

Week 13 Homework

Goal: Determine which customer's power should be shut off for failure to pay bill. We should only consider customers that we believe are capable of paying and but do not, rather than all non-paying customers. From that subset we should prioritize which of the capable of paying customers should be shut off to maximize company revenue, based on forecasted power usage and power prices. Finally, based on the priority we should determine which can be shut off based on worker availability

Data Needed:

Payment History (both number of missed payments and current amount due, and previous amount of on time payments)

Income

Credit Score

Debt Level

Own vs. Rent Home

Duration at Current Residence

Power usage history

Historical power prices

Probability of being able to pay (output of model 1)

Forecasted power usage (output of model 2)

Forecasted power costs (output of model 3)

Cost to shut off power

Expected value of shutoff (Output of model 4)

Location of each customer

Starting and ending location of workers

Number of available shutoff workers

Average time required per shutoff

Variance of required time to shutoff

Hours worked per day

Model 1: Determine which of the non-paying customers are capable of paying

Given: Payment History (both number of missed payments and current amount due, and number of previous on time payments), Income, Credit Score, Debt Level, Own vs. Rent Home, Duration at Current Residence.

Use: Logistic Regression.

To: Determine probability that customer is able to pay.

Model 2: Estimate Future Power Usage

Given: Power usage history, historical power prices.

Use: Exponential Smoothing.

To: Estimate future power usage.

Model 3: Estimate Future Power Prices

Given: Historical Power Prices.

Use: Exponential Smoothing.

To: Estimate future power prices.

Note: There may be much better estimates of future prices available from outside sources that we may want to consider.

Model 4: Prioritize Shutoffs

Given: Forecasted power usage (output of model 2), forecasted power costs (output of model 3), probability of being able to pay (output of model 1), cost to shut off power.

Use: Weighted combination of model factors.

To: Calculate expected value of shutting off each customer.

Model 5: Determine best selection of customers to shut off based on priority (output of model 4) and availability of labor

Given: Expected value of shutoff (Output of Model 4), location of each customer, starting and ending location of workers, Number of available shutoff workers, avg. time required per shutoff, variance of required time to shutoff, hours worked per day.

Use: Clustering, Simulation, or Optimization

To: Determine which grouping of shutoff customers maximizes expected value to the company given worker constraints.

We would first use clustering to assign each worker a cluster of customers, choosing the number of clusters based on the number of available workers. We would then optimize within each cluster so that the customers shut off maximized value to the company based on the constraints of the number of homes the worker could reach in a given day based on average shut off time and travel time. We could alternatively use simulation to determine the best homes in each cluster. This could be a better alternative if there is significant variability in shut-off time at each home.