Business Proposal

Credit Risk Management System Development

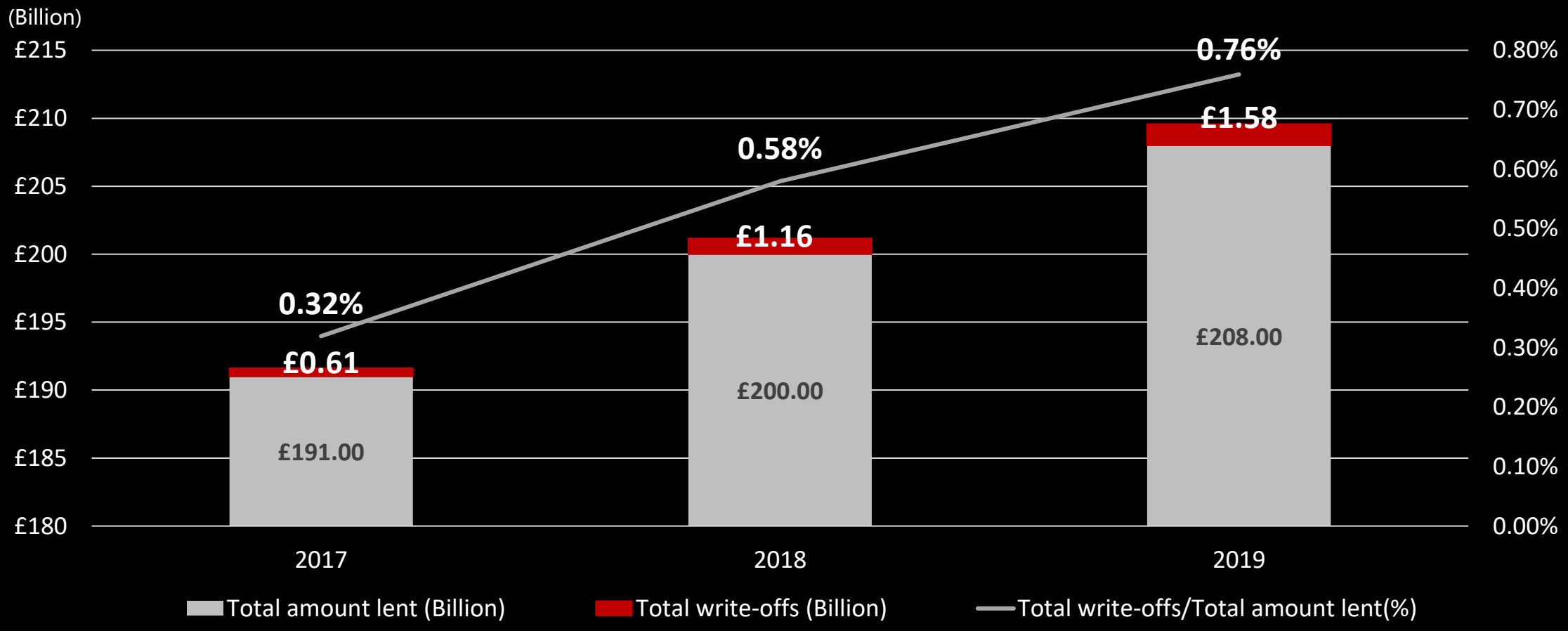
CONTENTS

1 PART One

Industrial Background

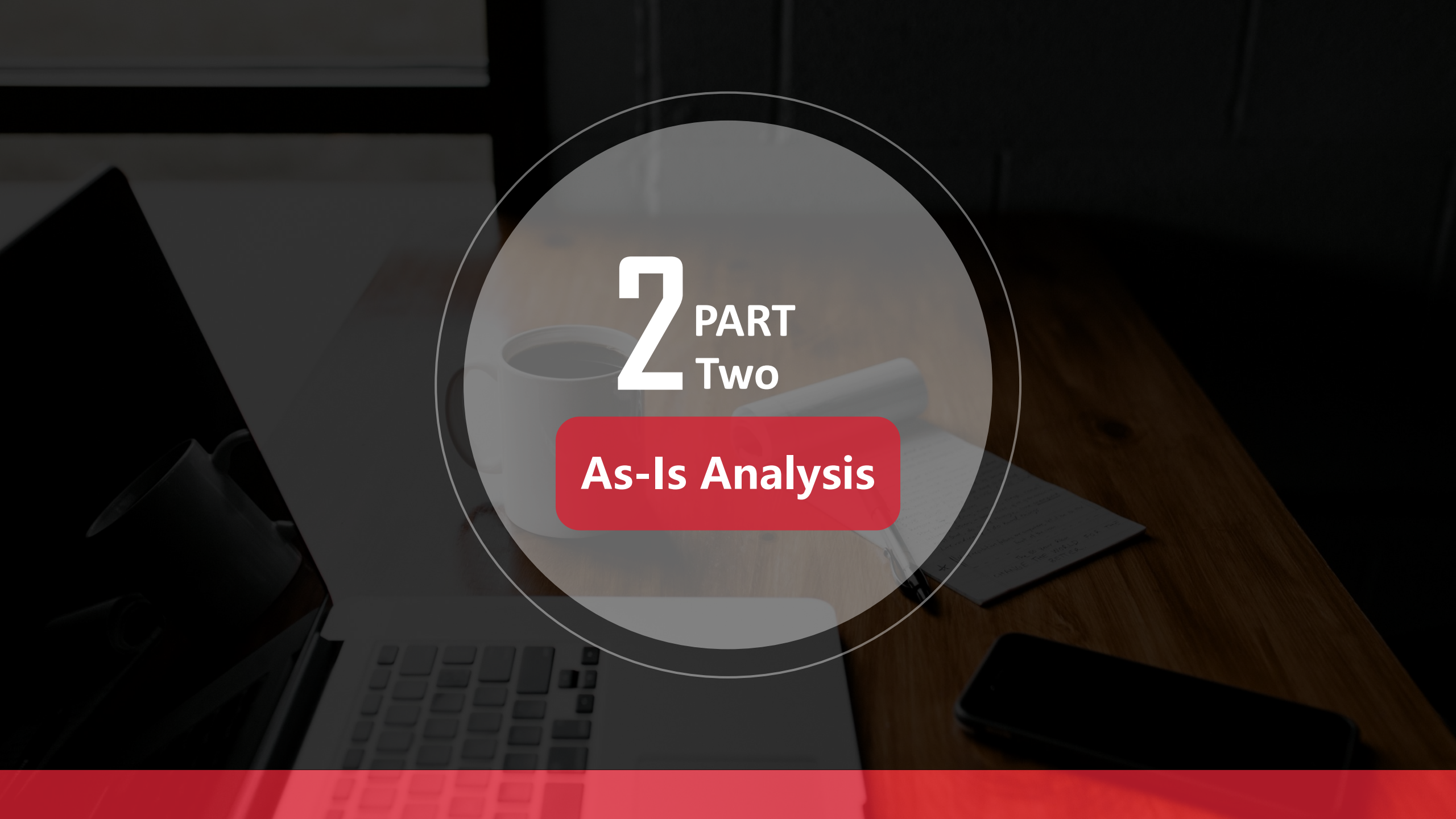
Industry Background

Personal loans between 2017 and 2019 in the UK



*Total write-offs : business accounting expense reported to account for unreceived payments or losses on assets.

Source: Lilly, C., 2021. Personal loan statistics 2021: Interest rates, total amount lent & more. [online] Finder UK.

