Data Science and Video Games

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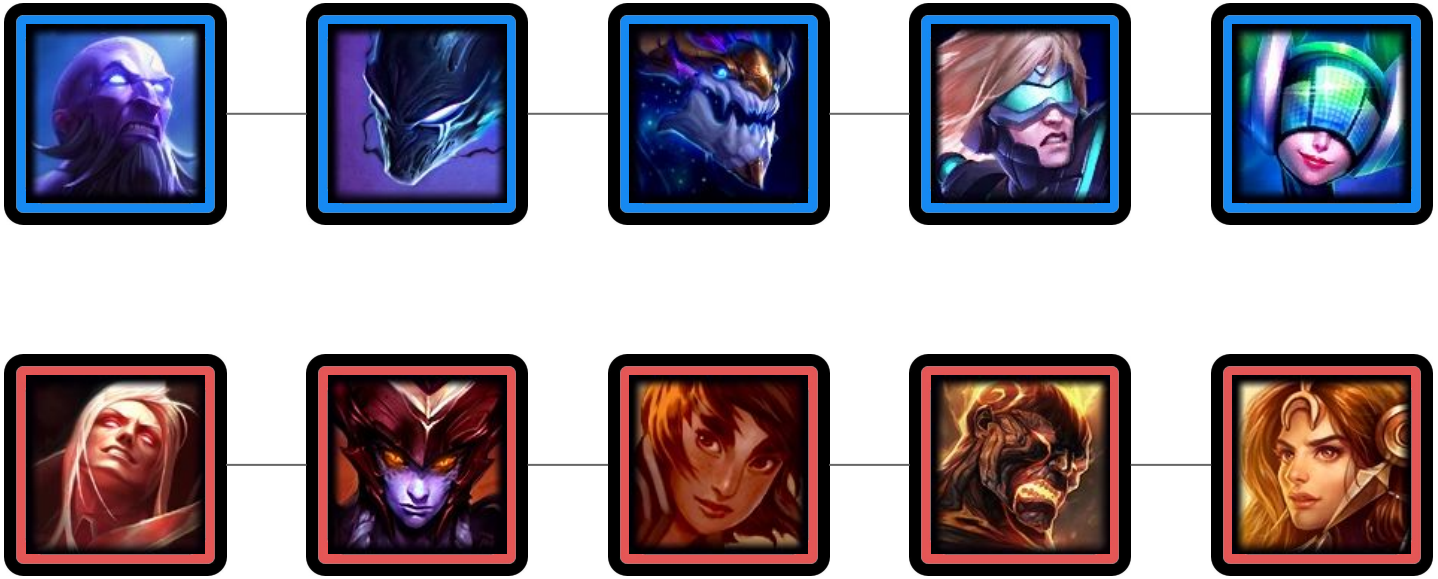
The Rise of Online Gaming

- Professional video game scene is growing rapidly
- Huge prize pools for annual and seasonal tournaments
- Teams using **data science** to provide best win conditions


