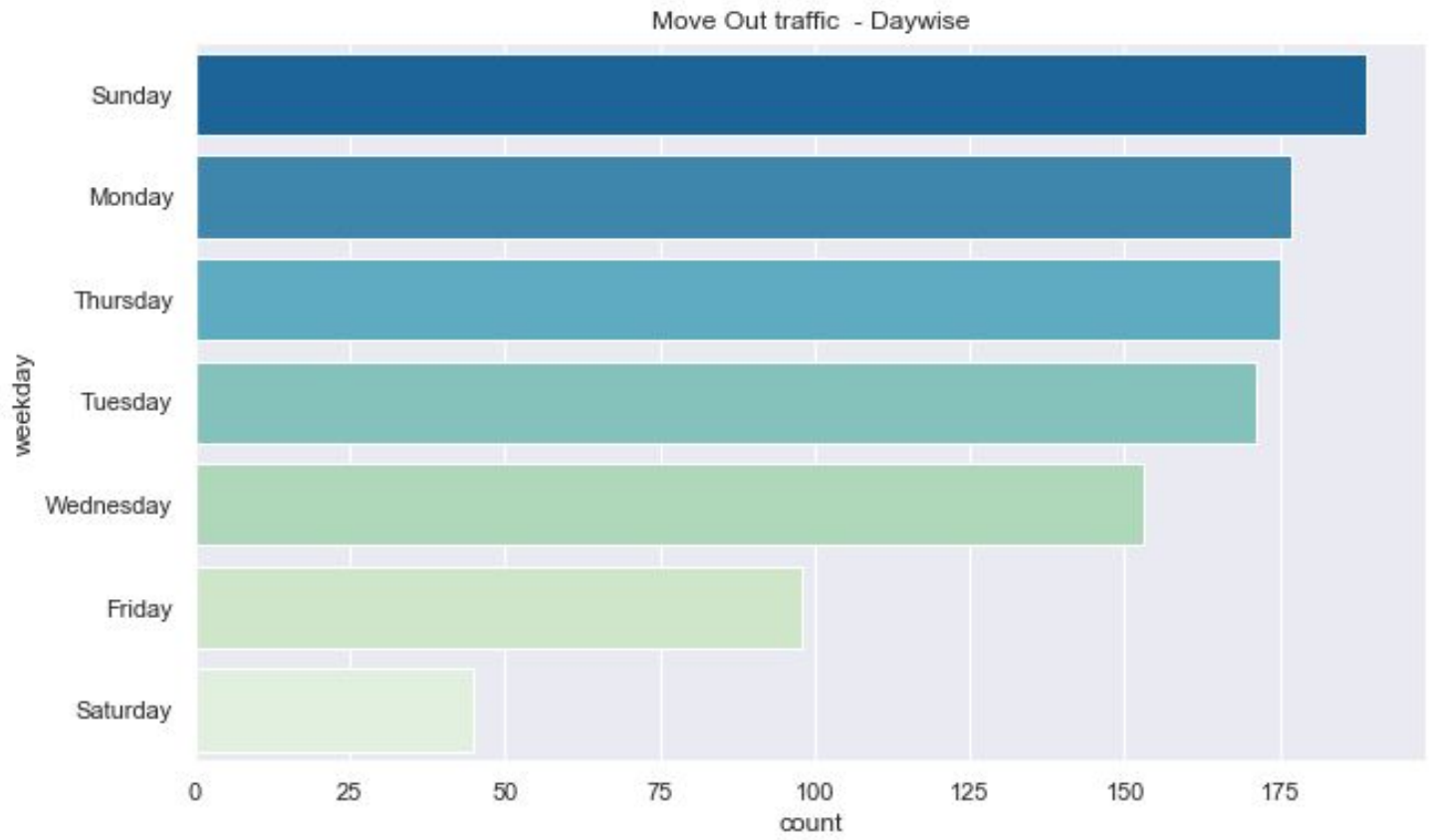
Monthwise Moveout Traffic Graph Interpretation

Traffic Graph shows that most of the traffic happens during Summer months (May, Jul, Aug, Oct). I have also noticed noticed that the traffic is more just after the beginning of School Holidays and picks up just before School start month.

EDA - Move-Out Day-wise



Daywise Moveout Traffic Graph Interpretation

The above graph of Daywise Moveout Traffic Graph shows that most of the traffic happens mostly during Sunday & Mondays.

