ANALYTICS EXPERIENCE 2018

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Customer Lifetime Value via SAS® Viya®

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A Bit of Terminology

Wikipedia, as of September 2018:

In marketing, **customer lifetime value** (CLV or often CLTV), lifetime customer value (LCV), or life-time value (LTV) is a prediction of the net profit attributed to the entire future relationship with a customer. The prediction model can have varying levels of sophistication and accuracy, ranging from a crude heuristic to the use of complex predictive analytics techniques.

For the most part, I like this definition. Though, I do wish it mentioned the notion of historical value. And I personally would not preface this with "in marketing" alone.

The Gist

- Customer Lifetime Value (CLV) implementations can be complex, leading to "analysis paralysis".

- This presentation provides a few "best practices" for how to structure your CLV project.

- SAS® Viya® makes CLV modeling and analysis easier.

- The end result gets you closer to *managing* customer value.

Outline of Today's Talk

- Motivating the need for CLV.

- Implementing CLV.

- Using CLV output.

- Demo of CLV implemented via SAS® Viya®.

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If you aren't making data-driven decisions, then you aren't keeping up with your competition.

Quote-worthy

"In God we trust. All others bring data."
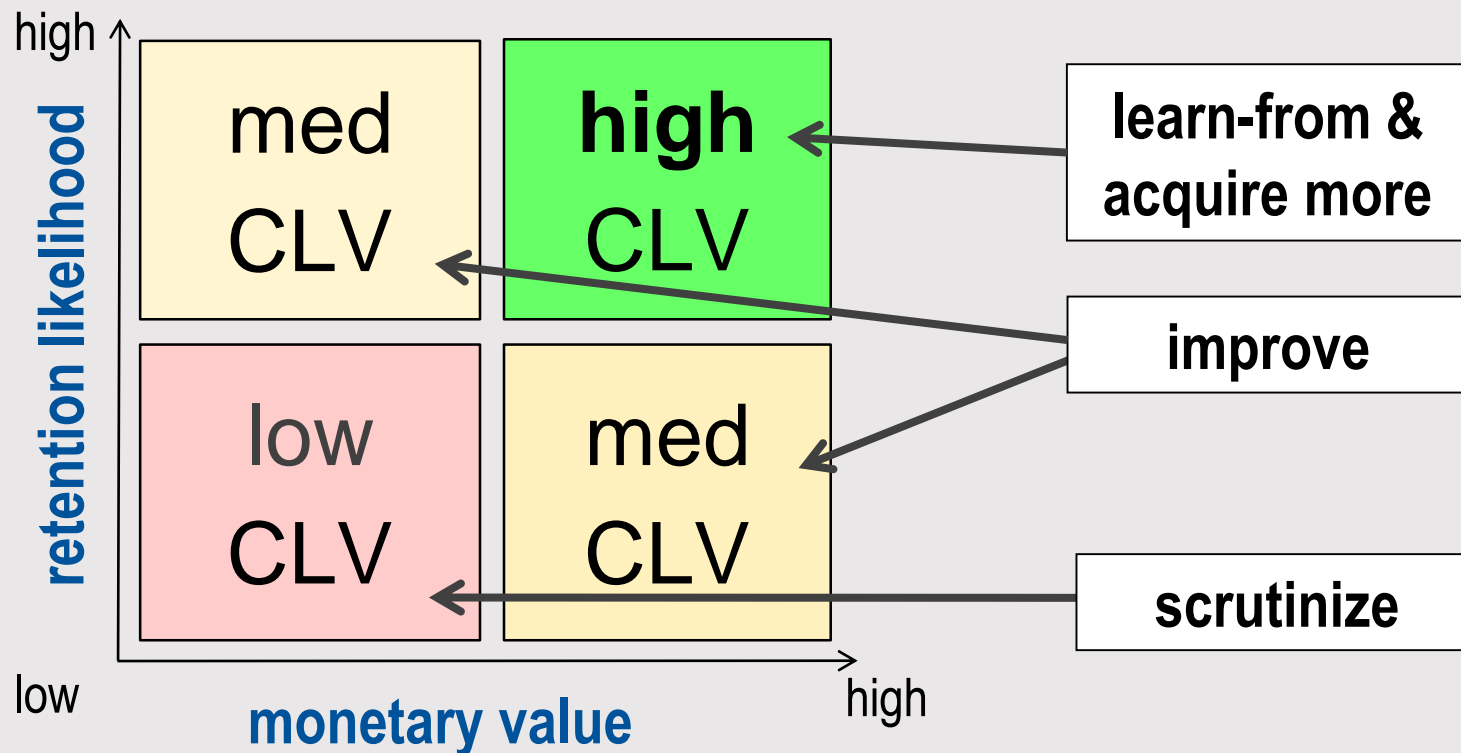
W. Edwards Deming