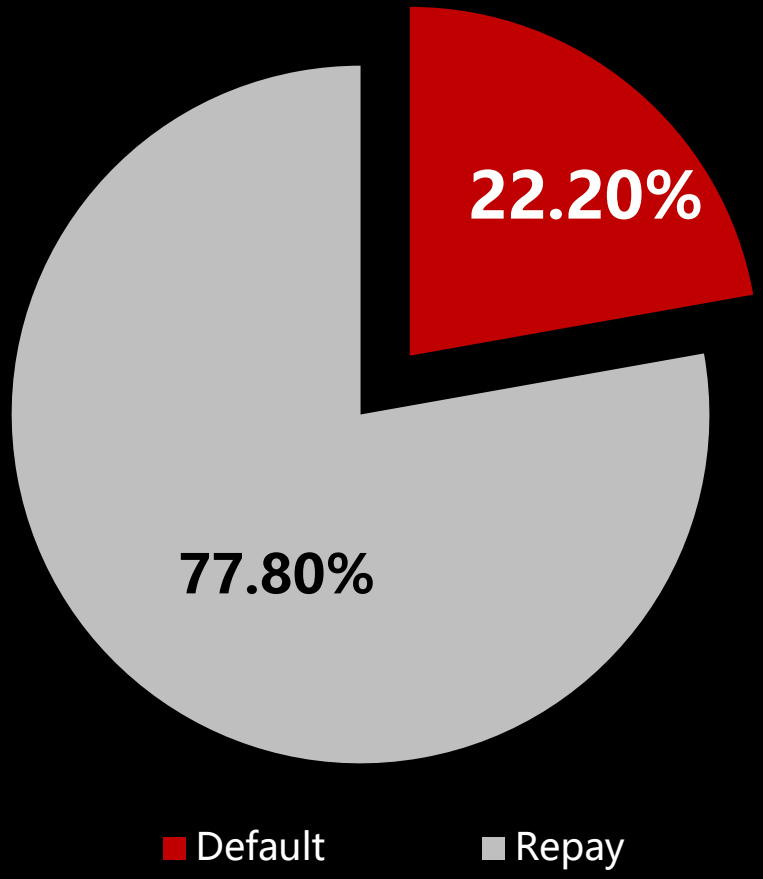


2 PART Two

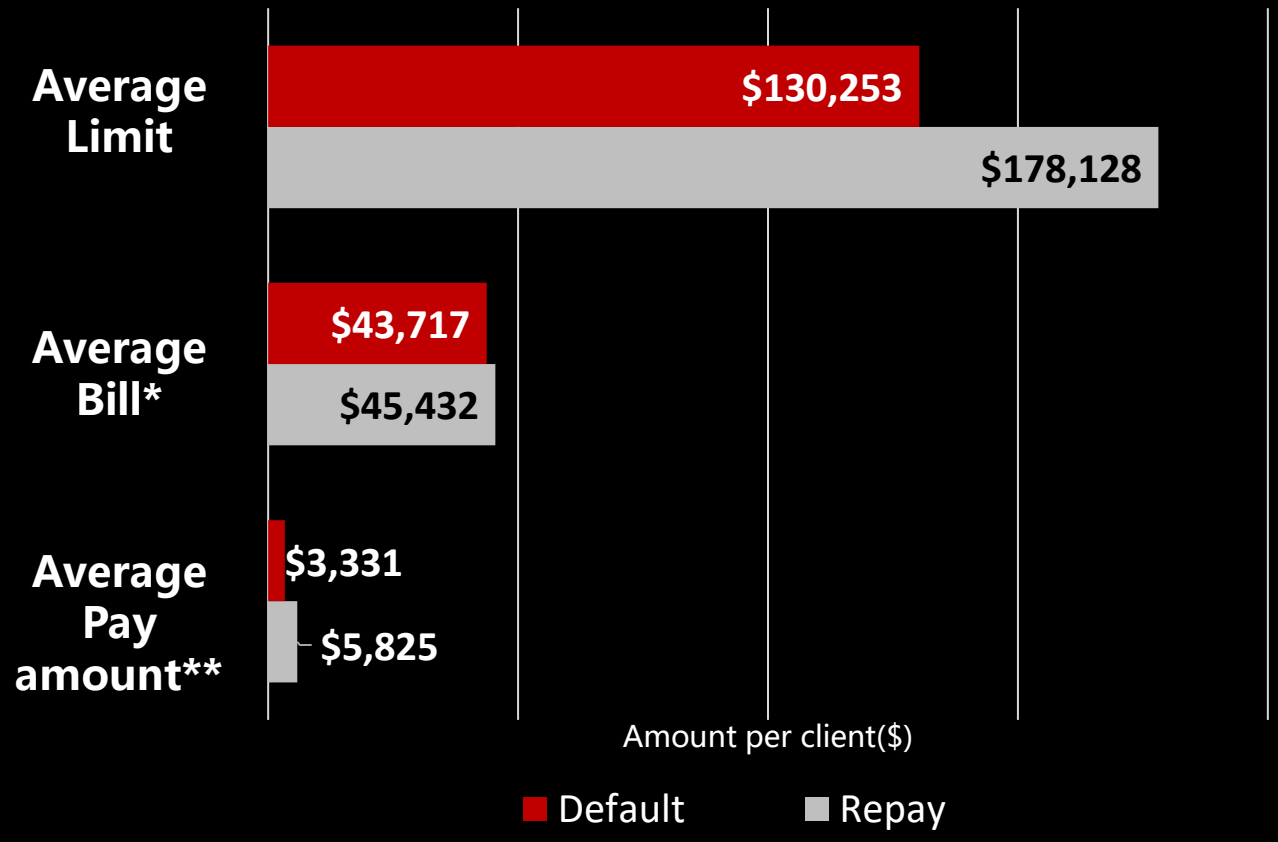
As-Is Analysis

As-Is Analysis (1/3)

