

# Impact of Offering Tech Support and a Discount Alongside Software Sales

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Scenario: A software company,  
having run two sales campaigns,  
offering tech support and a discount,  
is seeking strategic guidance

# Synthetic Data Sourced from Kaggle

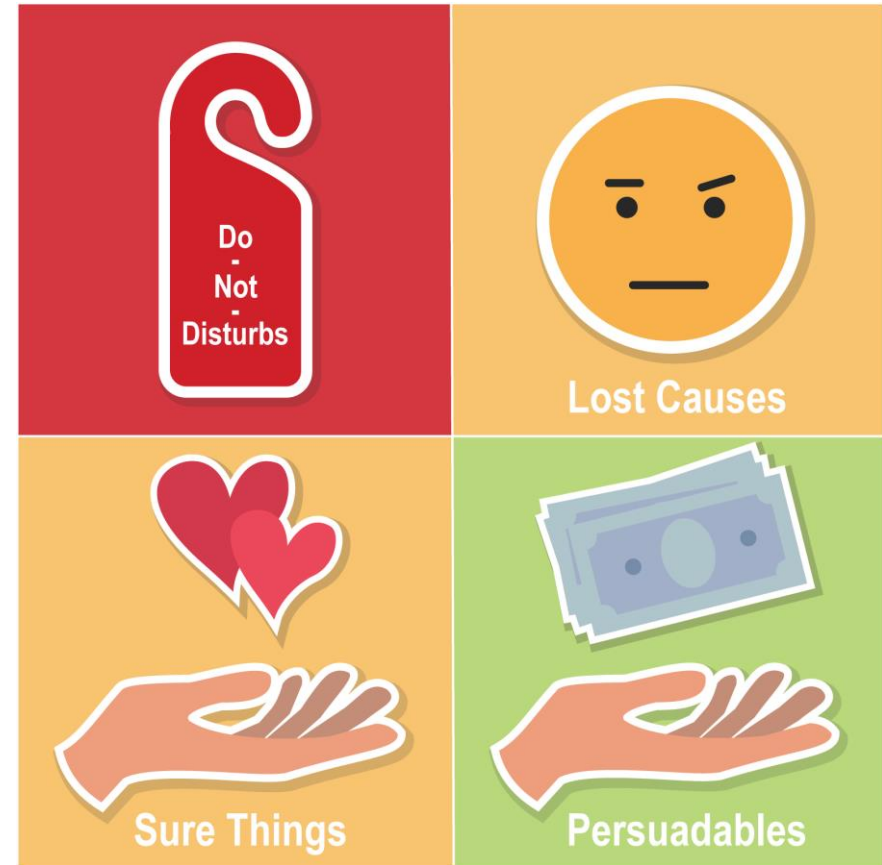
- Data is clean. Contains 2000 customer sales with 11 columns
- Columns:
  - Yearly revenue from customer (Outcome)
  - 2 Treatments
    - Tech Support & Discount
  - 4 Binary descriptors
    - Global, Major, SMC, Commercial
  - 4 Continuous descriptors
    - IT Spend, Employee Count, PC Count, Size given by yearly revenue

# Objectives

- Report on the effect of sales campaigns
  - Average revenue from customers given tech support? Discount?
  - Which customers should be offered tech support and/or discount?
    - What percentage?
- Provide guidance for sales team
  - Which customers should sales team focus on?
    - How can the sales team convert these customers?
      - Offer tech support? Offer discount?