The Impetus

- Who are my *best* customers?

- How do I keep my *best* customers?

- How do I acquire more of the *best* customers?

- How do I make my existing customers *better*?

How do I use an understanding of customer value
to make economically sound decisions...
in marketing, sales, financial planning, operations,
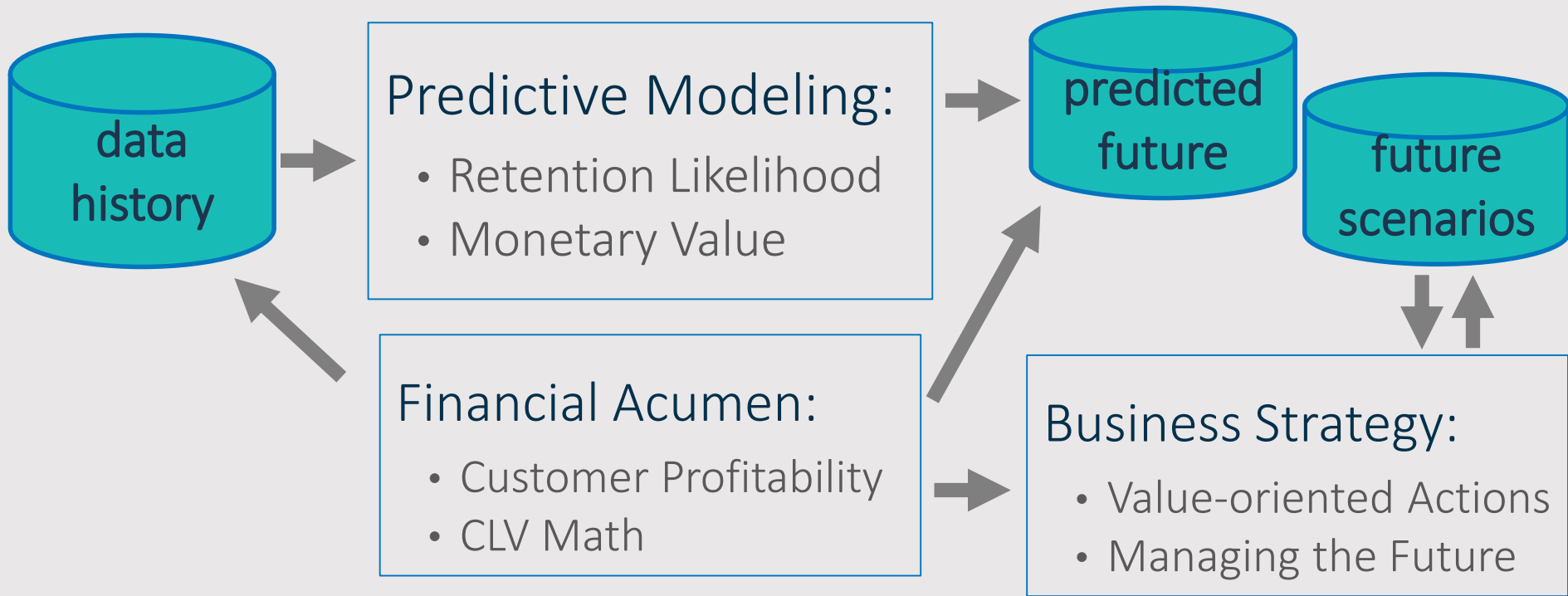customer service, process improvements, etc.