Model Evaluation

Criteria :

- Main Metric - Testing Accuracy
  - Confusion Matrix
  - ROC with AUC curve
  - Model coefficients

Model Performance - overview

Model	Train Score	Test Score
Base Line	0.78	
Logistic Regression	0.78	0.77
Decision Tree	1.0	0.90
Random Frst.	1.0	0.90
Extra trees	1.0	0.90
Voting clsfr.	0.99	0.87

Model Evaluation

Extra trees model produced

0.90

accuracy score - better than other machine models.

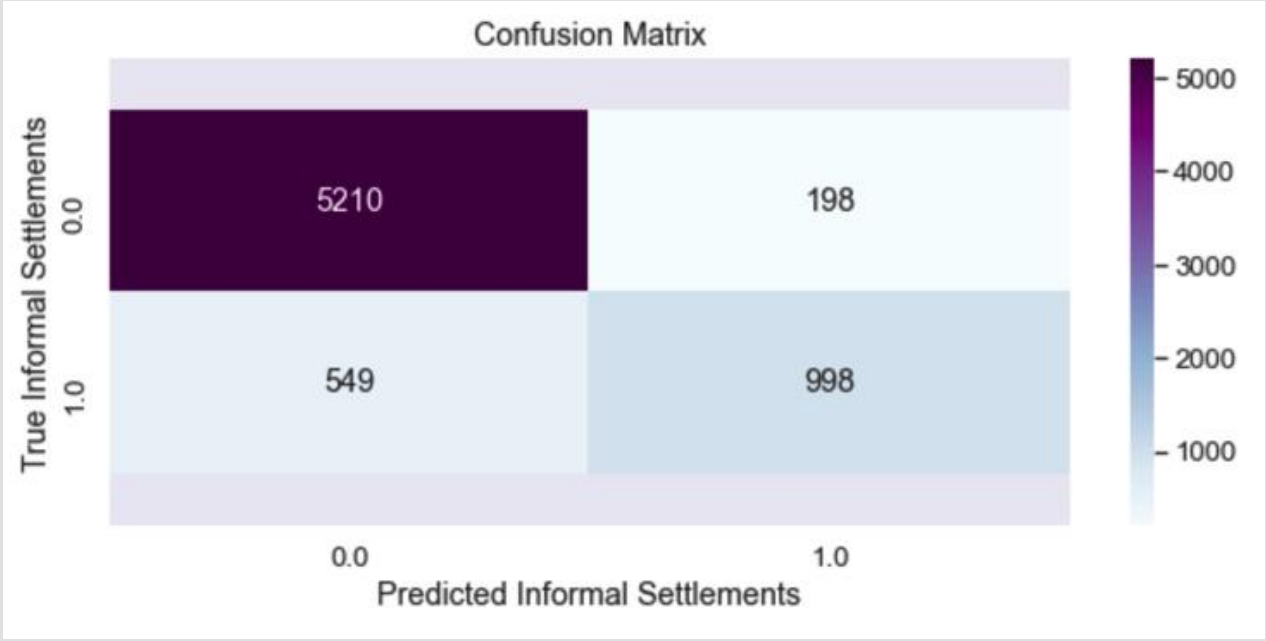
Model Evaluation - Confusion Matrix

- Accuracy = 0.90

- TPR % 83.6%
(TPR=TP/(TP+FN))