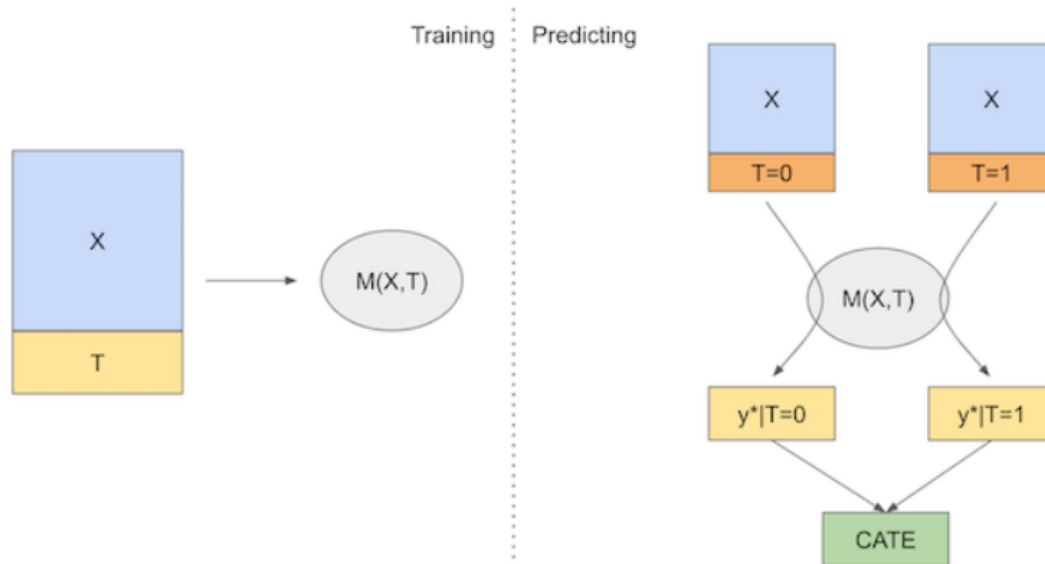
# Uplift Modeling Provides More Nuanced Effect and Informative Guidance

- Not all customers are equal:
  - Want to target Persuadables and leave the rest alone
- Uplift allows us to estimate the treatment effect and predict the outcome of new customers

