Bank Telecaller Decision Support System

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Outline

- Introduction
- Dataset
- User Stories
- Analysis
- Dashboard Demo
- Challenges
- Conclusion

Introduction

- Market research sector valued over \$47 billion in 2018
- Growth rate exceeded the Global GDP, at 10%
- JPMorgan Chase spent over \$1 billion on marketing in 2018

The Dataset

- Bank Marketing Data Set [1] UC Irvine's machine learning repository
- Collected between May 2008 to November 2010
- 41188 samples and 20 features

Direct marketing campaigns of a Portuguese banking institution

marital	age	month	day_of_week	job	education	housing	loan	duration	campaign	contact	у
married	56	may	mon	housemaid	basic.4y	no	no	261	1	telephone	no
married	57	may	mon	services	high.school	no	no	149	1	telephone	no
married	37	may	mon	services	high.school	yes	no	226	1	telephone	no
married	40	may	mon	admin.	basic.6y	no	no	151	1	telephone	no
married	56	may	mon	services	high.school	no	yes	307	1	telephone	no
married	45	may	mon	services	basic.9y	no	no	198	1	telephone	no
married	59	may	mon	admin.	professional.course	no	no	139	1	telephone	no
married	41	may	mon	blue-collar	unknown	no	no	217	1	telephone	no
single	24	may	mon	technician	professional.course	yes	no	380	1	telephone	no
single	25	may	mon	services	high.school	yes	no	50	1	telephone	no

Our interest

- Maximize the output of the marketing campaigns
- How?
 - => By knowing who to target for the campaign

How can we take calls from this



to this?



User Stories

Upper management:

• Understand potential success rate of campaign to optimize campaign investment

Telecaller:

• Able to call the customers who are more likely to purchase the product

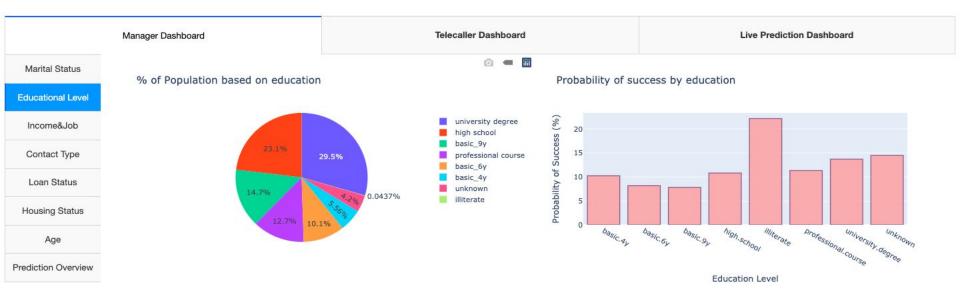
Analysis

- Important features
- Probability prediction for current bank customers
- User input prediction for future customers

Analysis - Important features

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- Individual analysis and visualization
- For managers to get actionable insights



Analysis - Current Customers

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- Predicting probability of success
- Optimizing telemarketers' calls