LEAGUE OF
LEGENDS

Game Rules

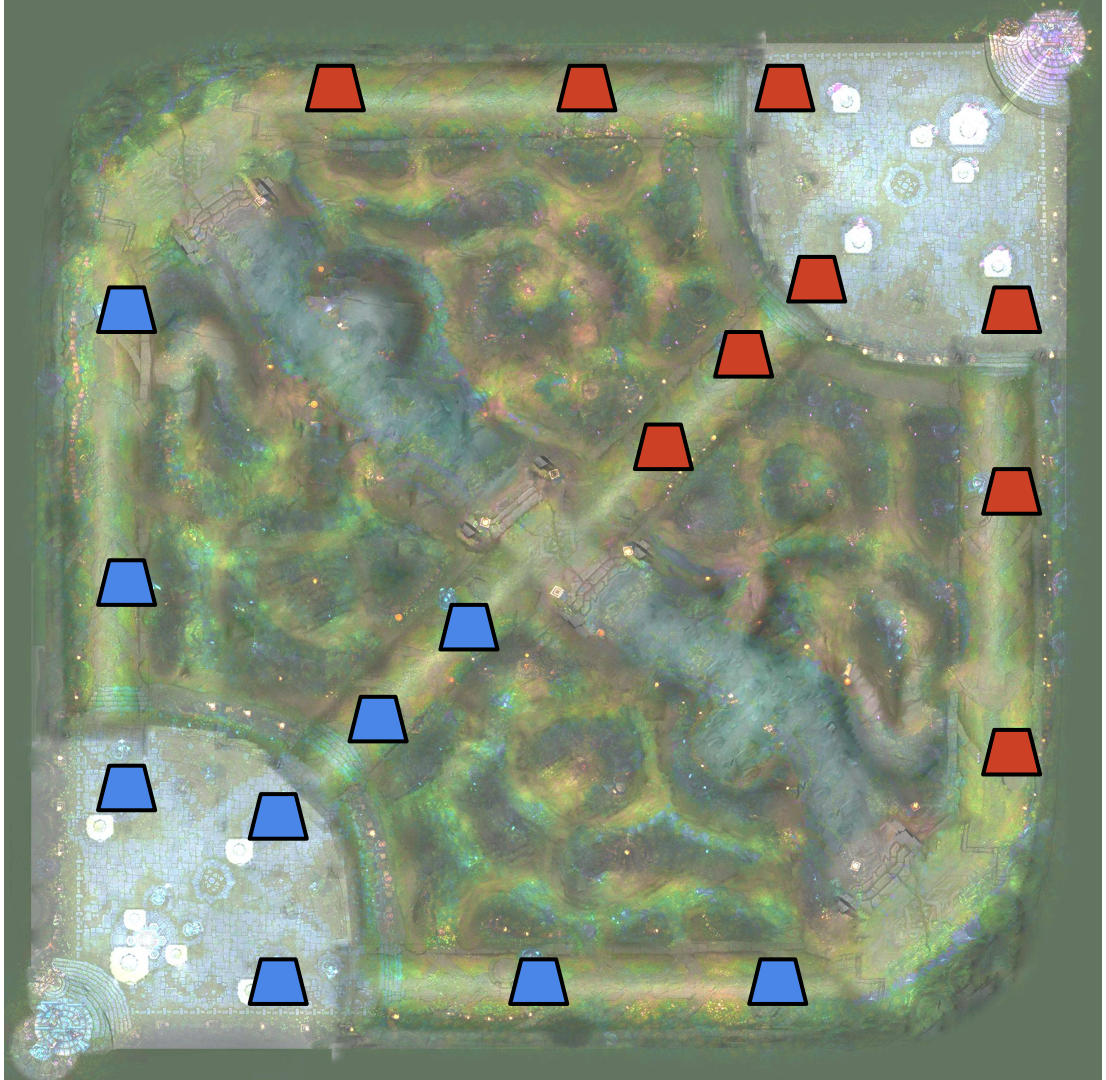


Two teams of 5 human players, each picks unique hero

Each player also bans a hero from the other team

Blue Turret

Red Turret

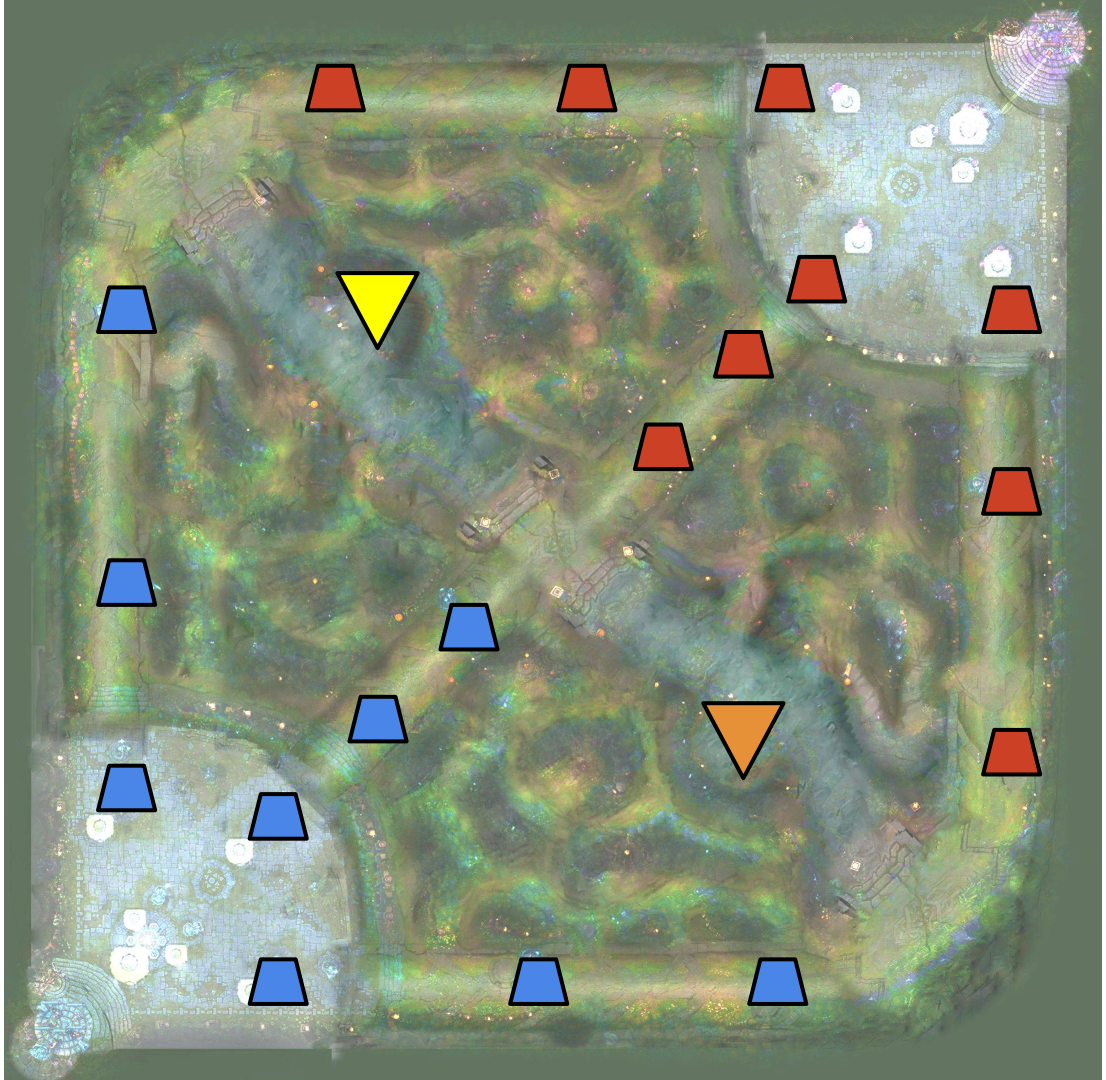


Blue Turret

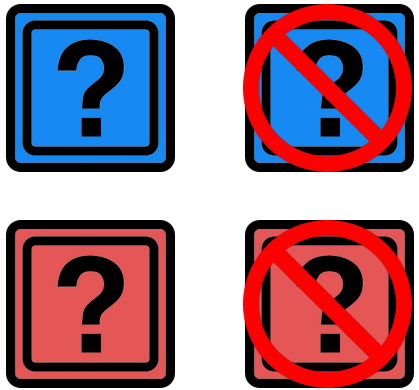
Red Turret

Rift

Dragon



