# Welcome!


Data Science Workshop

# Real Estate Marketing for First.io

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# Finding a Needle in a Haystack

## Our gigantic dataset

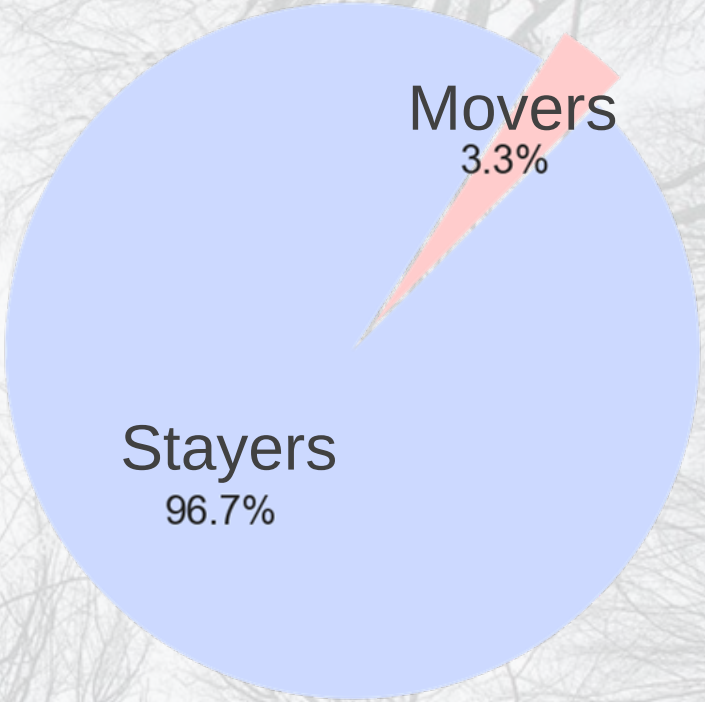
- 700+ features
- ~ 2,000,000 households in the state of NC
- Two time records: 09/2016 and 06/2017

## Our goal

- Predict and validate who has moved between the period of 09/2016 and 06/2017

## Computational tools (BIG challenge)

- Cloud computing resources:
- Distributed file system:
- Distributed computing environment:



# Hyperparameter Tuning - Logistic Regression

## Hyperparameters

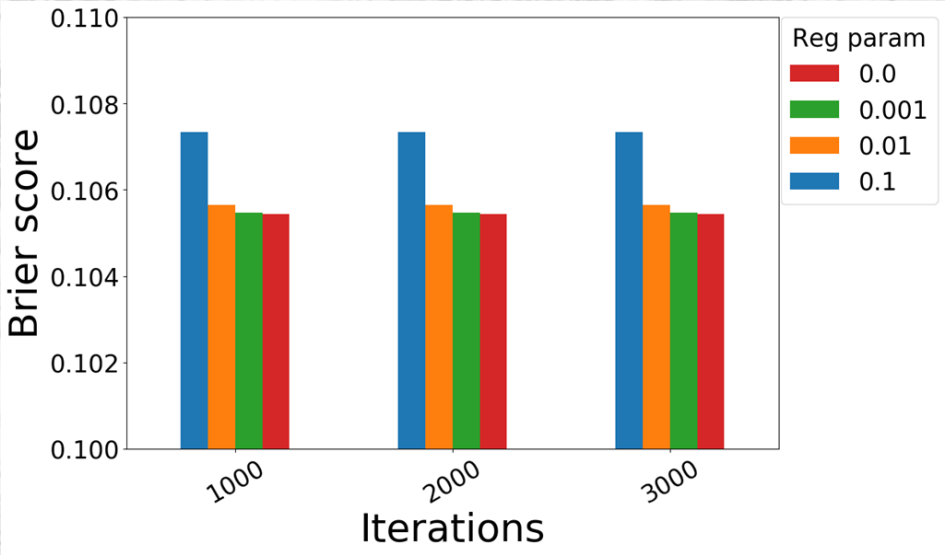
1. Regularization coefficient (λ)
2. L1/L2 regularization ratio (α)
3. # of iterations in gradient descent