					100				
Manage	er Dashboard		Ţ	relecaller Dashboard	Live Prediction Dashboard				
Customer ID	♦ Age	\$	Income	Previously Contacted	\$	Probability of Success	\$	Call Result	
filter data									
39334	30		No Income	Success		93.0%		Success	
39222	34		Higher Income	Success		90.0%		Not Called	
40276	68		No Income	Success		89.0%		Not Called	
41053	23		No Income	Success		89.0%		Not Called	=
40574	45		Higher Income	Success		89.0%		Failure	-
39224	55		No Income	Success		89.0%		Not Called	7
39738	28		Higher Income	Success		89.0%		Not Called	
40735	60		No Income	Success		89.0%		Not Called	
40419	41		Higher Income	Success		88.0%		Not Called	
39803	48		Higher Income	Success		88.0%	1	Not Called	7
	Customer ID filter data 39334 39222 40276 41053 40574 39224 39738 40735 40419	filter data 39334 30 39222 34 40276 68 41053 23 40574 45 39224 55 39738 28 40735 60 40419 41	Customer ID \$\to\$ Age \$\to\$ 39334 30 30 39222 34 40276 68 41053 23 45 40574 45 45 39224 55 39738 28 40735 60 40419 41	Customer ID \$\phi\$ Age \$\phi\$ Income 39334 30 No Income 39222 34 Higher Income 40276 68 No Income 41053 23 No Income 40574 45 Higher Income 39224 55 No Income 39738 28 Higher Income 40735 60 No Income 40419 41 Higher Income	Customer ID ♣ Age ♣ Income ♣ Previously Contacted 39334 30 No Income Success 39222 34 Higher Income Success 40276 68 No Income Success 41053 23 No Income Success 40574 45 Higher Income Success 39224 55 No Income Success 39738 28 Higher Income Success 40735 60 No Income Success 40419 41 Higher Income Success	Customer ID ♣ Age ♣ Income ♣ Previously Contacted ♣ 39334 30 No Income Success 39222 34 Higher Income Success 40276 68 No Income Success 41053 23 No Income Success 40574 45 Higher Income Success 39224 55 No Income Success 39738 28 Higher Income Success 40735 60 No Income Success 40419 41 Higher Income Success	Customer ID ♣ Age ‡ Income ₱ Previously Contacted ₱ Probability of Success 39334 30 No Income Success 93.0% 39222 34 Higher Income Success 90.0% 40276 68 No Income Success 89.0% 41053 23 No Income Success 89.0% 40574 45 Higher Income Success 89.0% 39224 55 No Income Success 89.0% 39738 28 Higher Income Success 89.0% 40735 60 No Income Success 89.0% 40419 41 Higher Income Success 88.0%	Customer ID ♣ Age ♣ Income ♣ Previously Contacted ♣ Probability of Success ♣ 39334 30 No Income Success 93.0% 39222 34 Higher Income Success 90.0% 40276 68 No Income Success 89.0% 41053 23 No Income Success 89.0% 40574 45 Higher Income Success 89.0% 39224 55 No Income Success 89.0% 39738 28 Higher Income Success 89.0% 40735 60 No Income Success 89.0% 40419 41 Higher Income Success 88.0%	Customer ID ♦ Age ‡ Income ‡ Previously Contacted ‡ Probability of Success ‡ Call Result 39334 30 No Income Success 93.0% Success 39222 34 Higher Income Success 90.0% Not Called 40276 68 No Income Success 89.0% Not Called 41053 23 No Income Success 89.0% Not Called 40574 45 Higher Income Success 89.0% Failure 39224 55 No Income Success 89.0% Not Called 39738 28 Higher Income Success 89.0% Not Called 40735 60 No Income Success 89.0% Not Called 40419 41 Higher Income Success 88.0% Not Called

Analysis - Future Customers

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 Predicting the probability of success for future customers based on logistic regression

Manager Dashboard	Telecaller Dashboard	Live Prediction Dashboard
Enter	number of employees (quarterly indicator): 5000	
	Enter the outcome of the previous marketing campaign: 1	
Enter the e	employment variation rate - quarterly indicator: -1.8	
Enter the	number of days since the last call (999 if NA): 3	
Enter	the euribor 3 month rate (daily indicator): 0.634	
Enter the no	income indicator, 1 if the customer job retired, student or unemploy	red 1
	Probability of Success:	
	Enter number of employees (quarterly indicator): 5000	

DEMO

Challenges

- Model selection
- Live prediction

Conclusion

- Predicted call results with 90% accuracy
- Generated actionable insights for upper management by analysing important features
- Optimized telecaller decisions by providing accurate predictions
- Live prediction support

Test Coverage Report

TOTAL

Name Missing	Stmts	Miss	Cover
/Users/harshita/Desktop/Spring2020/ECE229/Project/new/ECE229-Project/dashboard.py	204	41	80%
587-604, 741-759, 767-772, 775-776			
/Users/harshita/Desktop/Spring2020/ECE229/Project/new/ECE229-Project/src/initpy	0	0	100%
/Users/harshita/Desktop/Spring2020/ECE229/Project/new/ECE229-Project/src/feature_extraction.py	56	0	100%
/Users/harshita/Desktop/Spring2020/ECE229/Project/new/ECE229-Project/src/pre_processing.py	55	4	93%
/Users/harshita/Desktop/Spring2020/ECE229/Project/new/ECE229-Project/src/prediction.py 52-54, 75, 77-102, 105-128, 158-161, 168	70	21	70%
test analysis.py	85	0	100%
test dashboard.py	32	3	91%
$12, \overline{39}-40$			
test feature extraction.py	33	0	100%
test pre processing.py	39	7	82%
20, 44-45, 53-54, 64-65			
test prediction.py	18	0	100%
test util.py	16	0	100%
/Users/harshita/Desktop/Spring2020/ECE229/Project/new/ECE229-Project/util.py	42	0	100%
/Users/harshita/Desktop/Spring2020/ECE229/Project/new/ECE229-Project/visualization/ init .py	0	0	100%
/Users/harshita/Desktop/Spring2020/ECE229/Project/new/ECE229-Project/visualization/analysis.py	89	6	93%
62-63, 121, 198-201	55	15	55.7
			

739 82 89%

Thank You

References:

[1] [Moro et al., 2014] S. Moro, P. Cortez and P. Rita. A Data-Driven Approach to Predict the Success of Bank Telemarketing. Decision Support Systems, Elsevier, 62:22-31, June 2014

[2] ECE143 WI'20 project of group 17, https://github.com/sepehrfrgh/ece143_direct_marketing