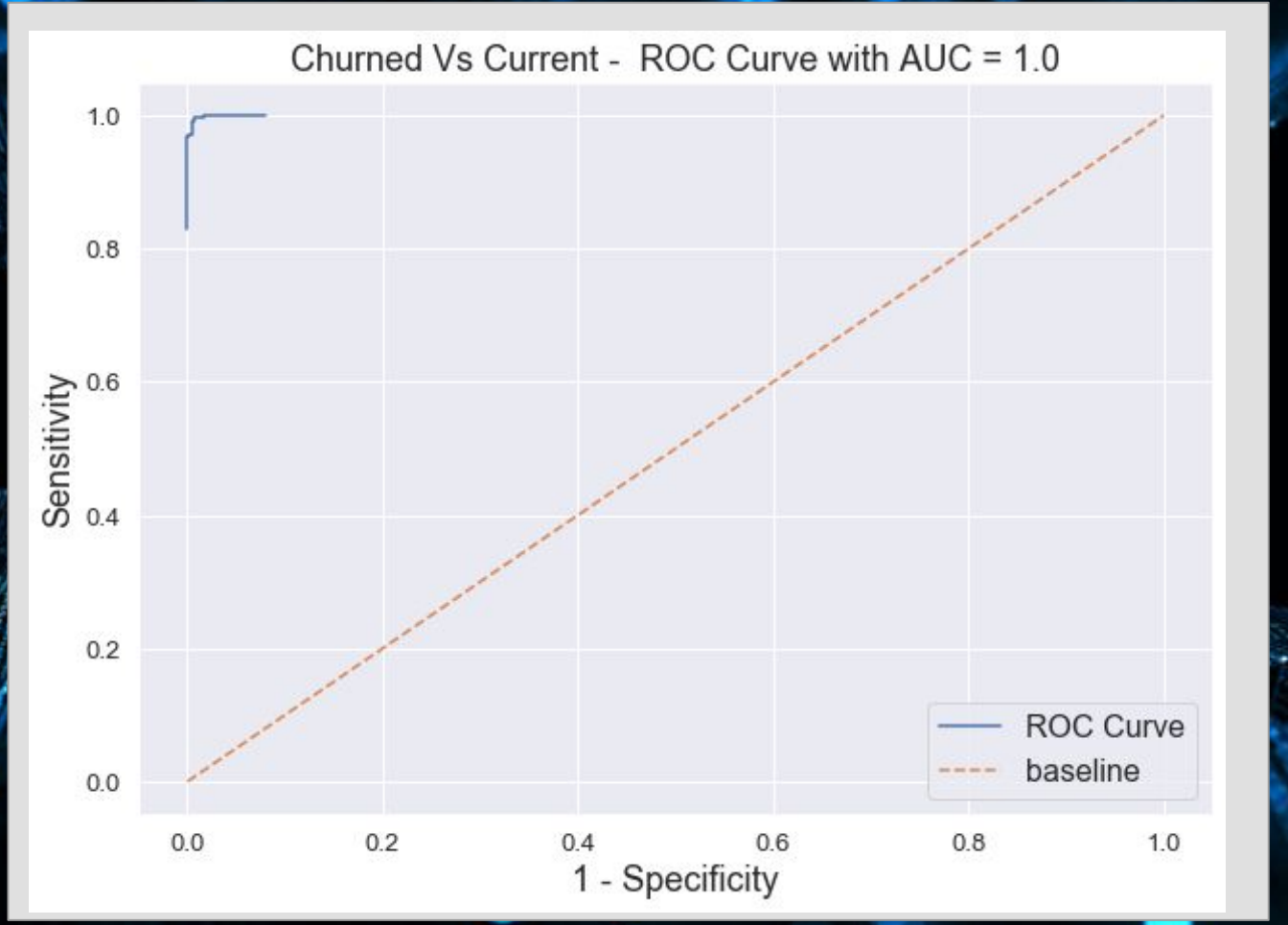
- TNR% 90.9%
(*TNR=TN/(FP+TN)*
)