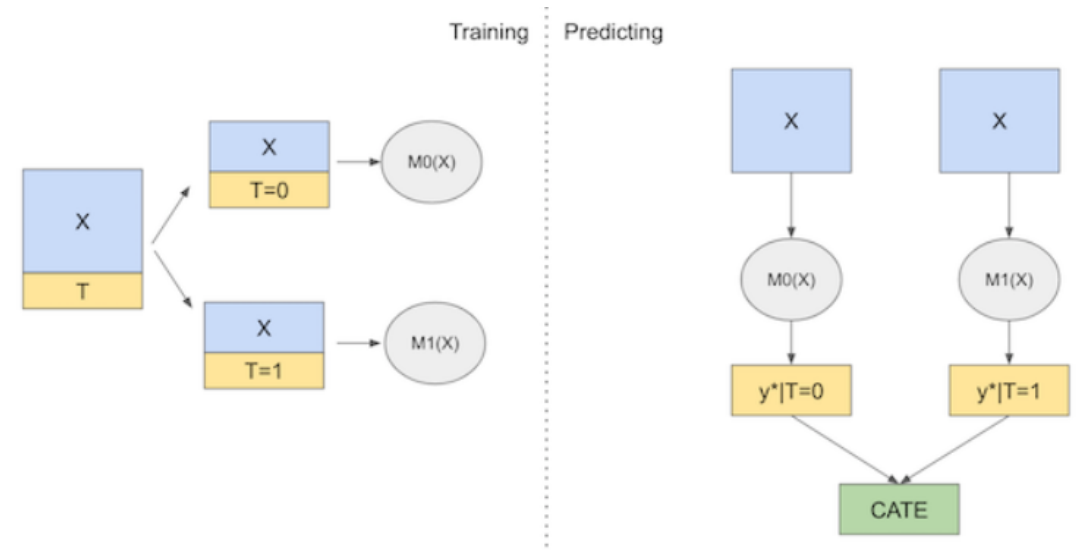


# Approximating Treatment Effects via Uplift

## S-Learner

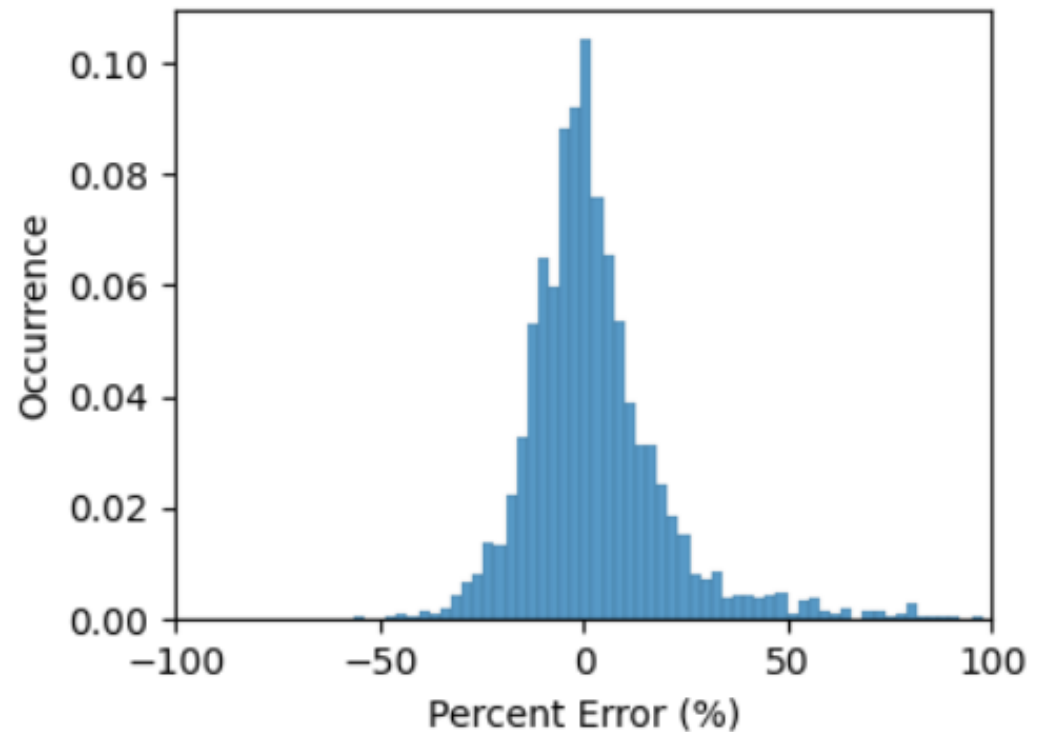


## T-Learner



# T-Learner Outperforms S-Learner in Training: S-Learner

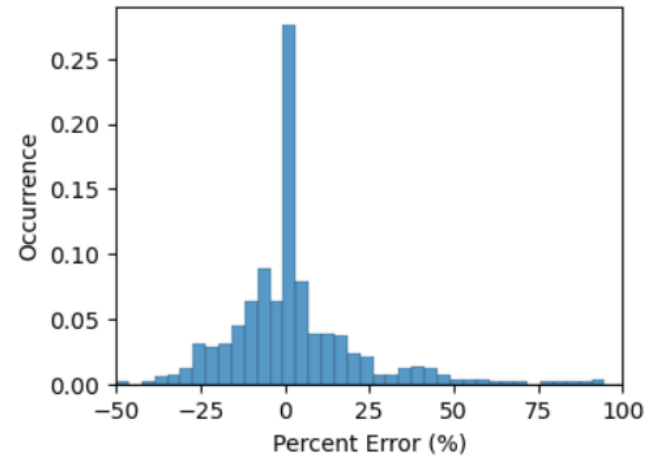
- Random Forest Regressor
- **Mean abs % error : 13.58**
- **Std abs % error : 26.88**
- Mean % error : 4.26
- Std % error : 29.81
- Median % error : 0.37



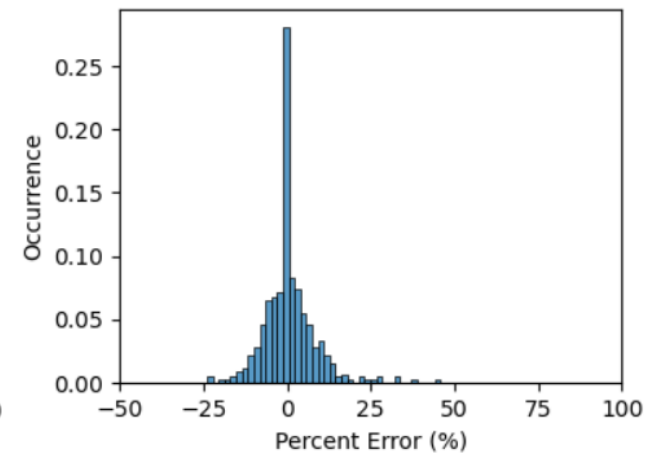
# T-Learner Outperforms S-Learner in Training: T-Learner

- Linear Regressor
- **Mean abs % error: 4.8**
- **Std abs % error: 7**
- Mean % error: 1.68
- Std % error: 14.09
- Median % error: 0