Percentage of default client vs repay client



The average amount per client by client default status

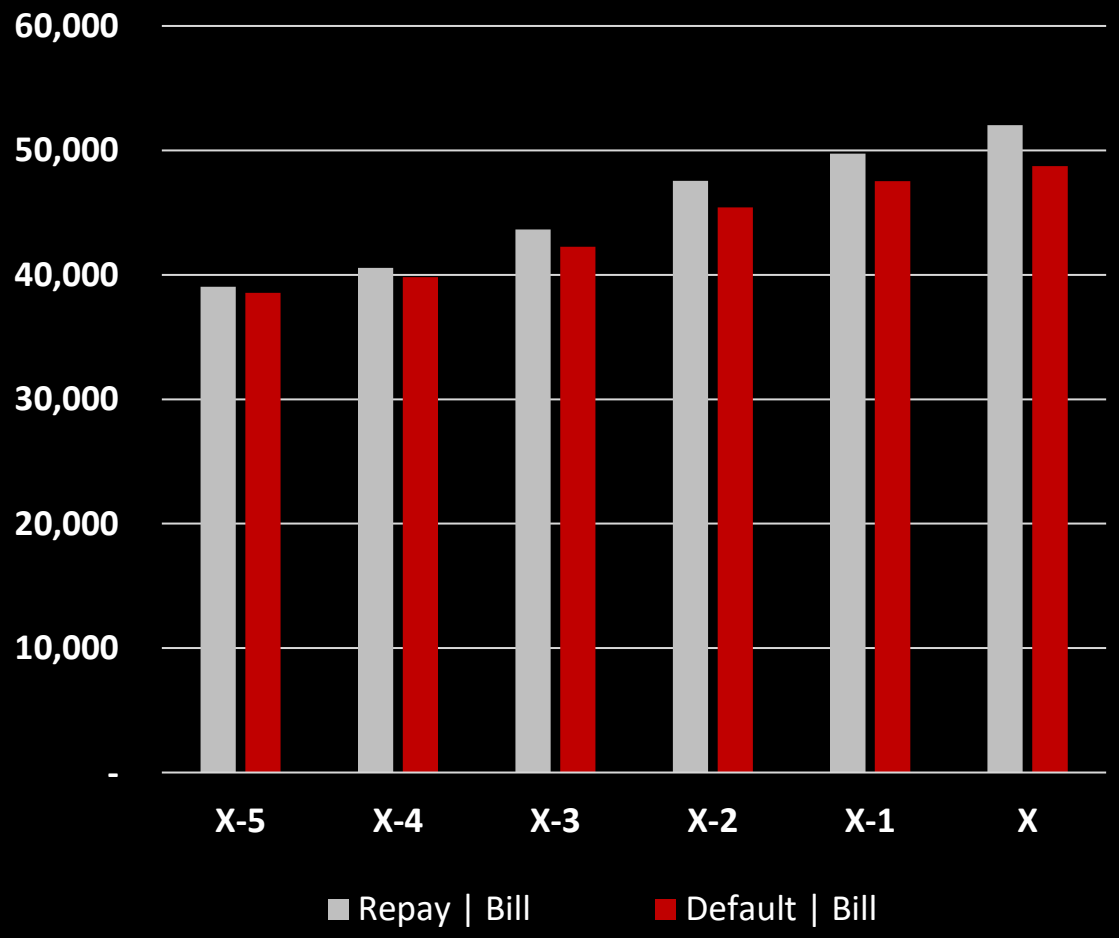


*Average Total Bill: Average of bill statement from period X-5 to period X

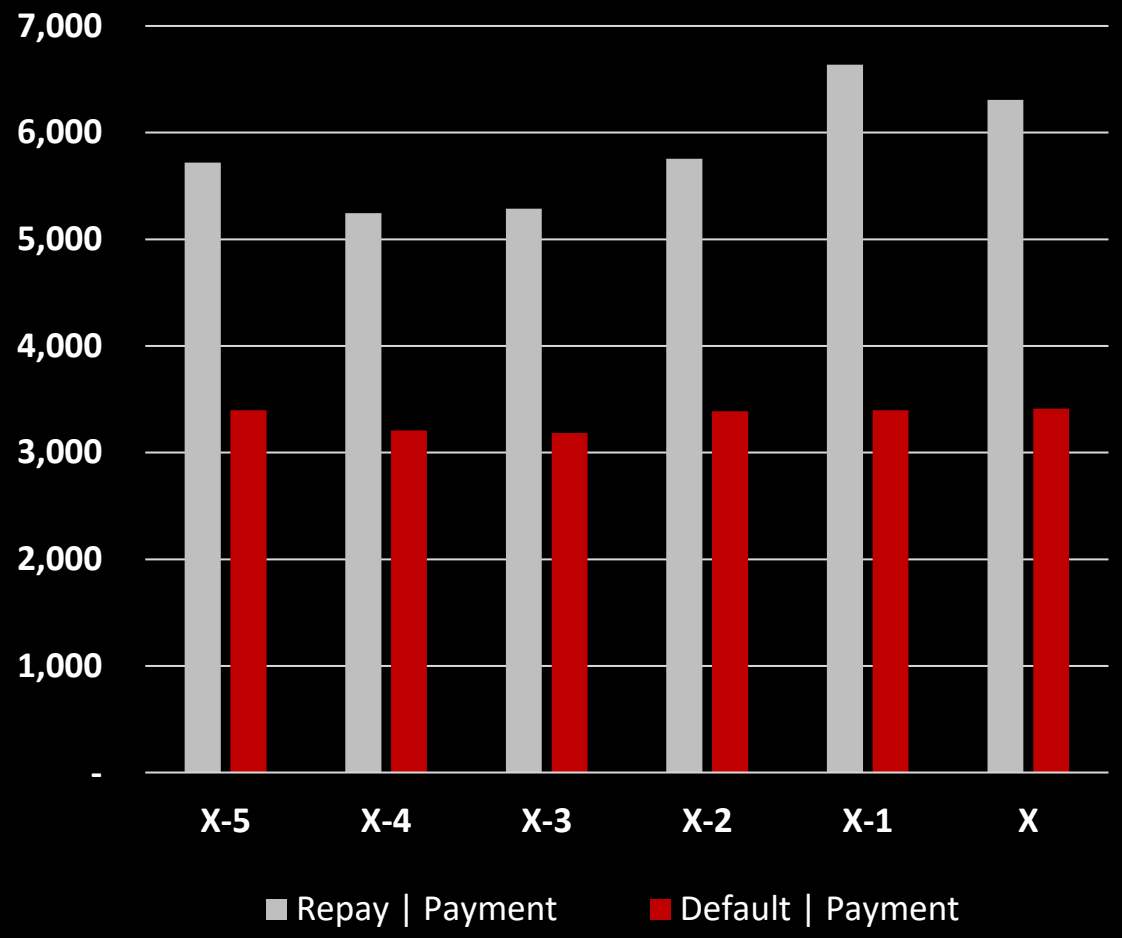
**Average Total Payment: Average of pay amount from period X-5 to period X

As-Is Analysis (2/3)

