
Predicting Financial Statement Auditor
Supervised Learning: Classification
Appendix
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Background & Purpose
Methodologies
Jason Dunleavy, Data Scientist


Introduction
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Purpose
Data

Big Four Effect

- Need for quality audits
  - Fewer restatements
  - More accurate forecasts
  - Lower cost of capital
- Why effect exists?
  - Better audit methodologies/tools/technologies
  - Hiring effect
  - Self-selection effect
- Target (Binary)
  - Big Four (PwC, EY, Deloitte, KPMG)
  - Other

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- Data sources:
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  - Quandl: US Company Fundamentals
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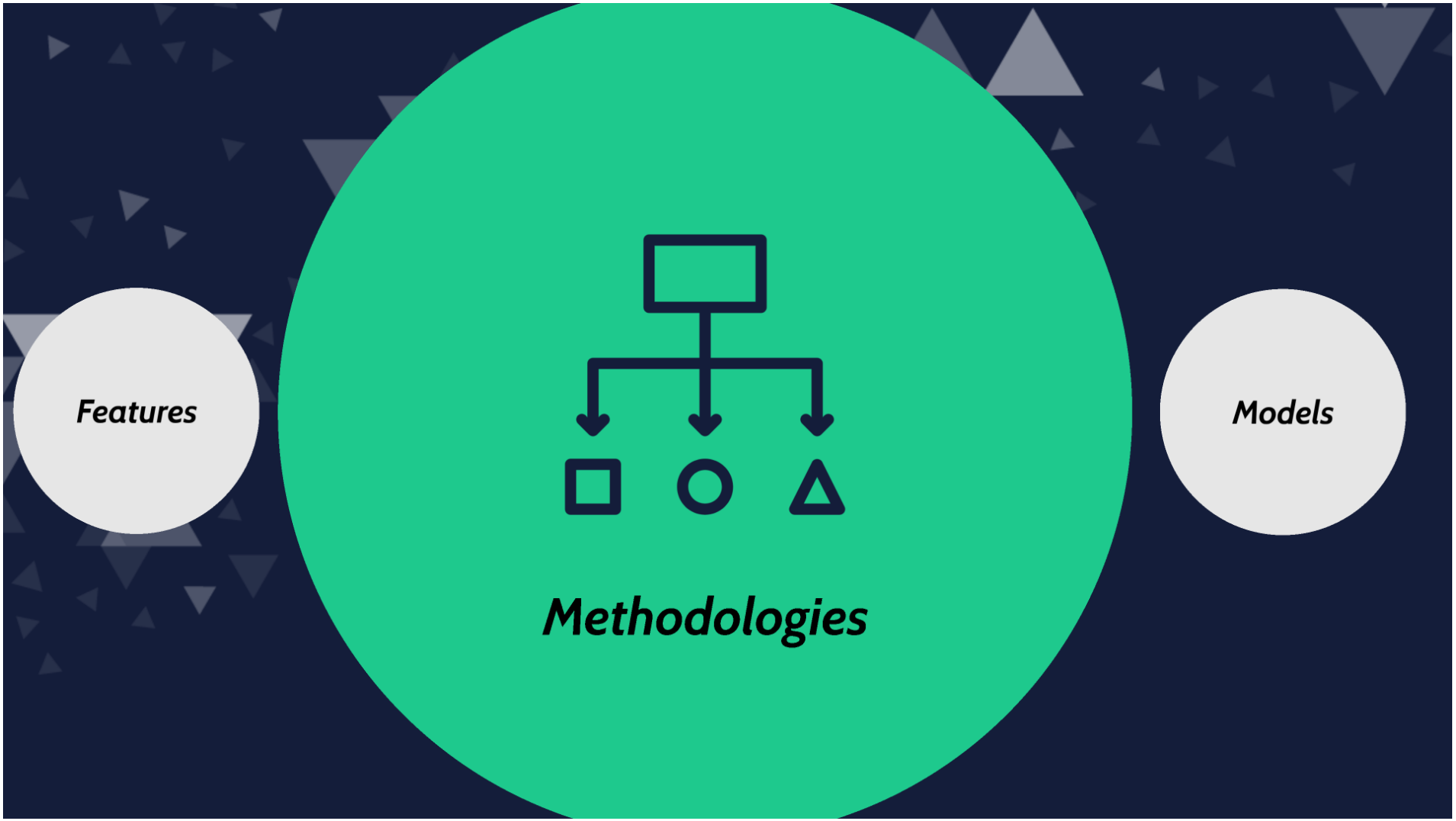
Features
Methodologies
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Features