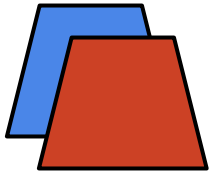
Features



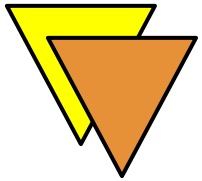
Picks

Bans

First
Kill



First
Turret

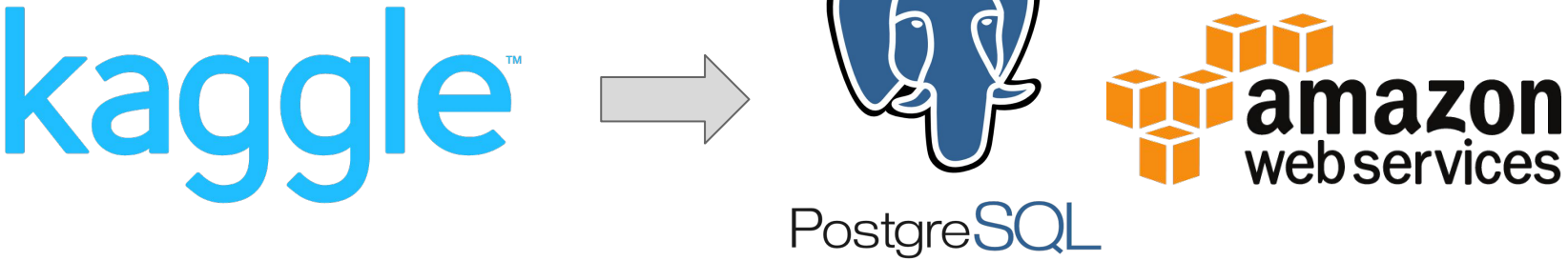


= **WINNER**

First
Rift / Dragon

Data and Assumptions

- Downloaded datasets from Kaggle
  - Game history containing **51490** games
  - Hero information about **138** unique heroes