Average bill amount by client default status

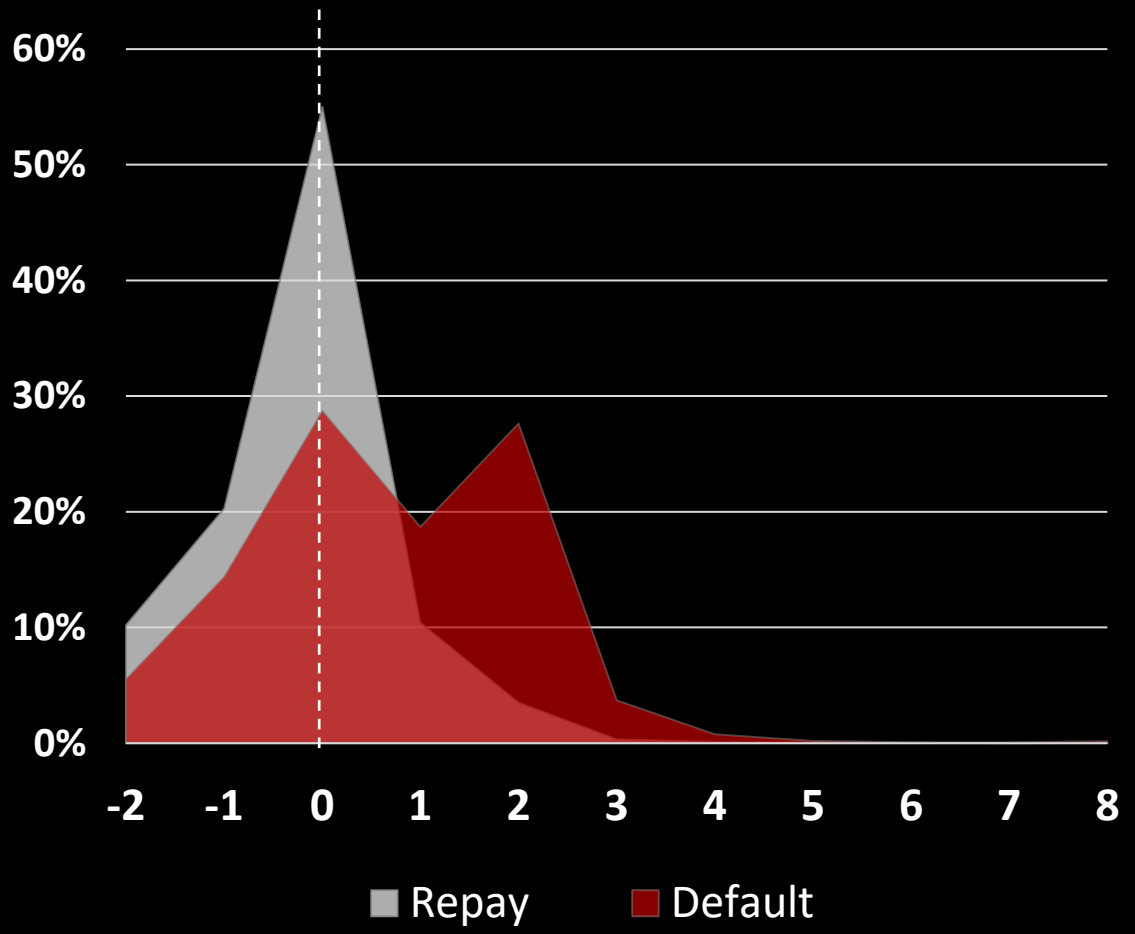


Average pay amount by client default status



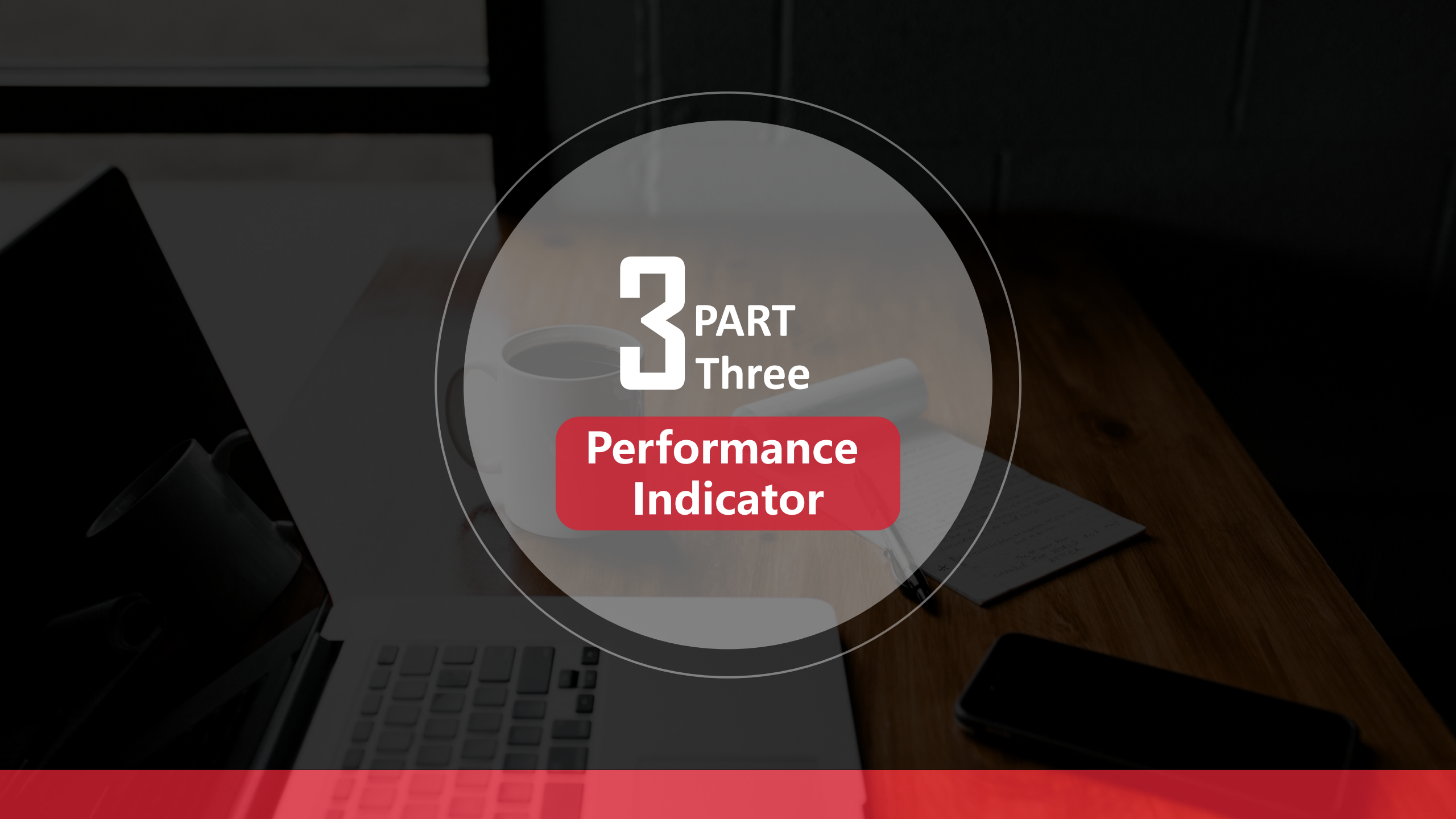
As-Is Analysis (3/3)

The repayment status in period X



X axis represents …

-2: No consumption/transaction
-1: Paid in full
0: small payment
1: payment delay for one period
2: payment delay for two periods
…
8: payment delay for eight periods
9: payment delays for nine periods and above



3 PART Three

Performance Indicator

Performance Indicator(1/2)

Confusion Matrix		Actual	
		Repay	Default
Predict	Repay (Approve loan)	A	C
	Default (Deny loan)	B	D

- **A -** Approve the loan and customer pay back
- **B -** Deny the loan but customer can pay back ▶ **Opportunity Cost**
- **C -** Approve the loan but customer would default ▶ **Loss on default**
- **D -** Deny the loan and customer would default

Performance Indicator(2/2)

Cost Matrix		Actual	
		Repay	Default
Predict	Repay (Approve loan)		(C) 5
	Default (Deny loan)	(B) 1	

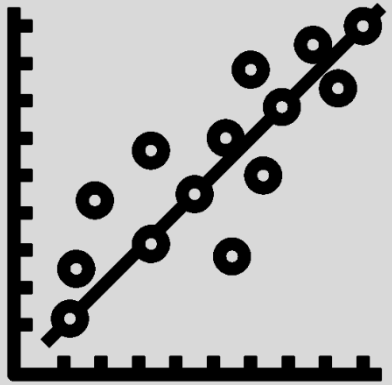
German credit data [Michie et al., 1994]

- Cost of B:C = 1:5
- **Expected Cost = Probability(B) * 1 + Probability(C) * 5**
- Find the **minimum** Expected Cost

4 PART Four

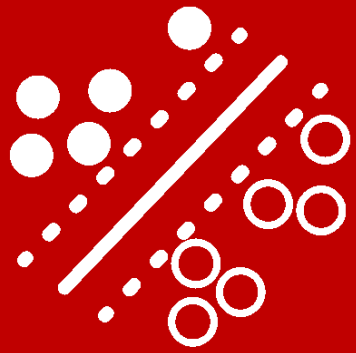
Model Selection

Machine Learning Models



Created by Becris.
From Noun Project

Logistic Regression



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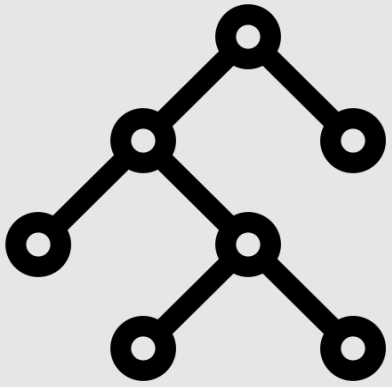
Support Vector Machine(SVM)



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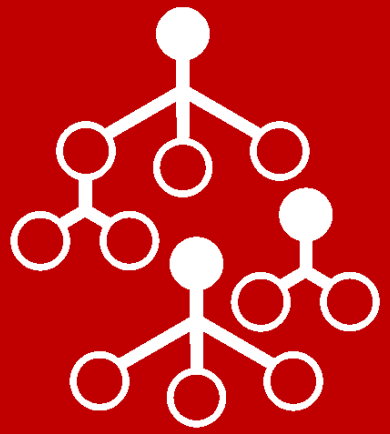
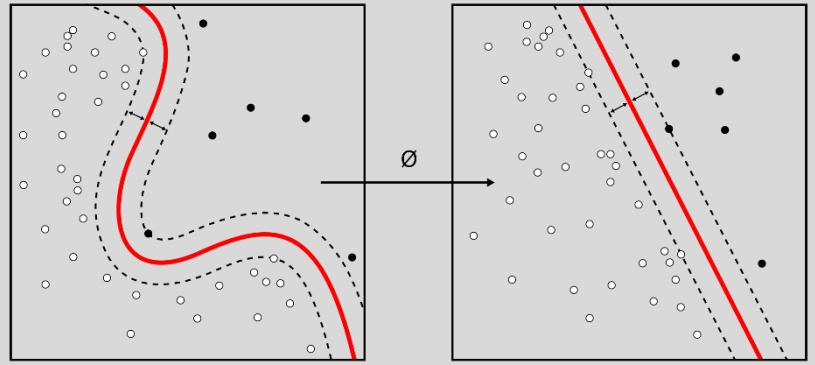
Decision Tree