- Cash Flows (Operating, Investing, Etc)
  - Feature engineering: Inflows vs. Outflows
- Balance Sheet Metrics
  - Assets, Cash, Liabilities, Debt, Equity
- Income Statement Metrics
  - Revenue
  - EBITDA
- Enterprise value
- Market value
- Location (State)
- Exchange
- Industry Sector

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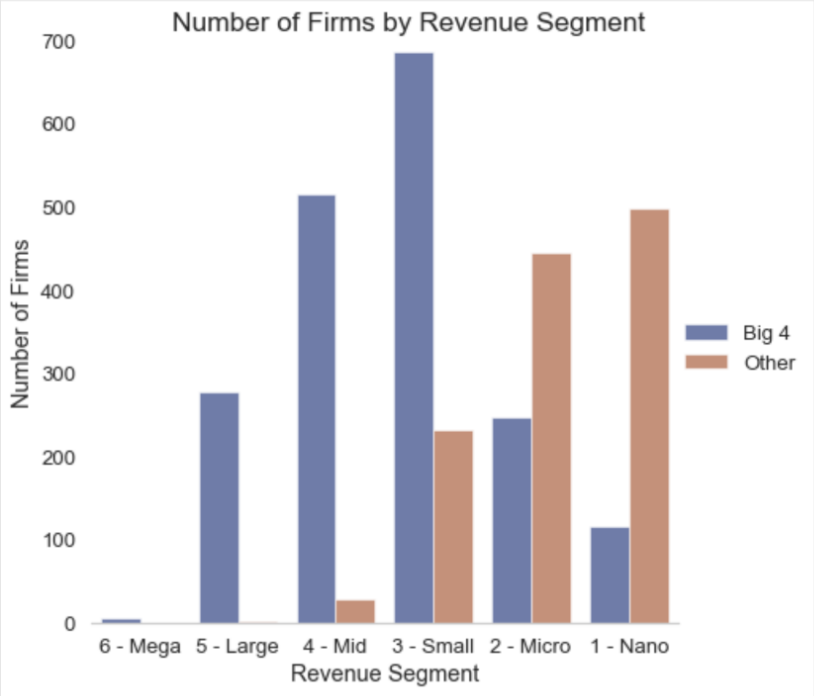
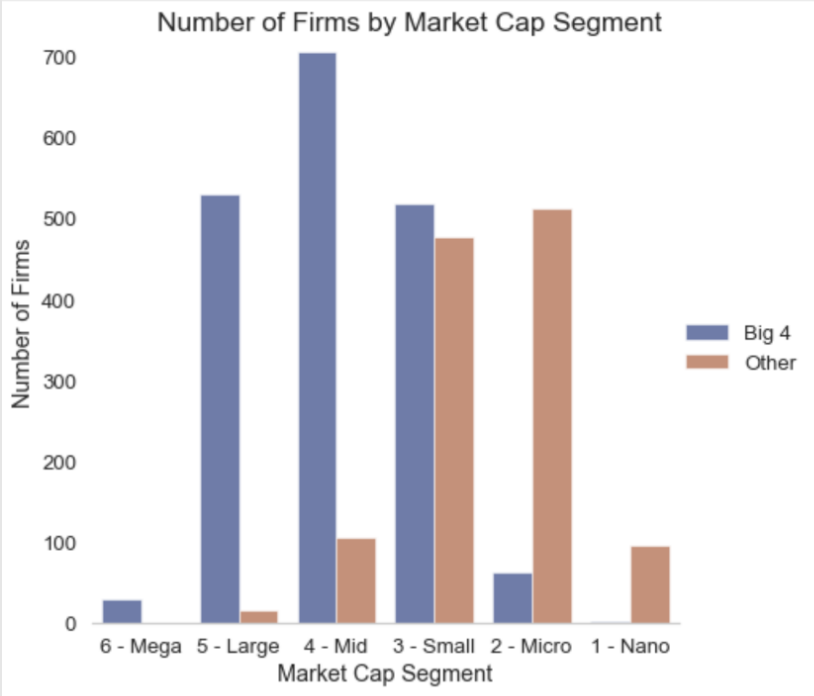
EDA