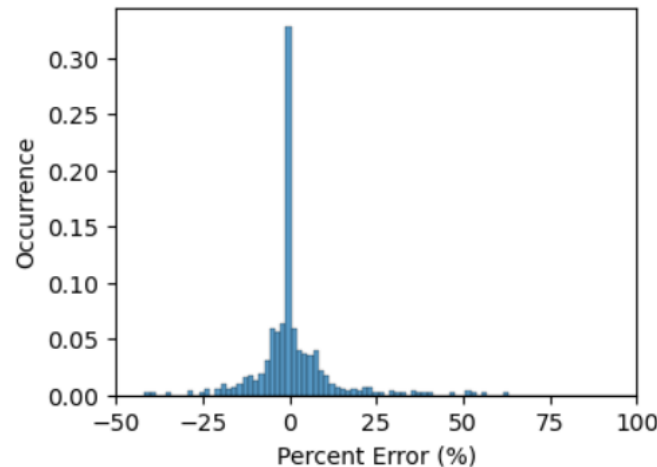
No Tech Support, No Discount



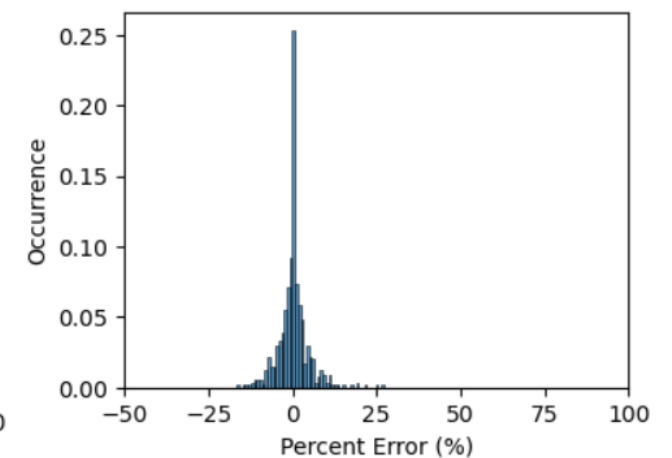
Tech Support, No Discount



Tech Support, No Discount



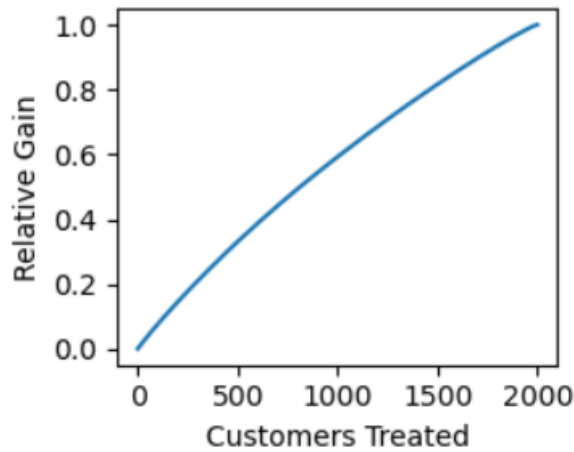
Tech Support, Discount





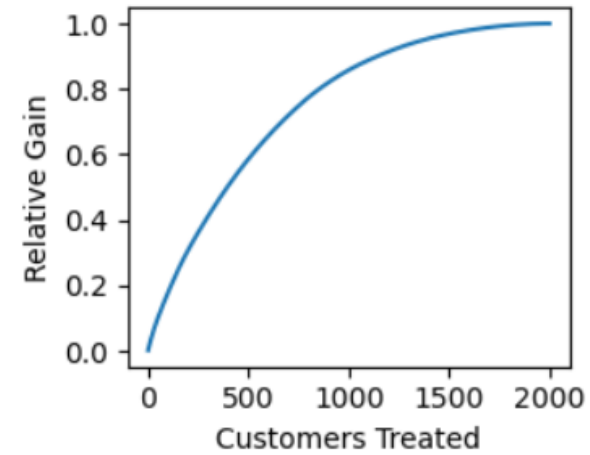
# S-Learner and T-Learner Qualitatively Identical Predictions: S-Learner

## Effect of Tech Support



- Total Gain: \$13.8 M
- **Offering Tech Support increases expected revenue for all customers**
- Tech Support not to exceed \$6900/customer

