CREDIT STRATEGY IMPACT ON LOAN PRODUCTION

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BACKGROUND

About Republic Finance

Republic Finance is a regional consumer lending institution servicing communities throughout the Southeastern United States.

$1.5B+
Annual loans

Customer base
300,000+

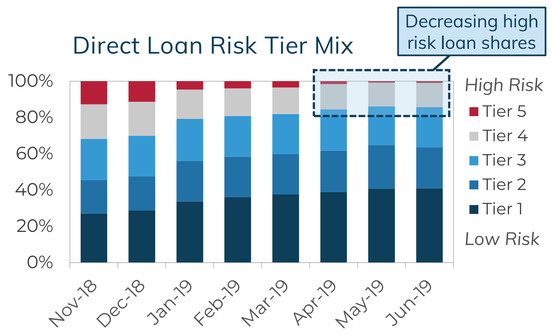
200+
local branches

Most incoming loans are 'renewals', an application coming from a customer with an existing loan.

20-30%	70-80%
New or former clients	Loan renewals for current clients

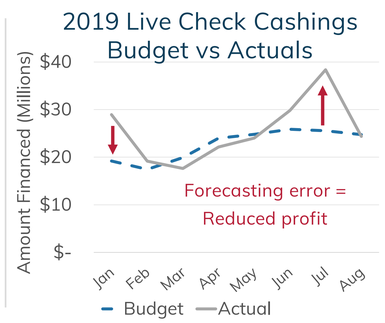
Problem Description

Republic Finance relies on predictive analytics to drive profitability. After shifting credit strategy to target lower risk and higher value loans, their predictive capabilities were reduced as typical customer behavior patterns also changed.



Significant Pain Points

- High overall forecasting error
- Lacking branch-level prediction method
- Weakened account-level insight



SOLUTION & IMPACT

1 Short-Term Account Level
Machine learning models determine propensity for loan renewal and attrition

2 Mid-Term Branch Level
ML-powered discrete simulation combines time-series analysis with account insights for detailed forecasts

3 Long-Term Portfolio Level
Aggregate loan outcomes forecasted with time series analysis

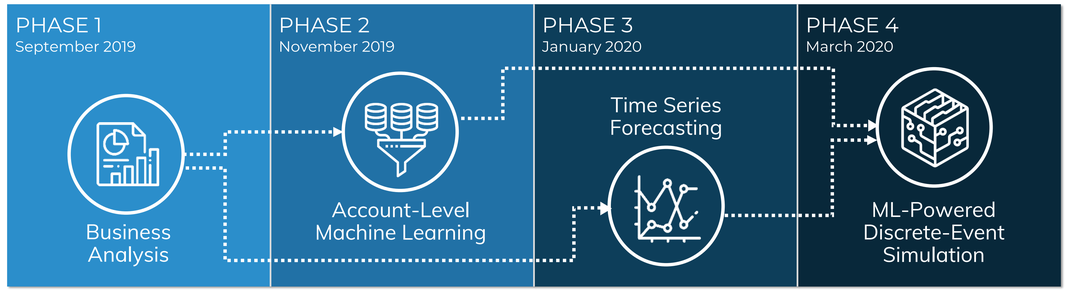
$12,000,000
Estimated increase in revenue from improvements to loan renewal rates

+ $3,000,000
Estimated labor cost savings from improved employee sales efficiency

Total estimated project impact
$15,000,000

PROJECT APPROACH

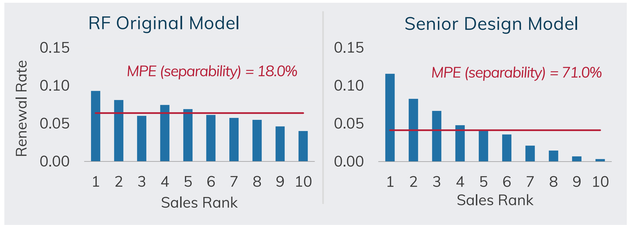
Our solution integrates machine learning, time-series analysis, and discrete-event simulation.



MACHINE LEARNING

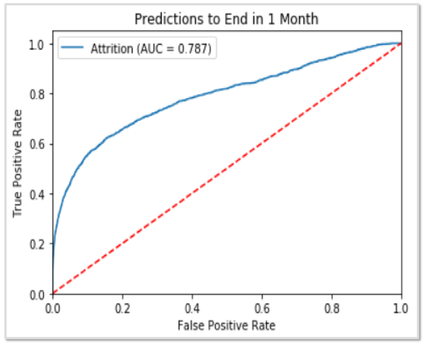
Multiple classifiers predict next-month account behavior:

- XGBoost: Direct loan renewal & live check conversions
- Random Forest: Attrition (early loan closure)



Our new models better distinguish high-priority and low-priority customer accounts, improving sales efficiency

AUC-ROC: Attrition Predictive Model



FORECASTING

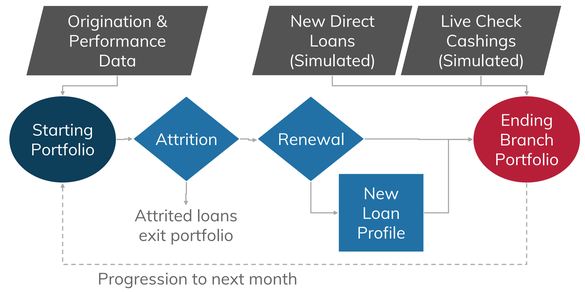
1 GOALS
- Predict unit portfolio inflow & outflow
- Accurate annual prediction window

2 METHODS
- Prophet (open source additive model)
- Branches lacking sufficient historical data – exponential smoothing & moving average

3 OUTCOMES
- Portfolio & branch-level unit forecasts of each flow type (1200+ fits)

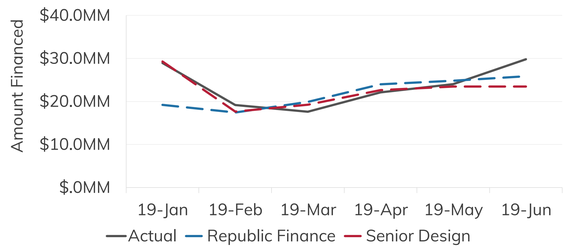
SIMULATION

Decision node outcomes are determined by machine learning classification instead of random probability.



Simulation results are aggregated to create forecasts.

Live Check Cashing Forecast Comparison



	Republic Finance	Senior Design	Difference
Total Error	$10.5 M	$5.9 M	$ 4.6 M
Total Absolute Error	$20.3 M	$10.9 M	$ 9.4 M
Mean Absolute Percent Error (MAPE)	13.39%	7.39%	6.00%
Mean Error (ME)	$1.7 M	$1.0 M	$ 0.7 M
Mean Absolute Error (MAE)	$3.4 M	$1.8 M	$1.6 M