Number of Firms by Revenue Segment
Number of Firms
700
600
500
400
300
200
100
0
6 - Mega
5 - Large
4 - Mid
3 - Small
2 - Micro
1 - Nano
Revenue Segment
Big 4
Other


Number of Firms by Market Cap Segment
Number of Firms
700
600
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Market Cap Segment
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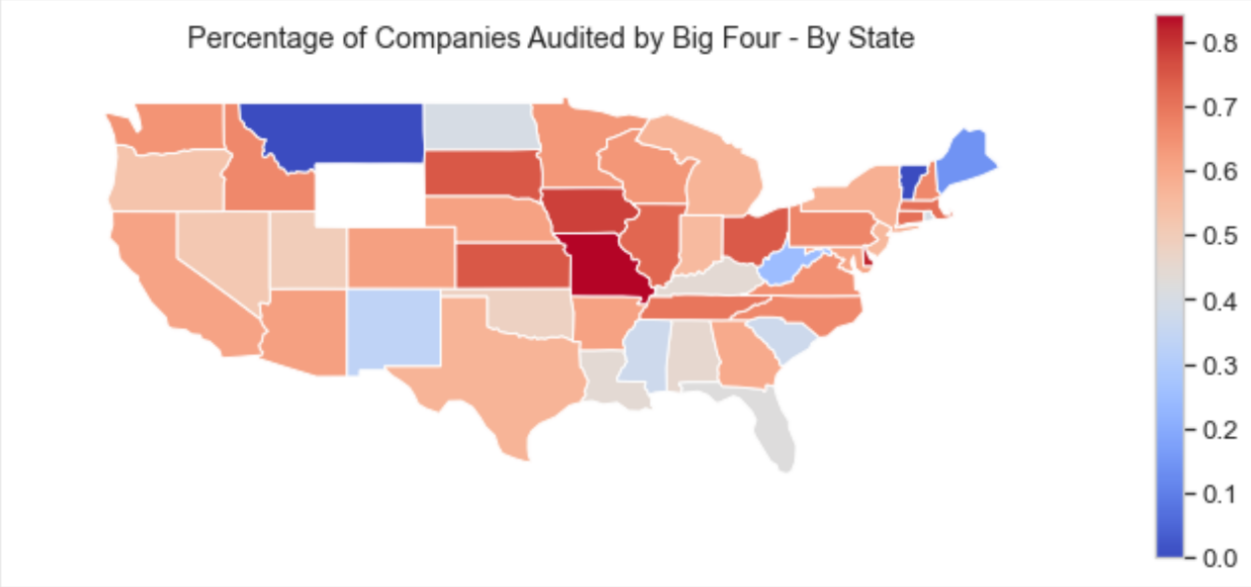
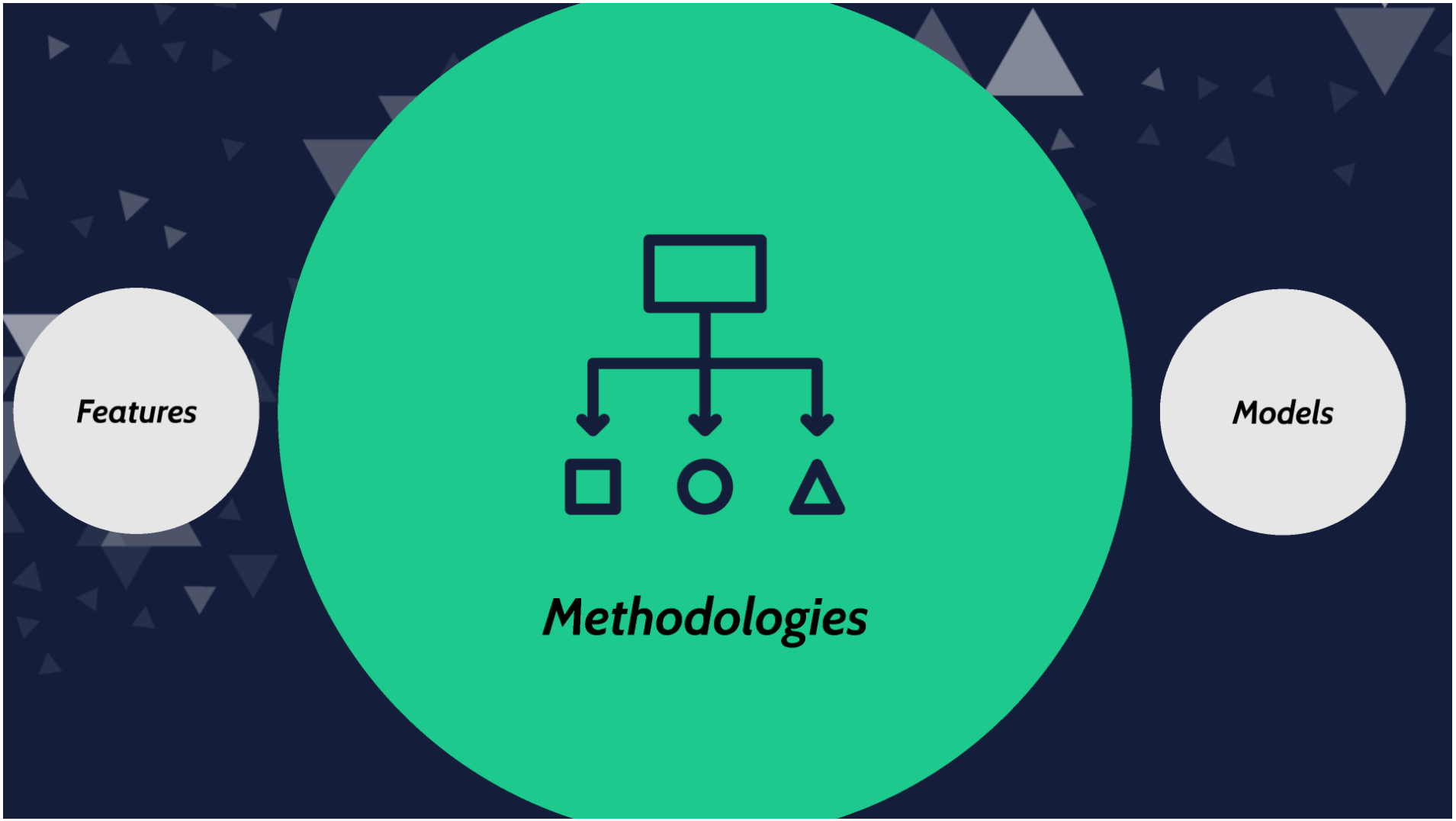


* For additional EDA visualizations see appendix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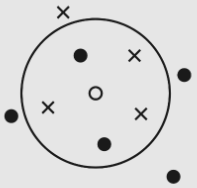
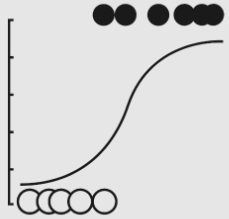
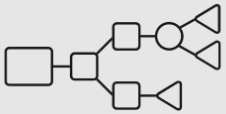