https://predictfavelas.github.io/kumar_predictions

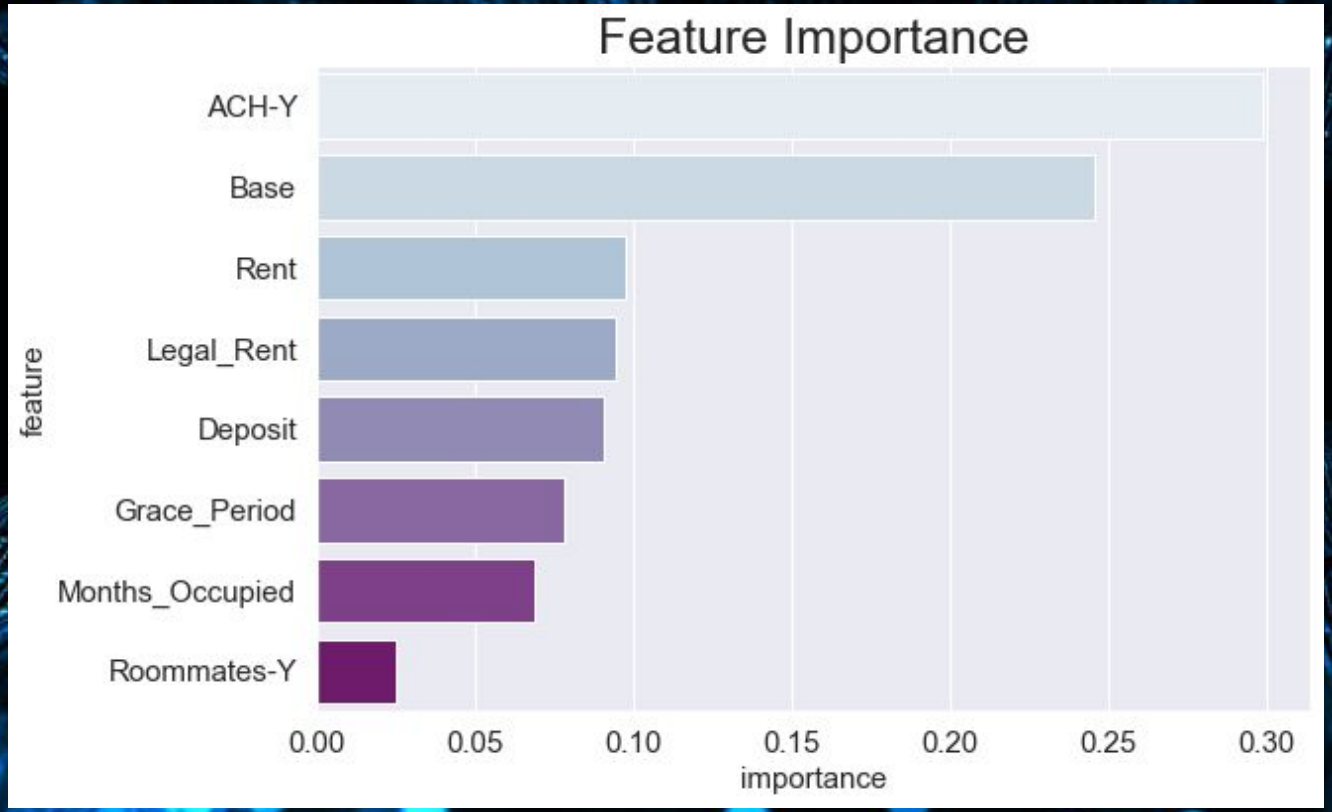


Model Evaluation - ROC AUC Curve

- ROC AUC of close to 1
- Positive and Negative classes are perfectly separated



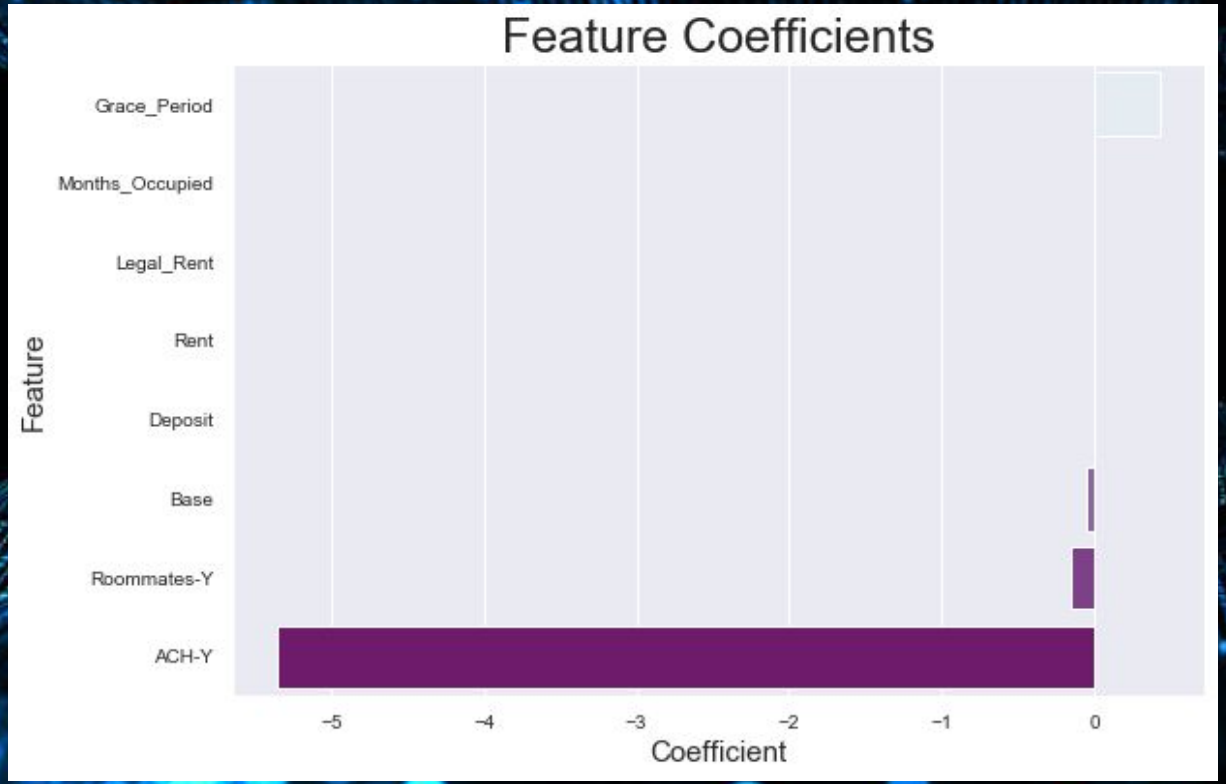
Model Evaluation - Feature Importance (Extra trees)