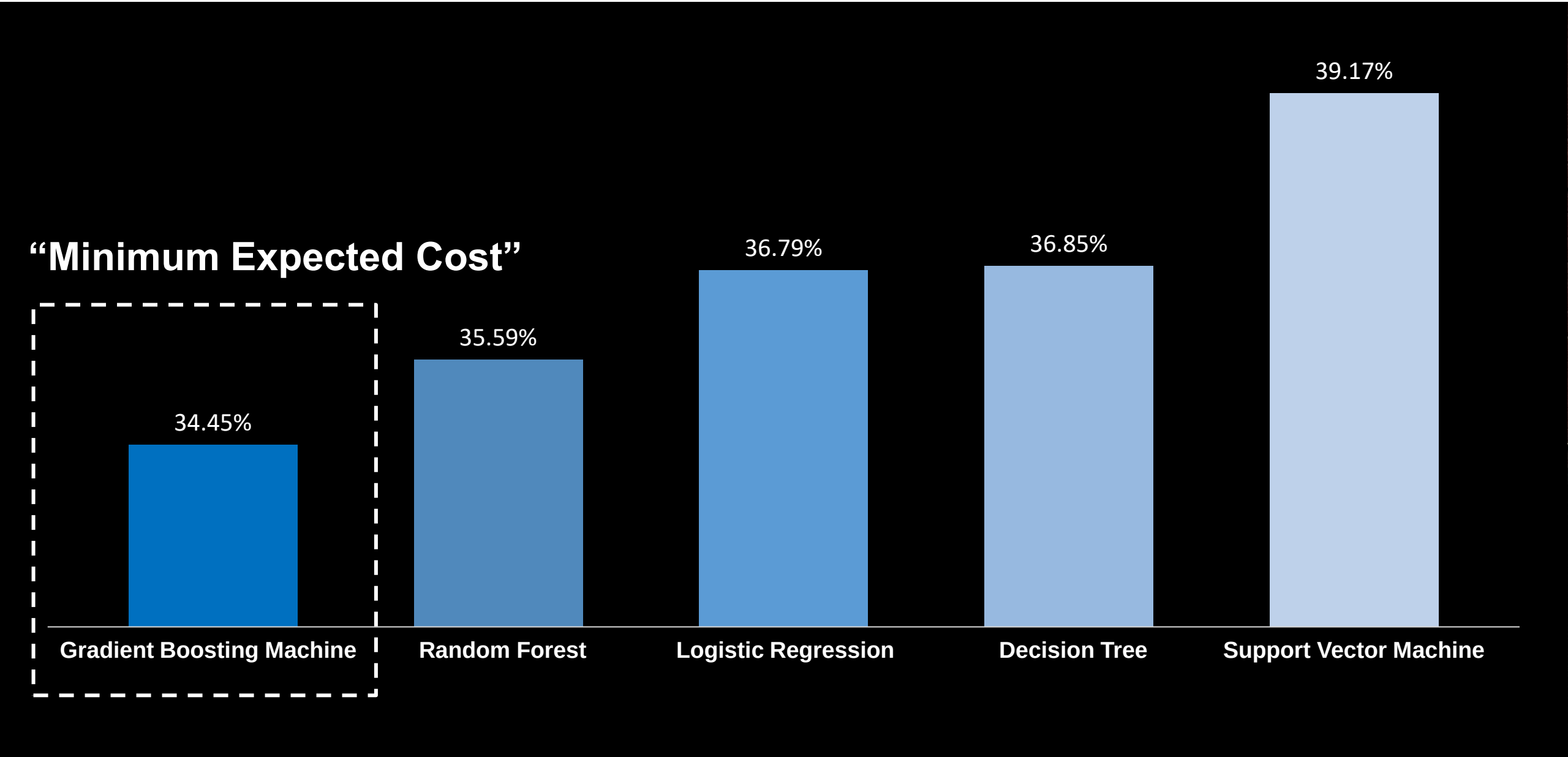
Created by sachin modgekar
from the Noun Project

Random Forest



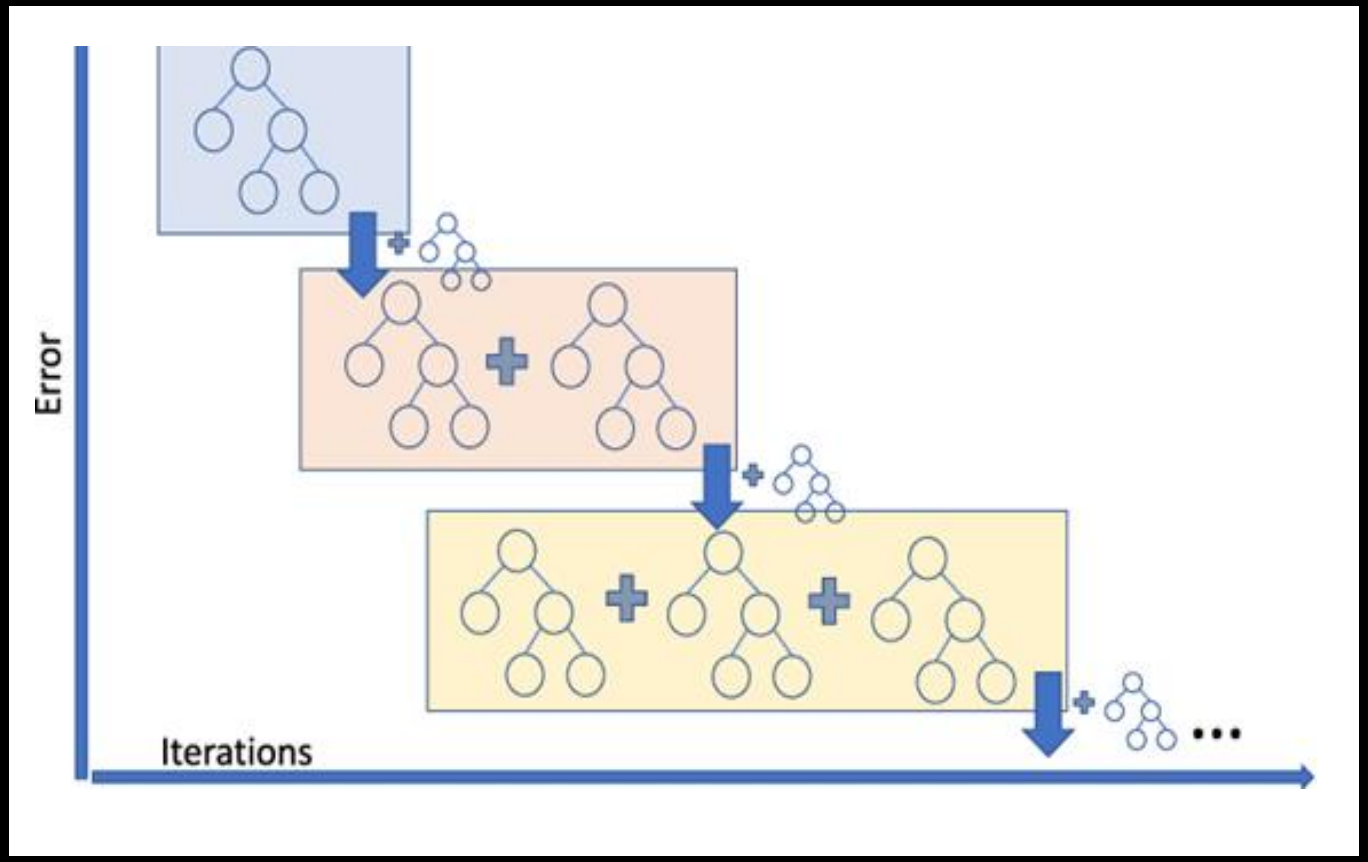
Gradient Boosting Machine(GBM)