KNN



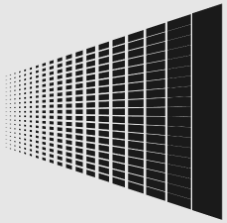
Logistic Regression

Naive Bayes

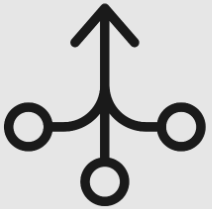


Decision Tree

Random Forest

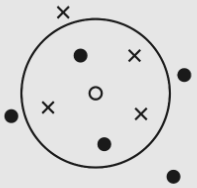


XGBoost



Ensemble

Models



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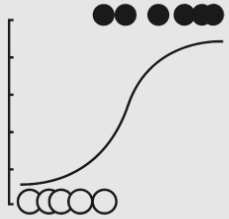

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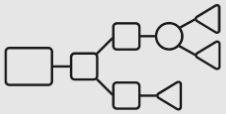

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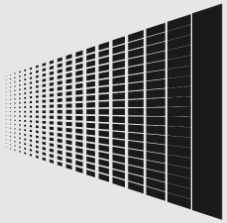

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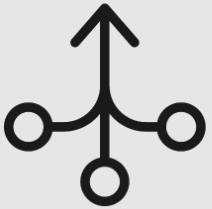
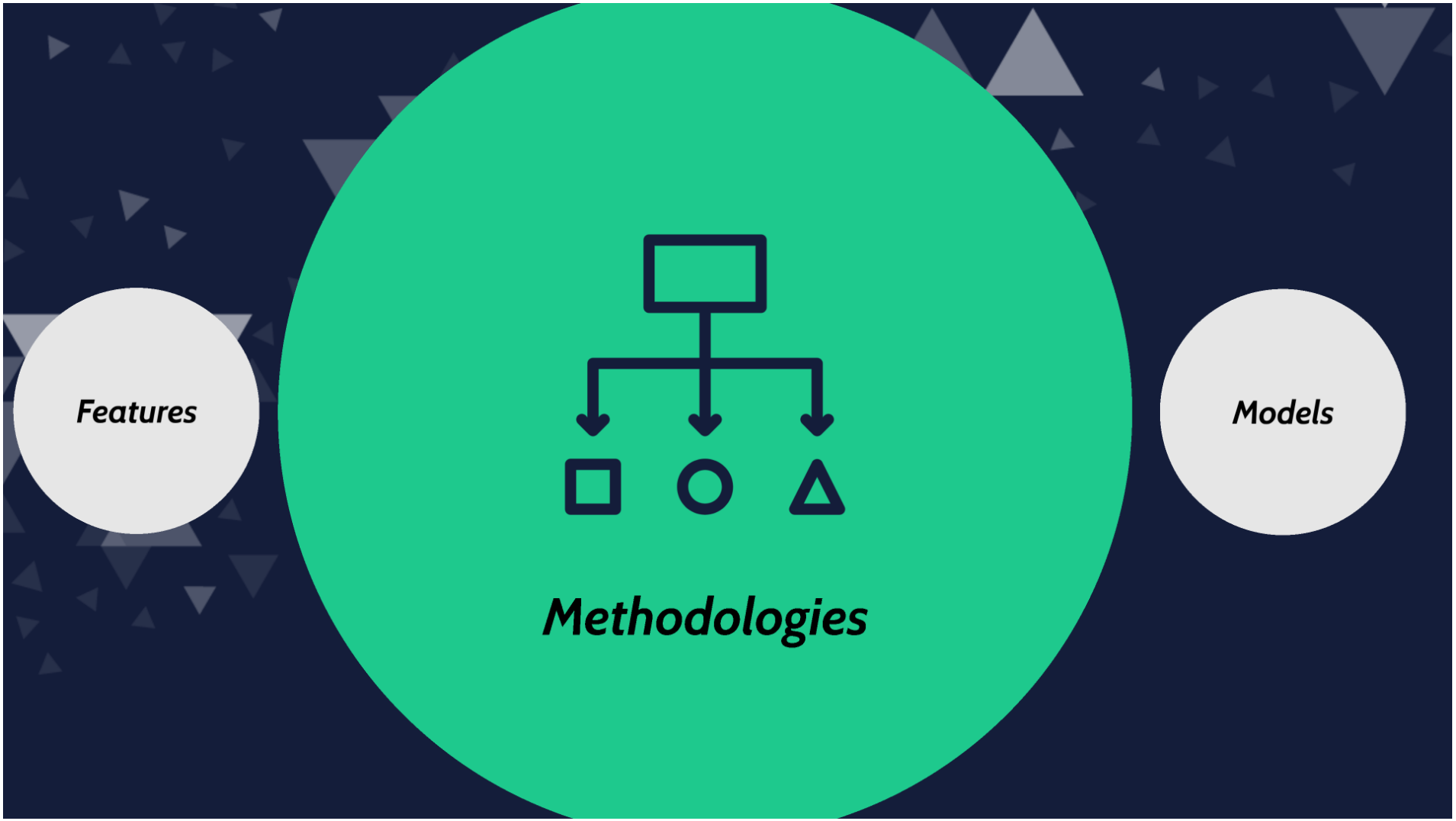