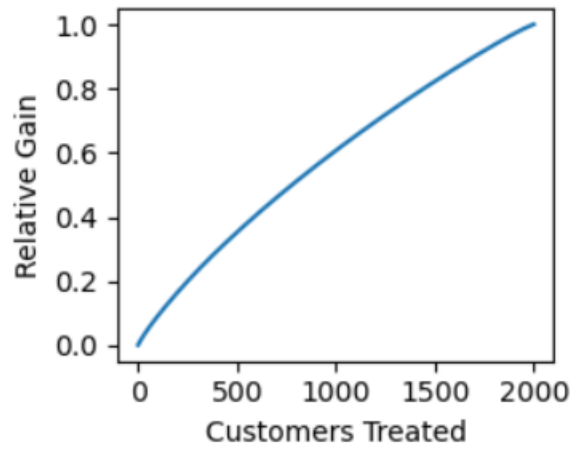
## Effect of Discount



- Total Gain: \$10.3 M
- **Offering Discount increases expected revenue for 98.65% of customers**
- **Can net 87% of total expected gain by offering discount to 50% of customers**

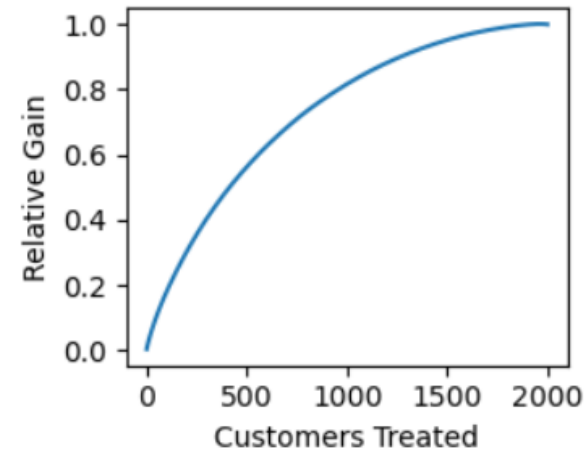
# S-Learner and T-Learner Qualitatively Identical Predictions: T-Learner

## Effect of Tech Support



- Total Gain: \$14.5 M
- **Offering Tech Support increases expected revenue for all customers**
- Tech Support not to exceed \$7260/customer

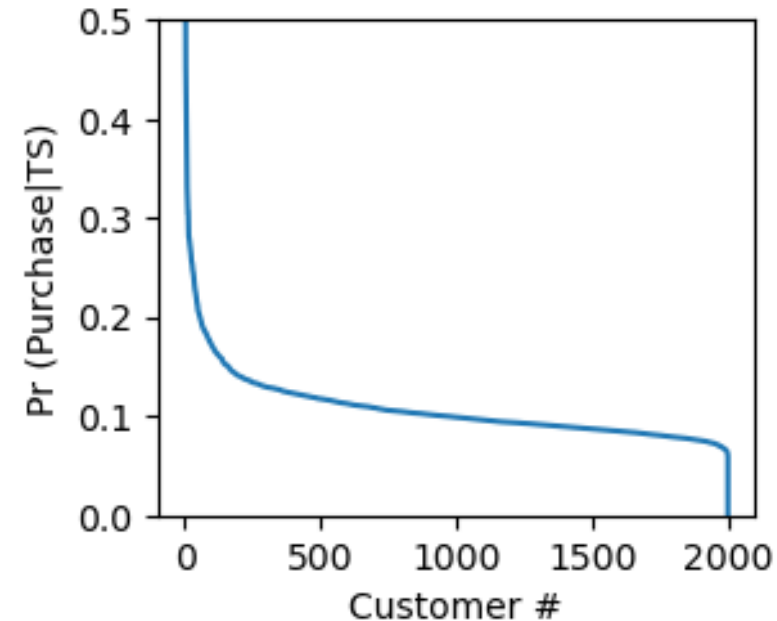
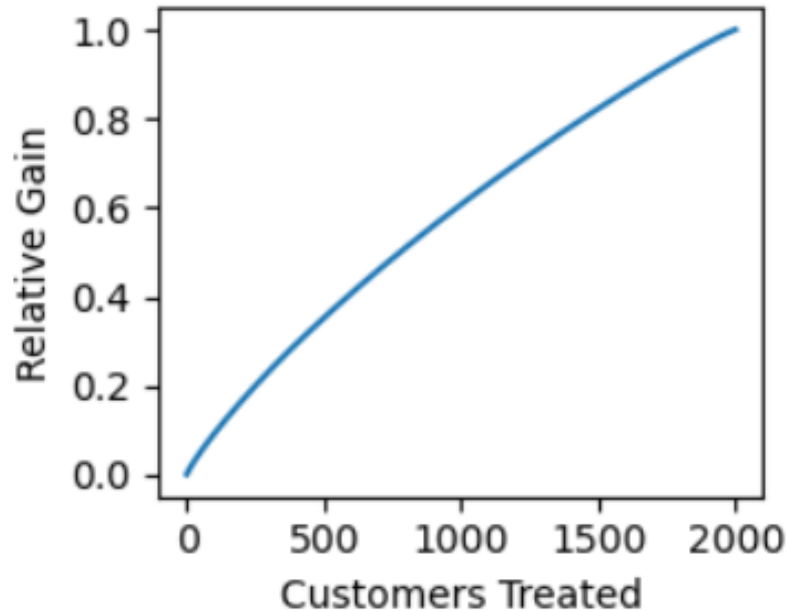
## Effect of Discount