Extra Trees Model

- **Tenants signing up for Auto debit of their rent is the most important feature of the model**
- **Late fee calculation percentage is the second most important feature.**

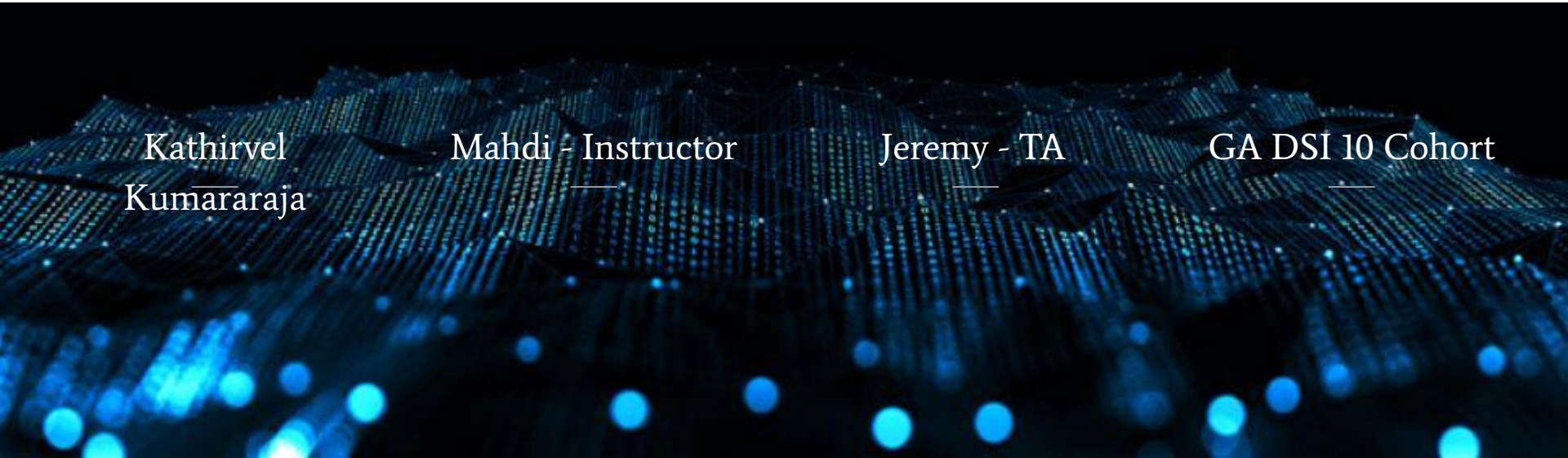
Model Evaluation - Model Coefficients



- We can infer from this findings that Low rent paying tenant tends to stay longer in a Unit that is he is less likely to churn / move-out.
- Another interesting findings is that the tenants who signed up for electronic payments tend to stay longer.

Conclusion

- Extra trees model performed the best (at 100% accuracy).
- Our model will help to differentiate the Churned and Non Churned tenants for the Property Managers.
- Would like to get more data from Social Media, Work Order Review to aid the predictive models.
- Time based predictions to be done using Generalized Linear Models.
- Develop an API between Machine Learning Models and the Property Management Application.

Thanks - Questions?

The Team