Ensemble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	Accuracy	F1 Score
KNN	.64	.67
Naive Bayes	.79	.79
Logistic Regression	.80	.78
Decision Tree	.87	.86
Random Forest	.88	**.88**
XGBoost	.88	.87
Ensemble	.87	.87

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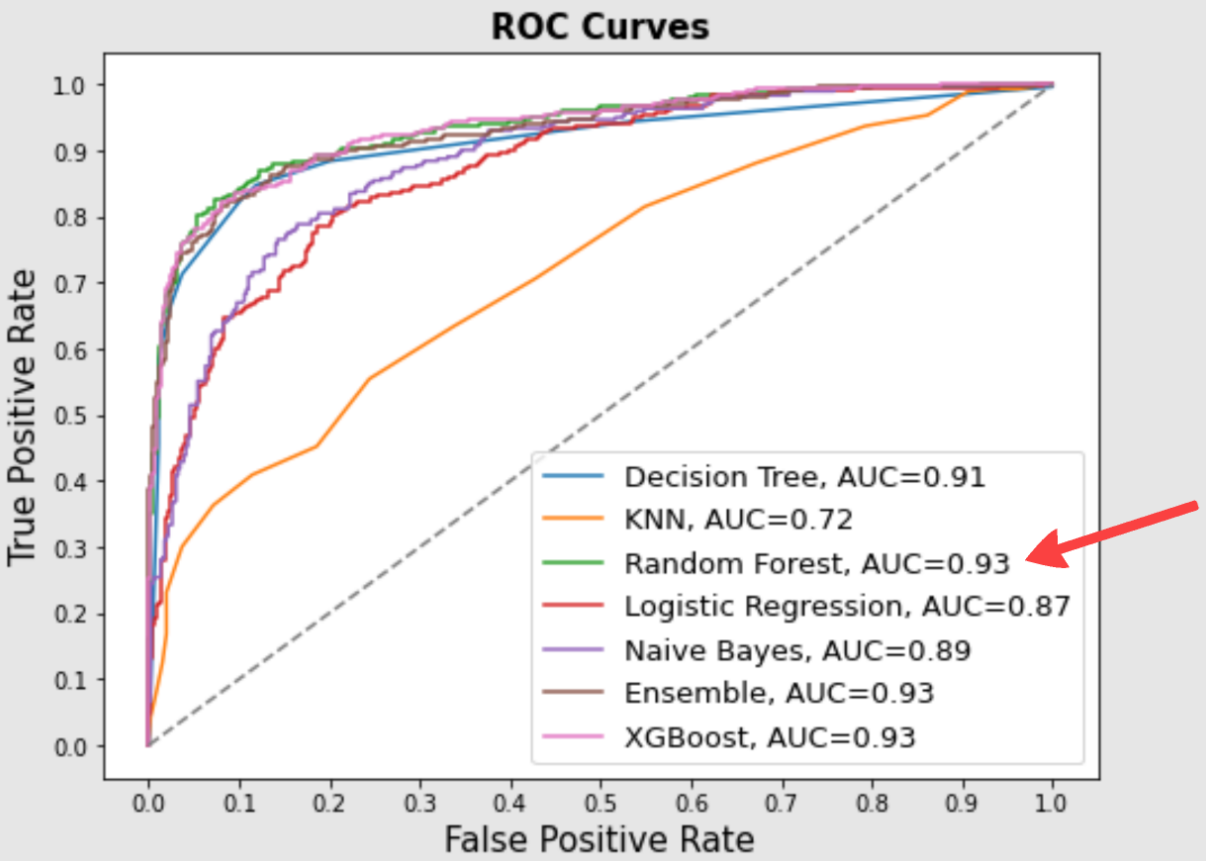
ROC Curves
True Positive Rate
False Positive Rate
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Decision Tree, AUC=0.91
KNN, AUC=0.72
Random Forest, AUC=0.93
Logistic Regression, AUC=0.87
Naive Bayes, AUC=0.89
Ensemble, AUC=0.93
XGBoost, AUC=0.93