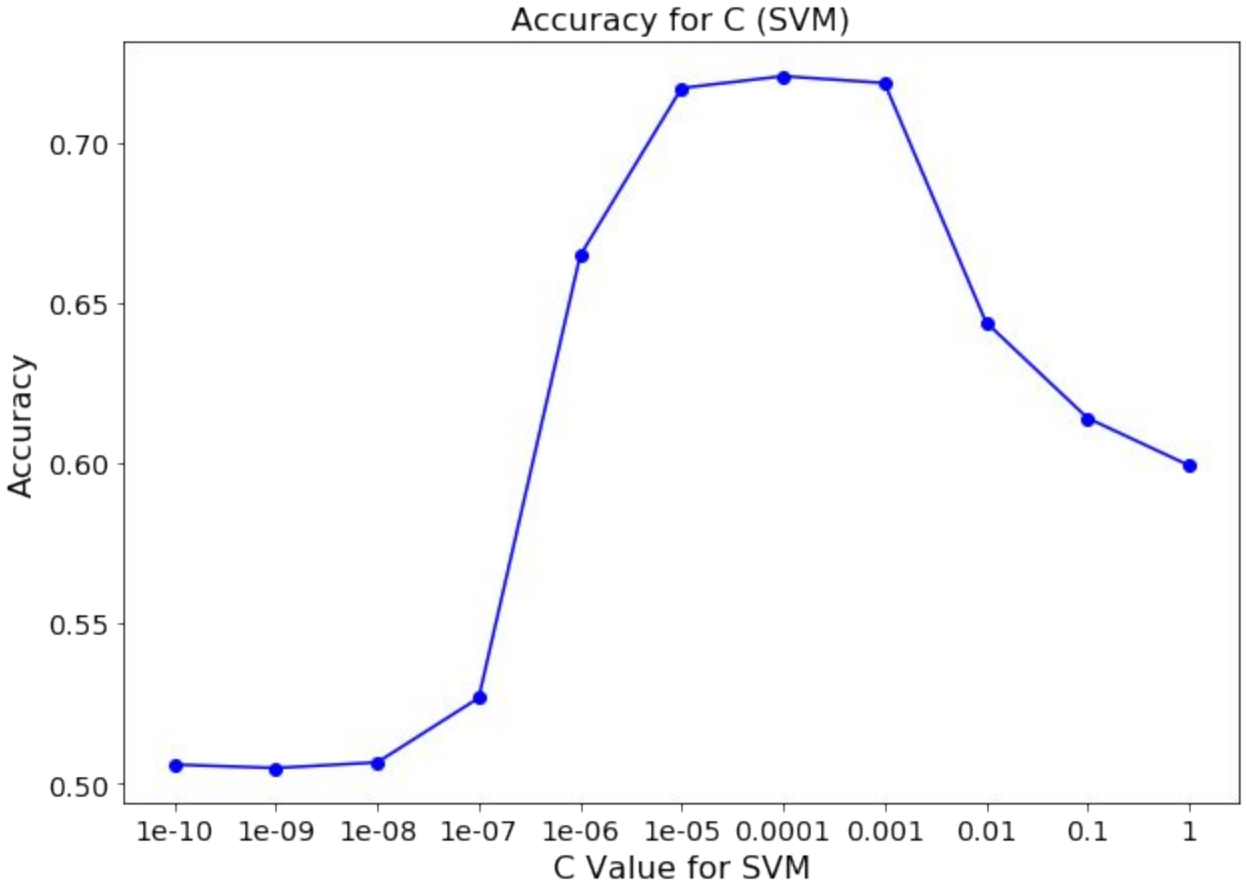
Modeling

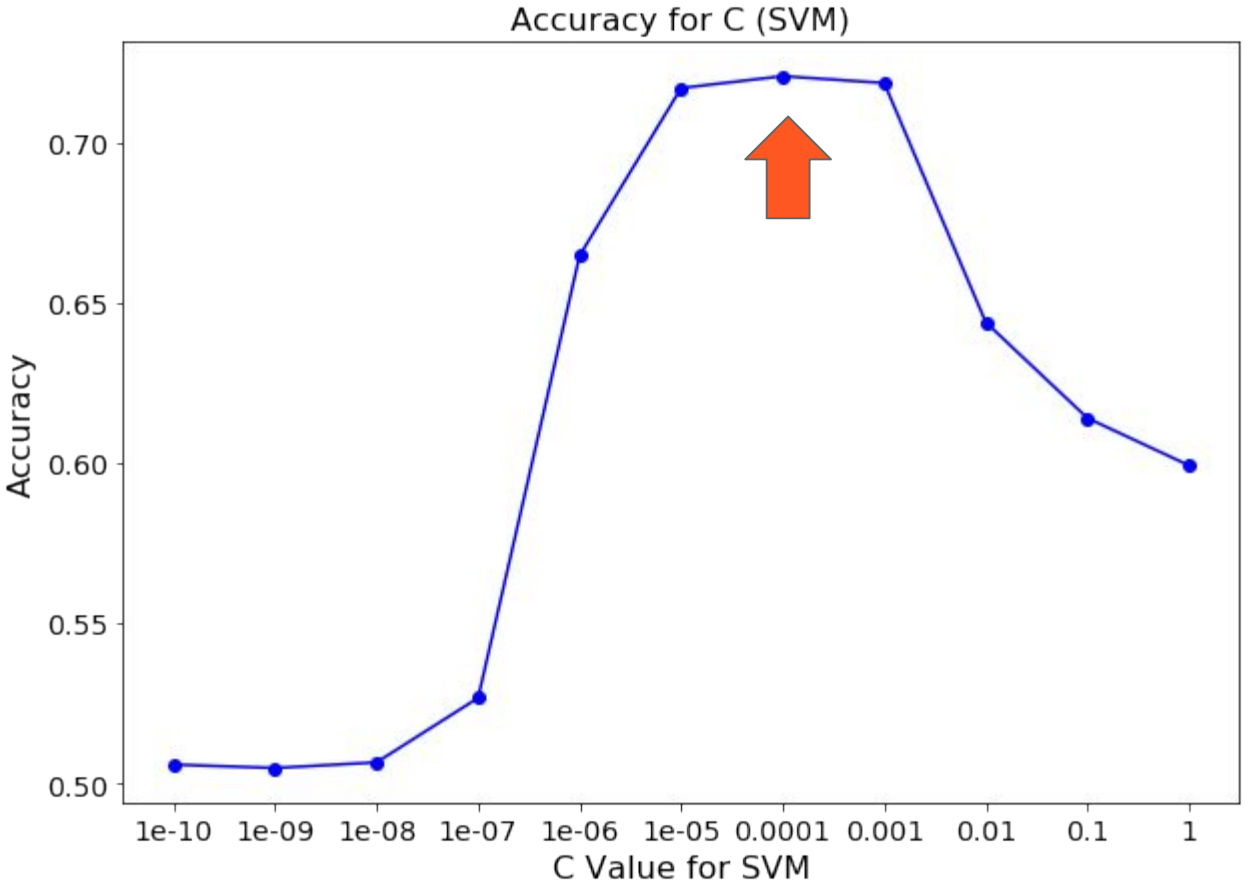
Algorithms and Hyperparameters

- Support Vector Machines: Budget
- Decision Tree: Depth and criterion
- Random Forest: Depth and number of trees
- Logistic Regression: Regularization Strength
- Bernoulli Naive Bayes: None