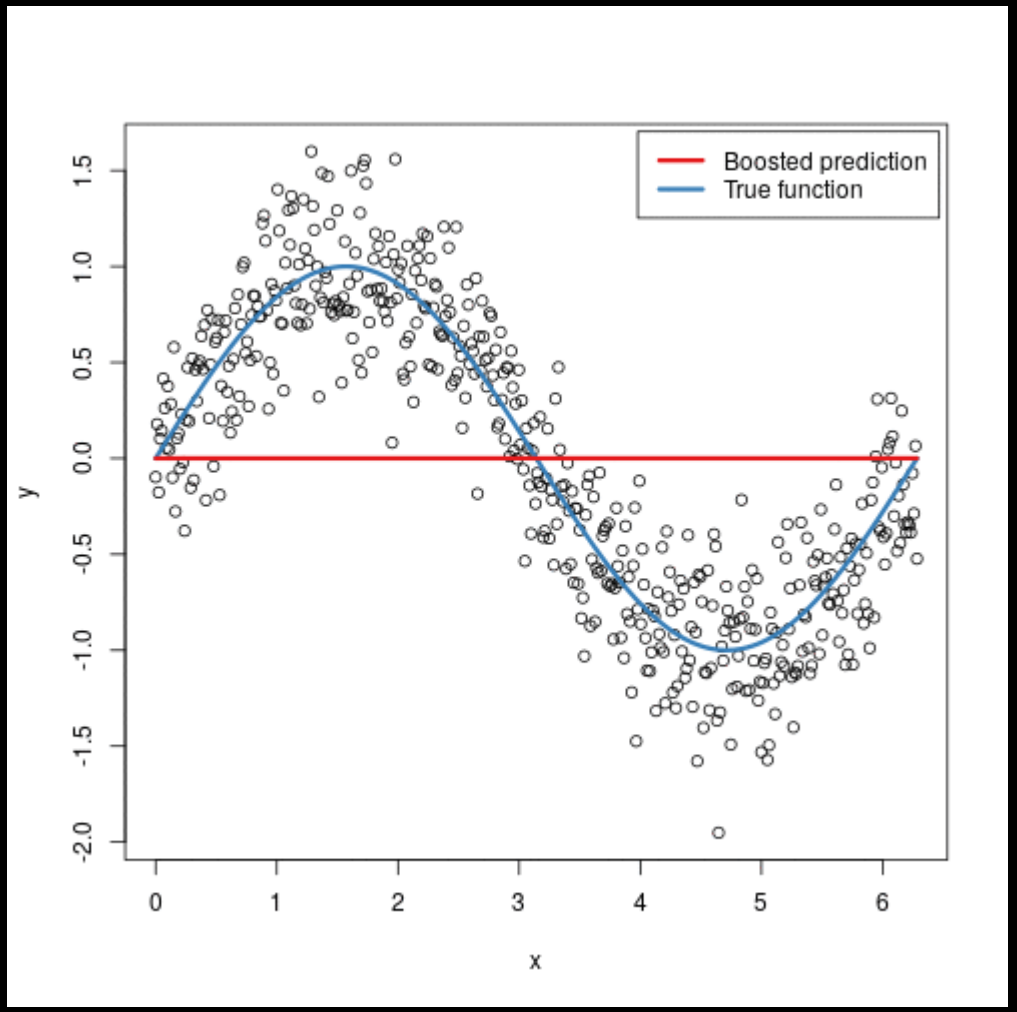
Expected Cost for each models



What is Gradient Boosting Machine?

GBM aggregates an **ensemble of individual models** to obtain a **more accurate** final model.





sources: https://medium.com/analytics-vidhya/what-is-gradient-boosting-how-is-it-different-from-ada-boost-2d5ff5767cb2
https://www.researchgate.net/figure/A-simple-example-of-visualizing-gradient-boosting_fig5_326379229 [accessed 5 Dec, 2021]
https://github.com/bgreenwell

Model Development > Data Preparation (1/2)

Change in payment status

Assumption: Customers' payment statuses will worsen over time if they are likely to default

- If payment status worsens by comparing previous period then assign 1, else assign 0

- PY1: The repayment status in period X
- PY2: The repayment status in period (X-1)
  …
- PY6: The repayment status in period (X-5)

- PY1D = IF(PY1 > PY2, 1, 0)
- SumPYD = PY1D+PY2D+PY3D+PY4D+PY5D

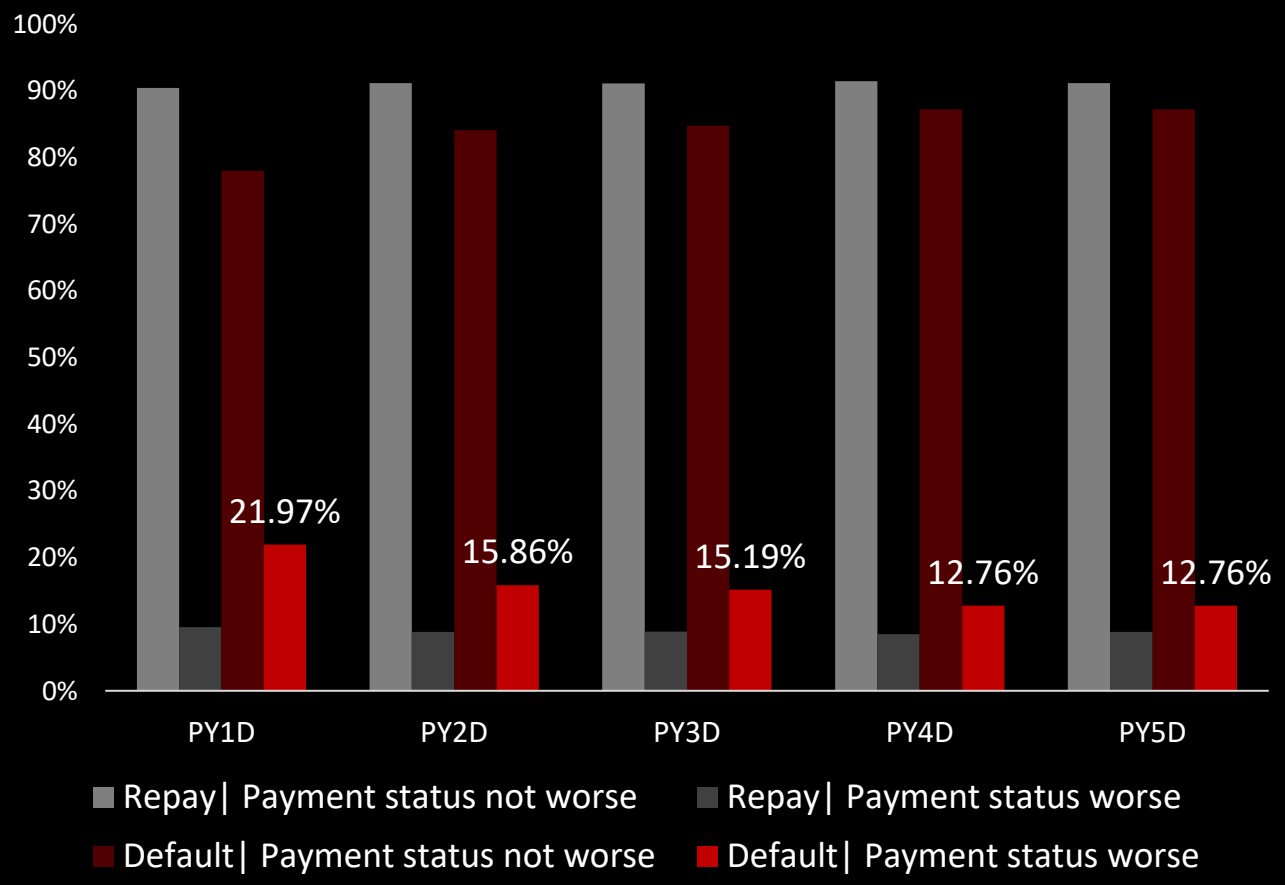
Example

PY1	PY2	PY3	PY4	PY5	PY6	New Variable
3	1					PY1D = 1
	1	0				PY2D = 1
		0	0			PY3D = 0
			0	-1		PY4D = 1
				-1	-1	PY5D = 0
						SumPYD = 3