- Total Gain: \$11.5 M
- **Offering Discount increases expected revenue for 98.25% of customers**
- **Can net 82% of total expected gain by offering discount to 50% of customers**

# Tech Support Doubles Likelihood of Sale

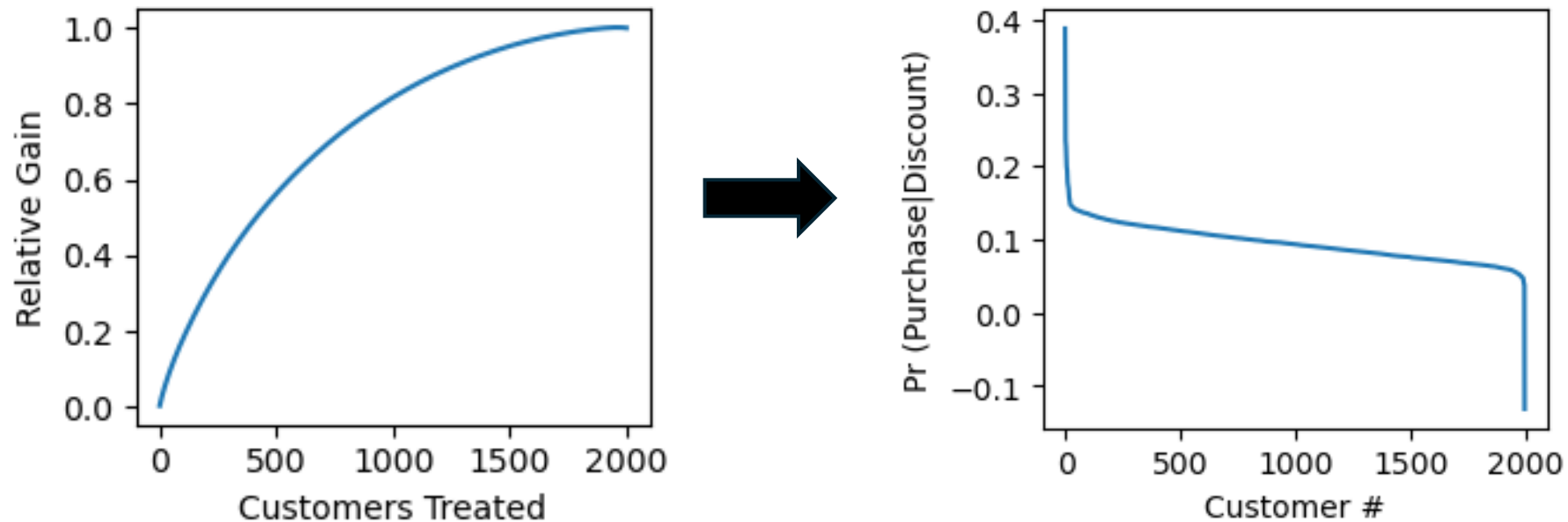
$$\text{Gain} = \text{Pr}(\text{Purchase}|\text{TS}) * \text{Cost} - \text{Pr}(\text{Purchase}|\text{No TS}) * \text{Cost}$$