Algorithms and Hyperparameters

- Support Vector Machines: Budget


Accuracy for C (SVM)
Accuracy
0.70
0.65
0.60
0.55
0.50
1e-10
1e-09
1e-08
1e-07
1e-06
1e-05
0.0001
0.001
0.01
0.1
1
C Value for SVM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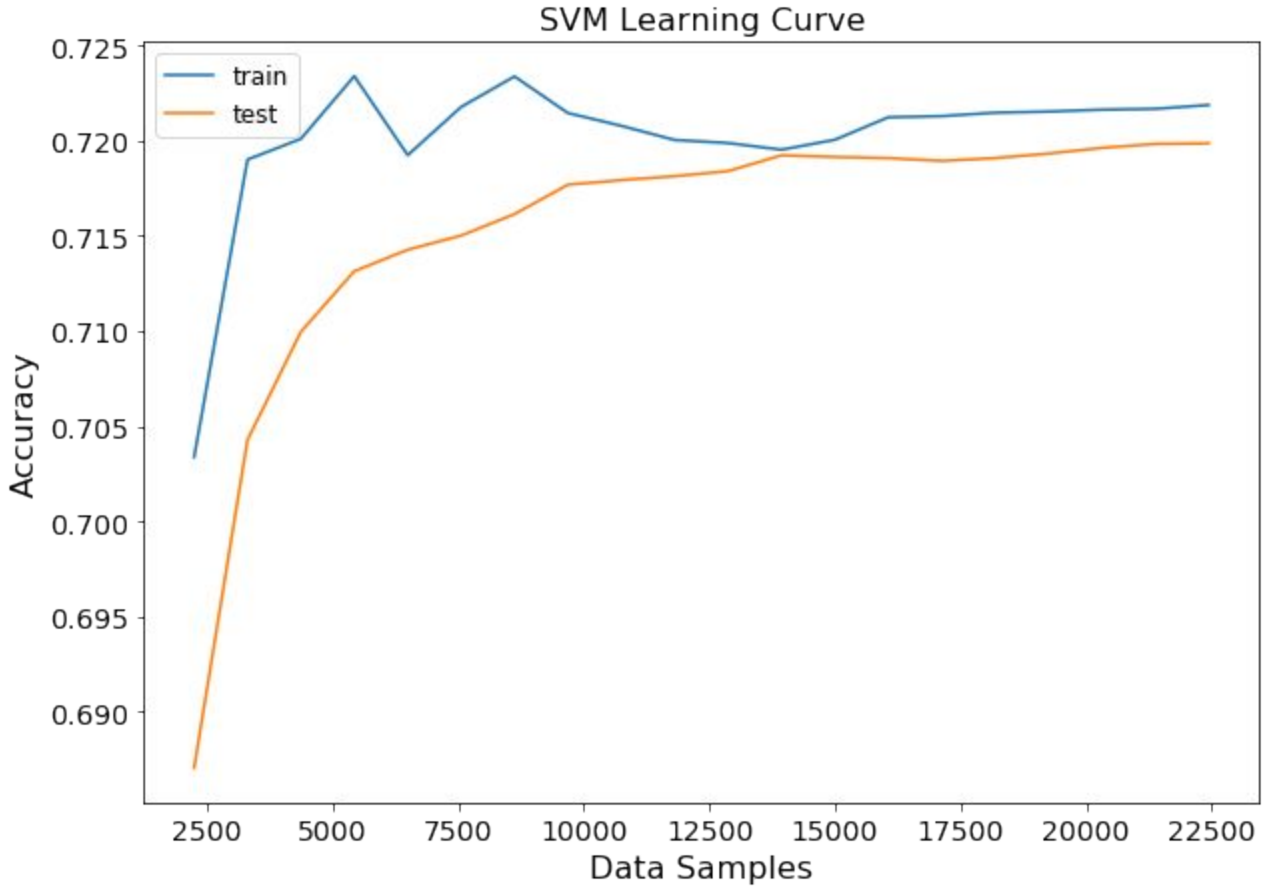
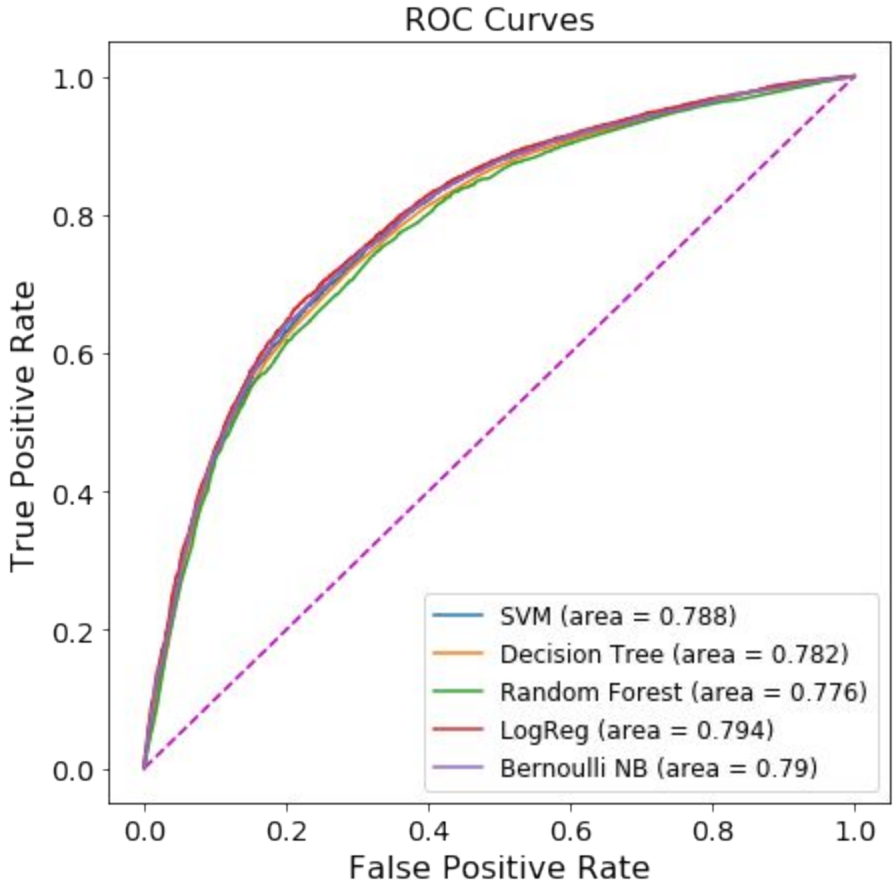
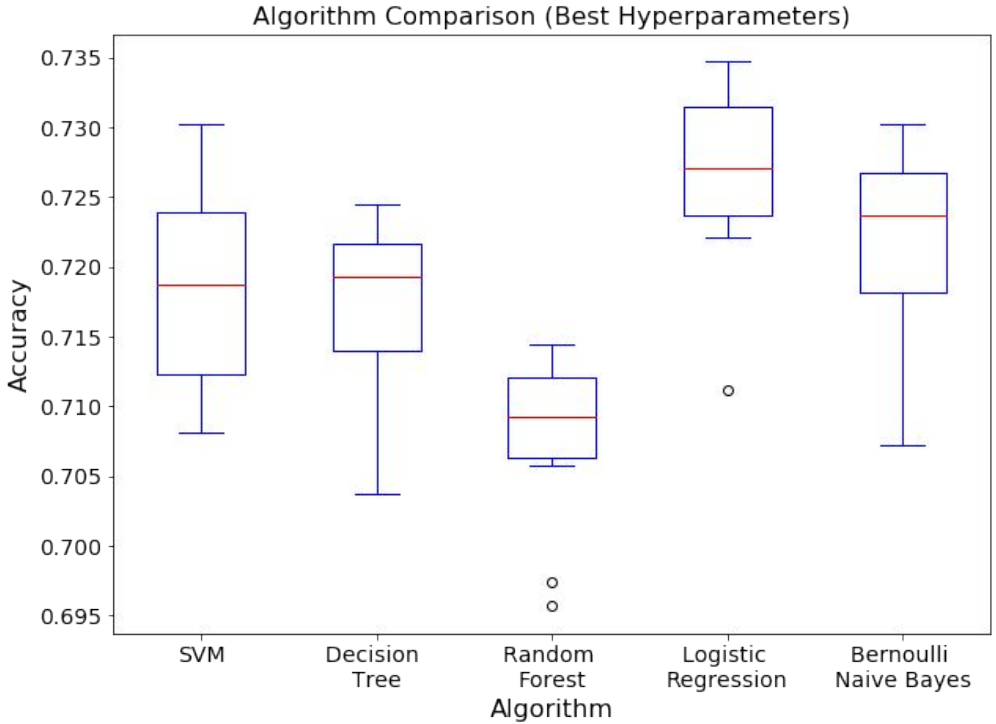
1
C Value for SVM