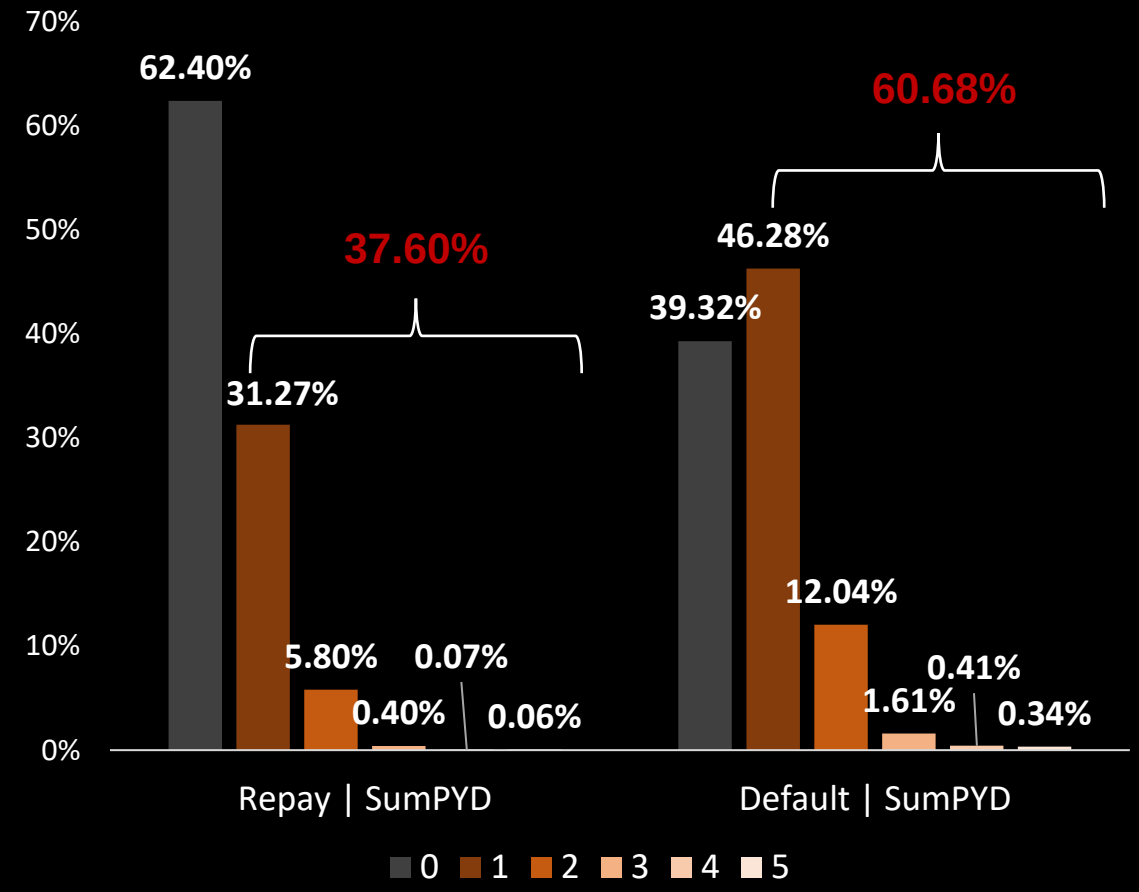
Model Development > Data Preparation (2/2)

Change in payment status

Change in payment status in given time



Sum of change in payment status



Model Development > Result

Confusion Matrix		Actual	
		Repay	Default
Predict	Repay (Approve loan)	3625	451
	Default (Deny loan)	1033	853

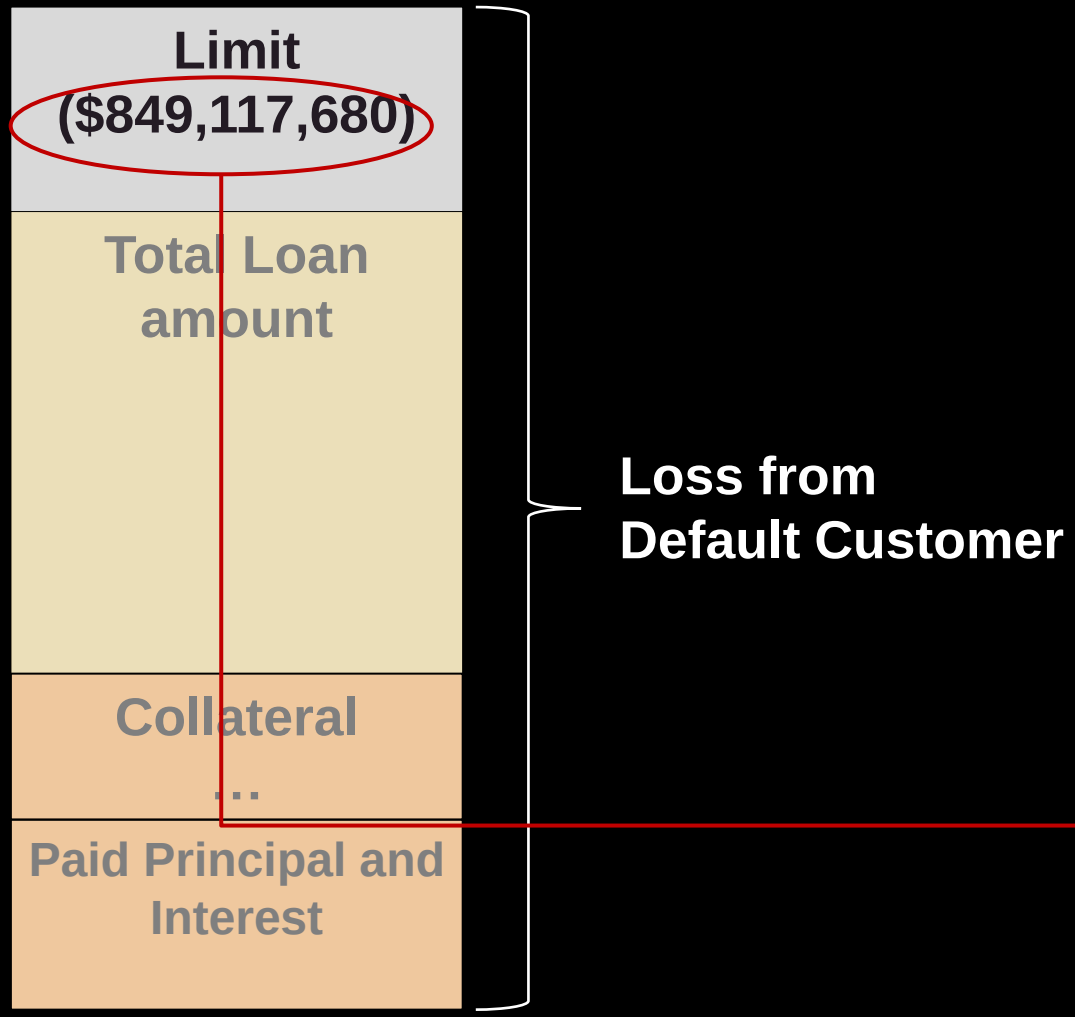
- Expected Cost = Probability(B) * 1 + Probability(C) * 5
  = 1033/5965 *1 + 451/5965 *5
  = 34.45 %