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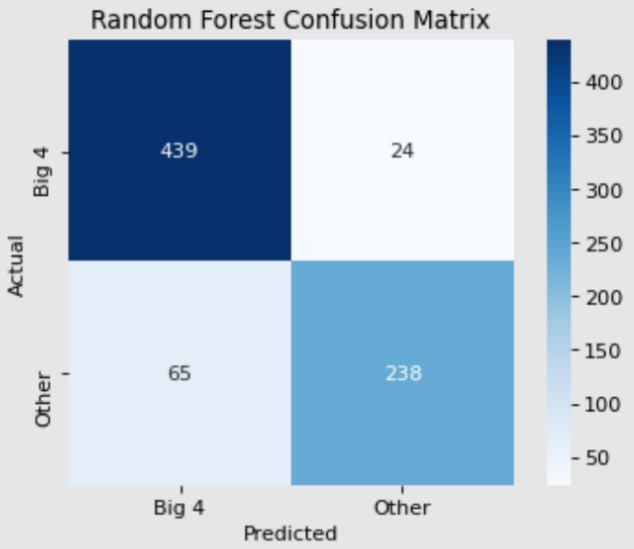

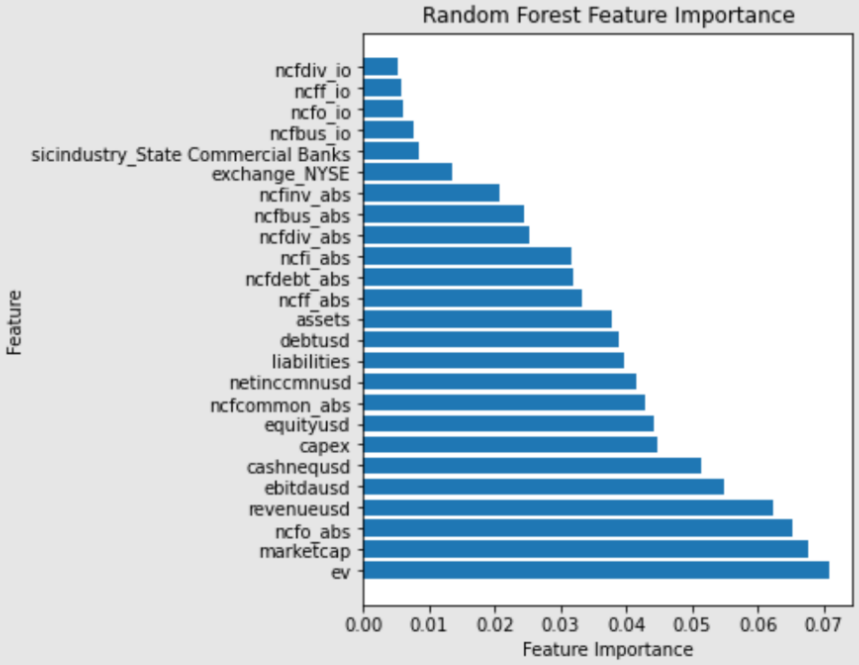

