Week12 Power Company Case

Ask:

Describe analytics models and data that could be used to make good recommendations to the power company.

Here are some questions to consider:

- The bottom-line question is which shutoffs should be done each month, given the capacity constraints. One consideration is that some of the capacity – the workers' time – is taken up by travel, so maybe the shutoffs can be scheduled in a way that increases the number of them that can be done.
- Not every shutoff is equal. Some shutoffs shouldn't be done at all, because if the power is left on, those people are likely to pay the bill eventually. How can you identify which shutoffs should or shouldn't be done? And among the ones to shut off, how should they be prioritized?

Think about the problem and your approach. Then talk about it with other learners, and share and combine your ideas. And then, put your approaches up on the discussion forum, and give feedback and suggestions to each other.

Challenge:

Logistical problem in manually sending employees to shut-off power across the city

Given:

Customer details									
Customer name	Customer Location	MonthYear	Payment History	Age	Household income	Family composition	Other Asset	Other Asset value	
John Doe	SugarHill	202101	$60	30	60k	Married	Home	300k	
John Doe	SugarHill	202110	$0						
..									
Joe Dan	Decatur	202101	$0	25	40k	Single	None		0
Jack Doe	Decatur	202102	$0	28	100k	Single	Car	20k	

Customer-Power Usage				
Customer	Average Monthly consumption	Variance with prior month consumption	variance with prior quarter consumption	Number of days past due
John Doe	10700 KWh	-1000	-1000	30
Joe Dan	11000 KWh	5000	5000	120

External Factors					
YearMonth	Major Happening	Impacted Location	Unemployment	Energy Costs	12 month % change
202103	Storm	Atlanta, GA	4	11.4 c	7.2

Model & Findings:

Step#1:

Given "Customer detail", "Customer-Power Usage" in conjunction with External factors, use Classification SVM to category Customers who will most likely never pay vs. Customers who will eventually pay. Given above information, use DOE to obtain probability of "never" pay customers by conducting 'Final notice' experiments.

More details:

This step is the crucial step of the entire process to classify the candidates who will never pay vs. eventually pay group. As part of the classification model, I will use classifier line away from the "customer who never pay" category as the cost of misclassifying a customer who will eventually pay to the "never" pay category is more.

Also, in my opinion, the customers who will "never" pay will hold historically default (with higher value on cumulative past due days) with less dependency to external factors of unemployment, weather,etc…

Also, historically information of Employees who has longer past due days can be the first set of customers to target. Given the customers of "never" pay category, use design of experiments to send final notification via mail which is cheaper than manual power shutoff visits from Power company employees to obtain the probability of customers who will "never" pay. Customers will No response can be used as an additional check before generating the final list to move on to step#2.

Alternate Approach:

1) Given above data, use Random forest model to classify the customers into "never" pay and "eventually pay" category. Using this model, predict the customers who will never pay (assuming historical information about the "never pay" employees has been captured.

Step#2:

Given input of previous model' output ("never pay" customers) and customer Location from "Customer Detail", use K-Means to cluster the Customers who are located to the close locations. Order the clusters by highly populated of predicted "never pay" customers and target each locations for Power shutoff every month. This will reduce the employees travel time and being dispersed across the entire city. Since the intention of the power company is to collect the past due and not punishments, the priority order can be defined and Customers with high past due days can be targeted first. This could promote local/neighborhood awareness of actions taken by Power Company which may lead to payment from the "never pay" customer.

This awareness process can again be used as exploration- exploitation model to identify probabilities of payments as we move to next neighborhood. The neighborhoods that are closer to each other can be targeted every month to take advantage of impact of local awareness to this initiative to encourage payment

Alternate/Extension Approach:

Optimization model can be used to understand the best sequence to follow for power shut off.

*********End of Power company Case study*********