Assumes  $\text{Pr}(\text{Purchase}|\text{No TS}) = 0.05$

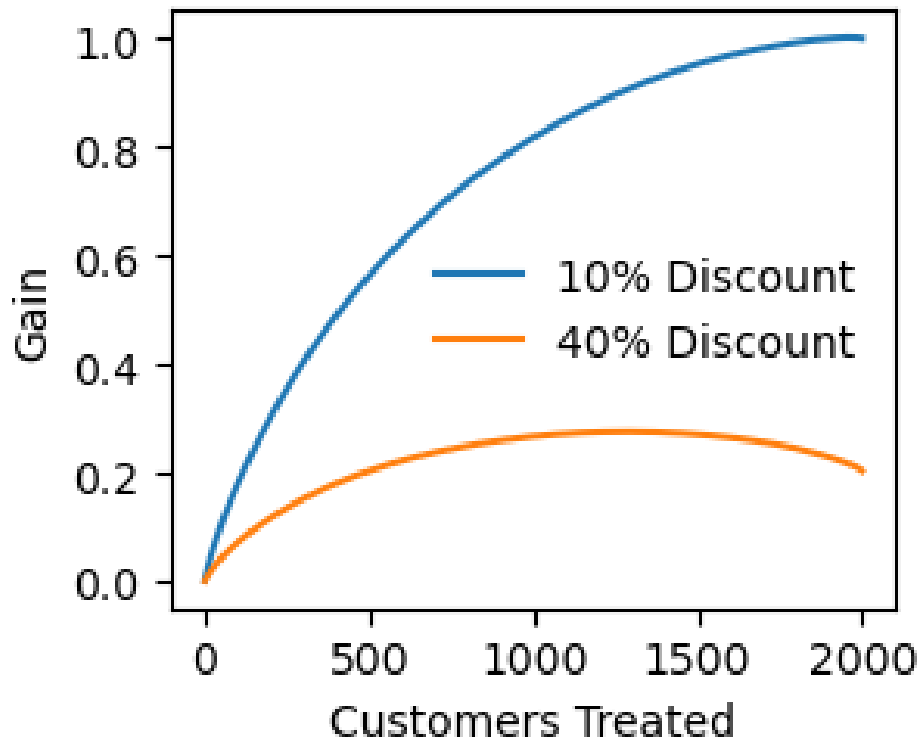
# Similarly, Discount Doubles Likelihood of Sale

- $\text{Gain} = \text{Pr}(\text{Purchase}|\text{Discount}) * \text{Cost} * (1 - \text{Discount}) - \text{Pr}(\text{Purchase}|\text{No Discount}) * \text{Cost}$



Assumes  $\text{Pr}(\text{Purchase}|\text{No Discount}) = 0.05$   
and Discount is 10%

# Can Offer Up to 40% Discount for Top 50% Customers



- **Question: What is the maximum discount before gain decreases?**
- Top 50% of customers:
  - > \$37846 spent on IT
  - > \$155667 in yearly revenue
- Assumptions:
  - 10% discount
  - $\text{Pr}(\text{Purchase}|\text{Discount})$  constant

# Summary

- S-Learner and T-Learner generate qualitatively identical predictions
  - T-Learner does outperform on training
  - T-Learner overestimates treatment effect relative to S-Learner
- **Tech Support increases revenue from all customers**
  - **Suggest adding tech support as an add-on or feature with software**
    - Cost of tech support not to exceed \$7000/customer
- Offering Discount also increases revenue by attracting more customers
  - Offering Discount to 50% of customers can increase revenue by \$9200/customer
    - **Can offer greater discounts if sales believes it will land the customer**

# Objectives (Results)

- Report on the effect of sales campaigns
  - Average revenue from customers given tech support? Discount?
    - **Gain \$7000/customer for offering tech support**
    - **Gain \$5700/customer for offering discount**
      - **Gain \$9200/customer for top 50% of customers**
  - Which customers should be offered tech support and/or discount?
    - **All customers should be offered tech support**
    - **Customers can be offered a discount if sales believes it will land the customer**

# Objectives (Results)

- Provide guidance for sales team
  - Which customers should sales team focus on?
    - **On larger companies, either spend on IT or high annual revenue**
      - > \$37846 spent on IT
      - > \$155667 in yearly revenue
  - How can the sales team convert these customers?
    - Offer tech support? Offer discount?
    - **Offering both tech support and a discount does increase chance of closing these customers**
    - **Can offer greater discounts if needed**