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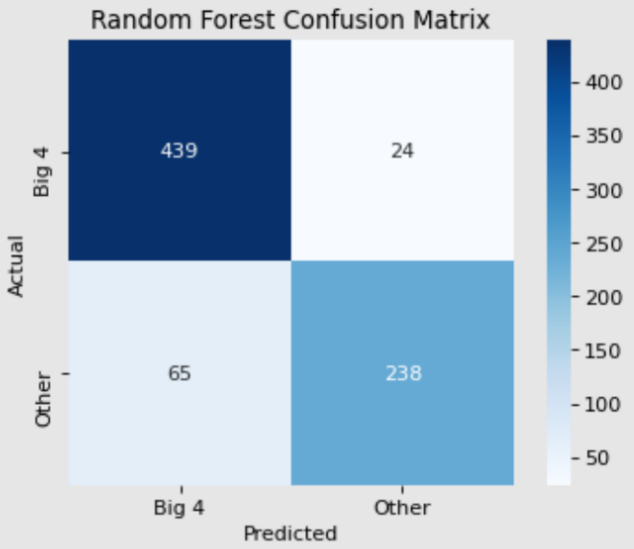

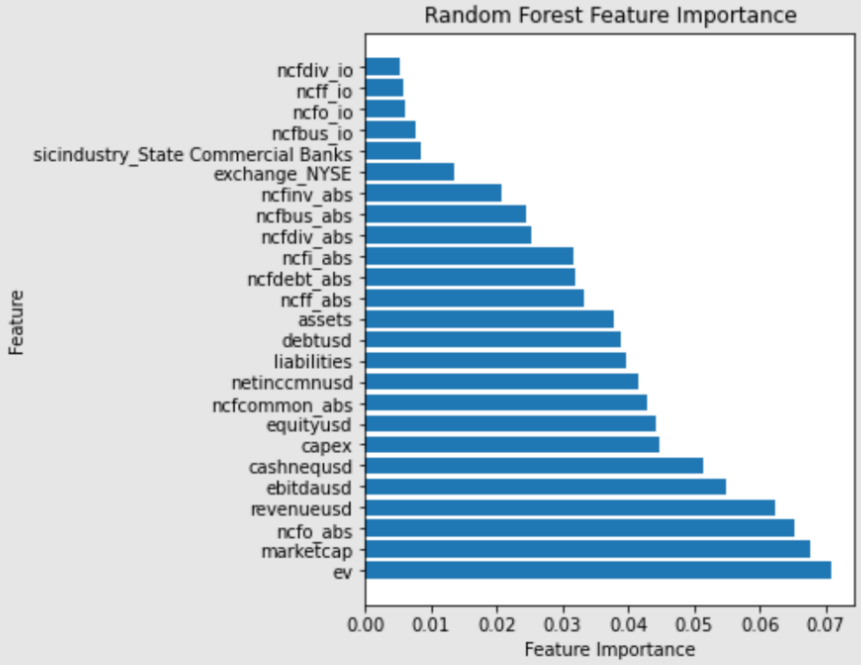

False Positives (n=65)