5 PART Five

Conclusion

Expected Cost Assumption

Loss from default customer for Universal Plus

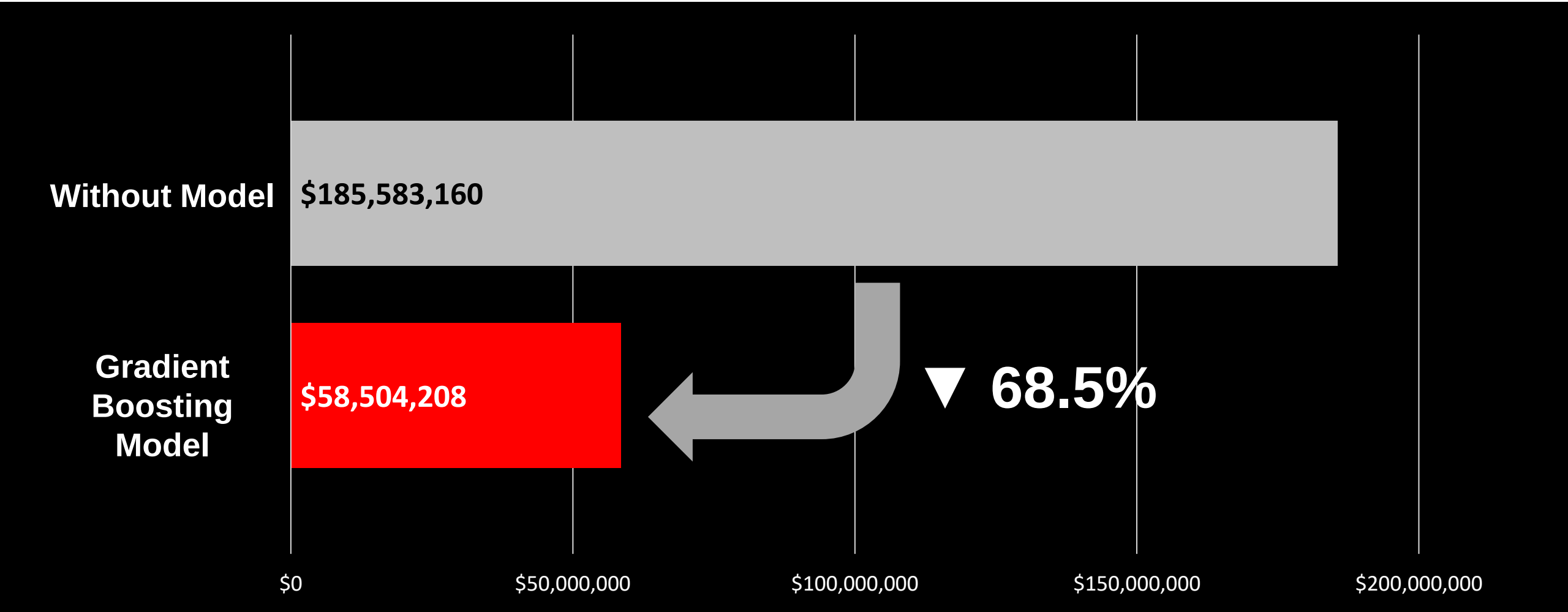


Cost Matrix for Universal Plus

Cost Matrix		Actual	
		Repay	Default
Predict	Repay (Approve loan)		(C) 5
	Default (Deny loan)	(B) 1	

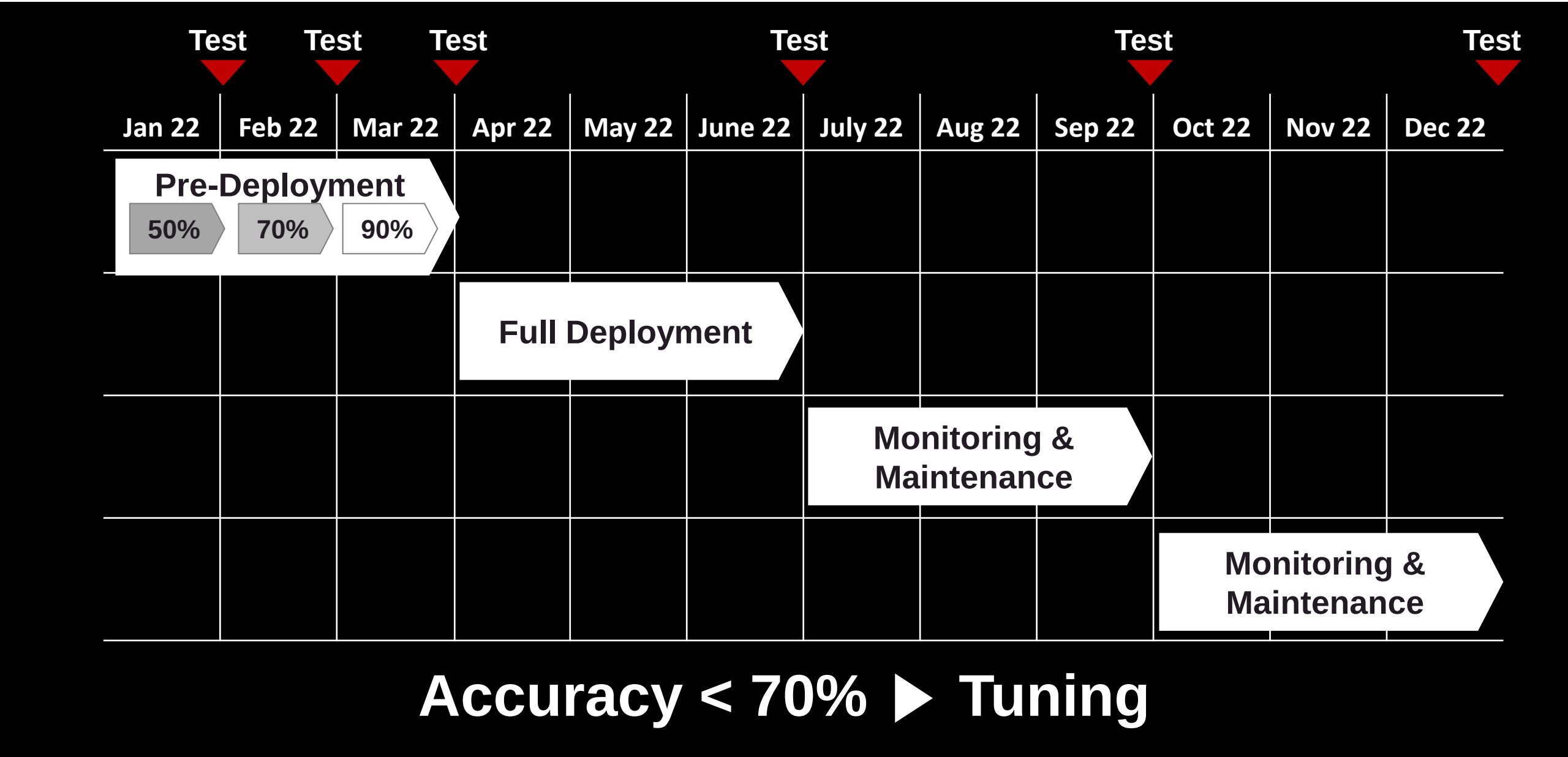
- Cost of B:C = 1:5
  = **$169,823,536 : $849,117,680**

Expected Cost Reduction



“Total Saving: $127,078,952”

Deployment Plan



Thank you