## Lessons Learned

1. No regularization is the best
2. LR model underfits the data
3. Need non-linear models for better performance

## Model metric

Brier score = (probability - label)$^2$



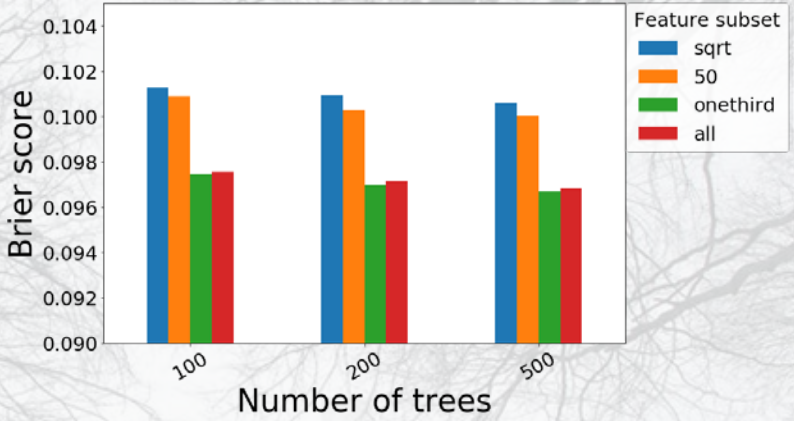
# Hyperparameter Tuning - Random Forest

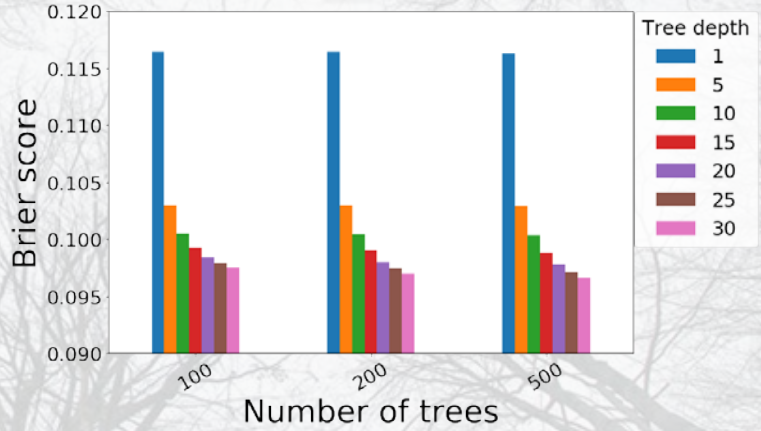
## Hyperparameters

1. # of trees in the forest
2. Max depth of trees
3. # of features

## Lessons Learned

1. Increasing tree depth and using ⅓ of total features are 2 critical factors in improving model performance
2. Increasing # of trees has no effect

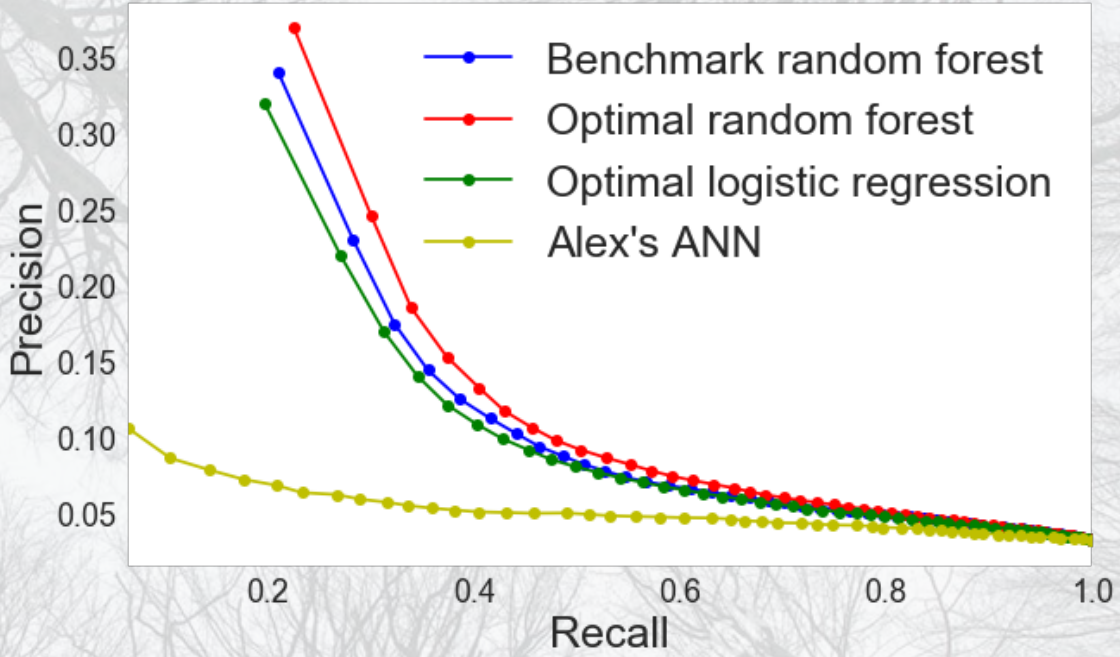


# Measuring Model Performance - P/R curve

$$\text{Precision} = \frac{\text{True positives}}{\text{All positive predictions (model accuracy)}}$$

$$\text{Recall} = \frac{\text{True positives}}{\text{Total positive targets (model sensitivity)}}$$



# Summary and Path Forward

## Conclusion

- Our optimized RF model achieves 7% improvement in Brier score over the production model

## Immediate Impact

- Insights already applied to the national model

## Long Term Prospects

- Moving decision-making is inherently a time dependent process. A time series model may offer unique perspectives and advantages