SVM Learning Curve
train
test
Accuracy
0.725
0.720
0.715
0.710
0.705
0.700
0.695
0.690
2500
5000
7500
10000
12500
15000
17500
20000
22500
Data Samples

Algorithm Analysis


ROC Curves
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
SVM (area = 0.788)
Decision Tree (area = 0.782)
Random Forest (area = 0.776)
LogReg (area = 0.794)
Bernoulli NB (area = 0.79)


Algorithm Comparison (Best Hyperparameters)
Accuracy
0.735
0.730
0.725
0.720
0.715
0.710
0.705
0.700
0.695
SVM
Decision Tree
Random Forest
Logistic Regression
Bernoulli Naive Bayes
Algorithm

	Bernoulli NB	Decision Tree	Logistic Regression	Random Forest	SVM
0	10	10	1	10	10
1	14	14	10	14	14
2	15	15	14	15	15
3	16	19	15	19	16
4	19	21	19	21	19
5	21	22	21	22	21
6	22	23	22	23	22
7	23	24	23	24	23
8	24	27	24	27	24
9	27	28	27	28	27

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1	14	14	10	14	14
2	15	15	14	15	15
3	16	19	15	19	16
4	19	21	19	21	19
5	21	22	21	22	21
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7	23	24	23	24	23
8	24	27	24	27	24
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5	21	22	21	22	21
6	22	23	22	23	22
7	23	24	23	24	23
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How Do I Choose an Algorithm?

- Accuracy
- Interpretability
- Computation Speed
- **Support Vector Machine!**

Conclusion

- Used Support Vector Machine for final model
- 24 Features
- Final scores
  - **Accuracy**: 71.74 %
  - Precision: 71.66 %
  - Recall: 73.01 %
  - F1: 72.33 %

Thanks for listening!

Appendix

The Rise of Online Gaming

- Big name sponsors and investors
- Teams using data science to provide best win conditions

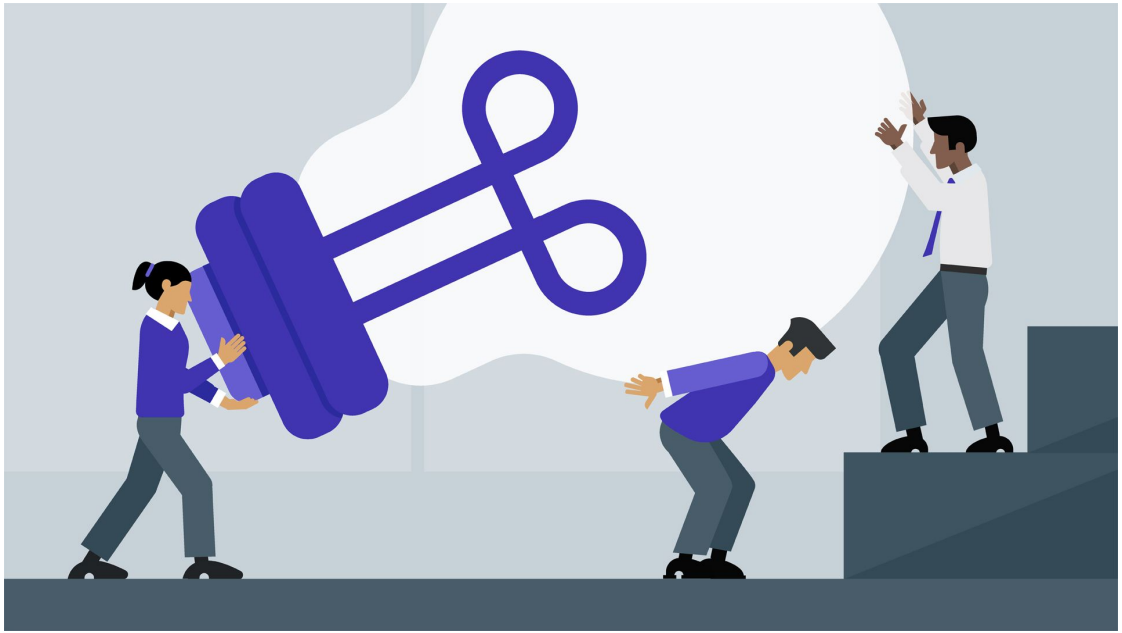
Data and Assumptions

1. The games are played on the same ranked scale.
2. Each player is playing their hero to full capacity.
3. Each player knows how to play all 138 heroes at equal levels.

Modeling Pipeline

1. Use cross validation to tune hyperparameters
2. Plot learning curve
3. Create model with best hyperparameters and record scores
4. Analyze

Conclusion



Game objectives more important than team composition

Future Improvements

- Add more data regarding individual game stats
- Only look at high ranked games
- Try and measure hero synergy