# Quick Look at Sales Campaign

- Majority of business comes from just a few customers
  - 50% of revenue comes from top 25% of customers
    - Conversely, bottom 25% contribute only 8% of revenue
- Higher profile customers tend to be larger
  - Percentiles for average top 25% customer:
    - 88% for IT Spend
    - 74.7% for Employee Count
    - 76% for PC Count
    - 88% for Size (by yearly revenue)
- Higher profile customers (top 25%) were offered Tech Support and a Discount
  - 85% were provided tech support and 84% offered discount
  - Conversely, for lower profile customers (bottom 25%), 4% were offered tech support and 29% offered discount

# Statistical Overview

- Mean (STD)
- Tech Support only: 8518.22 (6355.26)
- Discount only: 5662.05 (8185.68)
- Tech Support & Discount: 20198.23 (13536.51)

# S-Learner

## Result:

- RandomForestRegressor(n\_estimators=125, criterion='absolute\_error', max\_samples=1080, max\_features=7) outperforms linear regressor.
  - Random forest has slight tendency to overpredict revenue gain
    - Would rather overpredict revenue gain than underpredict. Underpredicting may drive sales team to underprioritize high revenue customers
  - Stats for random forest:
    - Mean absolute percent error (%): 13.58
    - Std absolute percent error (%): 26.88
    - Mean percent error (%): 4.26
    - Std percent error (%): 29.81
    - Median percent error (%): 0.37
- 
- Linear regression too much bias, RF is better model
  - Multiple models for treatment variable (T-learner) does improve performance (minimizes percent error)

# T-Learner: MLR

## No Tech Support, No Discount

### Result:

- Global Flag, Major Flag, and PC Count
- Stats:
  - Mean absolute percent error (%): 14.90
  - Std absolute percent error (%): 27.96
  - Mean percent error (%): 4.85
  - Std percent error (%): 31.31
  - Median percent error (%): 0.00

## No Tech Support, Discount

### Result:

- Size, Global Flag, PC Count, and Major Flag are most important
- Stats:
  - Mean absolute percent error (%): 6.60
  - Std absolute percent error (%): 10.86
  - Mean percent error (%): 1.10
  - Std percent error (%): 12.66
  - Median percent error (%): 0.00

## Tech Support, No Discount

### Result:

- Size, Global Flag, PC Count most important
- Stats:
  - Mean absolute percent error (%): 4.94
  - Std absolute percent error (%): 5.83
  - Mean percent error (%): 0.56
  - Std percent error (%): 7.62
  - Median percent error (%): 0.00

## Tech Support, Discount

### Result:

- Size, Global Flag, Major Flag, PC Count are most important
- Stats:
  - Mean absolute percent error (%): 2.96
  - Std absolute percent error (%): 3.74
  - Mean percent error (%): 0.20
  - Std percent error (%): 4.77
  - Median percent error (%): 0.00

# T-Learner: RF – too much variance

## No Tech Support, No Discount

### Result:

- PC Count, Employee Count, and Size are now the 3 most important features
- Stats:
  - Mean absolute percent error (%): 20.07
  - Std absolute percent error (%): 43.51
  - Mean percent error (%): 7.71
  - Std percent error (%): 47.29
  - Median percent error (%): 0.00

## No Tech Support, Discount

### Result:

- Size, IT Spend, PC Count most important
- Stats:
  - Mean absolute percent error (%): 11.24
  - Std absolute percent error (%): 16.08
  - Mean percent error (%): 2.87
  - Std percent error (%): 19.41
  - Median percent error (%): 0.00

## Tech Support, No Discount

### Result:

- Size, IT Spend, PC Count most important
- Stats:
  - Mean absolute percent error (%): 9.66
  - Std absolute percent error (%): 8.87
  - Mean percent error (%): 1.49
  - Std percent error (%): 13.03
  - Median percent error (%): 0.03

## Tech Support, Discount

### Result:

- Size, IT Spend, PC Count most important
- Stats:
  - Mean absolute percent error (%): 5.80
  - Std absolute percent error (%): 6.72
  - Mean percent error (%): 1.18
  - Std percent error (%): 8.80
  - Median percent error (%): 0.00