CLV 101

Outline of Today's Talk

- Motivating the need for CLV.

- **Implementing CLV.**

Collecting all the requisite data may be the most time-consuming part of any CLV project. This presentation does not cover the data requirements for a successful CLV project.

- Using CLV output.

- Demo of CLV implemented via SAS® Viya®.

CLV Step-by-Step

1. **Pick an approach for calculating future value.**

   - Financial acumen and mathematical formulas. (braving your fears)

2. **Calculate historical customer profitability.**

   - You can't predict it if you can't measure it. (accepting imperfection)

3. **Build the predictive models that provide inputs to future value calcs.**

   - All models are wrong; yet some happen to be useful. (gaining insights)

4. **Use the CLV output to make value-oriented business decisions.**

   - Believing in what you built, and actually using it. (walking the walk)

Pick Your Formula

$$CLV = CHV + CFV$$

$$CHV_j = A_j * (1+r)^M + \sum_{t=0}^{M} m_{jt} * (1+r)^t$$

$$CFV_j \rightarrow m_j \left(\frac{1 - c_j}{d + c_j} \right)$$

$$CFV_j = \sum_{t=1}^{T_j} m_{jt} * \frac{r_{jt}}{(1+d)^t} + V_j$$

$$CFV_j = \sum_{t=1}^{k} \frac{m_{jt}}{(1+d)^t}$$

$$V_j = M_j \left(\frac{1 - C_j}{d + C_j} \right) \left(\frac{1 - C_j}{1+d} \right)^{T_j}$$

Your presenter welcomes a deep dive discussion into the various options for calculating CLV.
That's just how geeky he is.

$$CFV_j \approx \sum_{t=1}^{T} m_{jt} * \frac{r_{jt}}{(1+d)^t}$$

present · future

$$CLV^k = \sum_{t=0}^{T} \frac{E_t^k - A_t^k}{(1+i)^t} = (E_0^k - A_0^k) + \frac{E_1^k - A_1^k}{(1+i)^1} + \cdots + \frac{E_T^k - A_T^k}{(1+i)^T}$$

The formula you pick is based on the modeling approach you use, and vice versa.

Quote-worthy

"Beware of geeks bearing formulas."

Warren Buffett

Calculate Historical Customer Profitability

- An accurate history of customer-specific margins is the first critical component to an accurate projection of future value.

- The degree of accuracy and sophistication is a critical consideration in your CLV project, and depends primarily on two key factors:

  1. How much time do you have to work on this project?

  2. How will the output be used? Basic ranking for marketing lists? Strategic investment planning?

- Whatever you do, please don't simply use revenue as your measure of monetary value. *Please*.

> The accuracy of customer-specific margins is as complicated as you want to make it. In order to get a CLV project off-the-ground, *some* "corners must be cut".

Build Predictive Models

- Option 1: The Game Theory Approach
  - Churn Model predicts future probabilities (time series) of retention.
  - Monetary Model predicts future cash, given retention.

- Option 2: The Survival Approach
  - Survival Model predicts remaining "life".
  - Monetary Model predicts customer value over remaining "life".

- Option 3: The Transactional Approach
  - Predict future transaction counts based on transactional history.
  - Monetary Model predicts value of future transactions.

> Within each of these options, there are a variety of modeling techniques.

> Each of these options requires history of customer data.

> Each option leads to a different math for calculating future value.

And now for the hard part…

Outline of Today's Talk

- Motivating the need for CLV.

- Implementing CLV.

- **Using CLV output.**

- Demo of CLV implemented via SAS® Viya®.

Believing in what you built.
Knowing how to use it.
Knowing how *not* to use it.

Convincing others to actually use it.

Quote-worthy

"Back off, man! I'm a scientist!"

Peter Venkman
"Ghostbusters" (1984)

Two Cardinal Rules for Using CLV Output

1. First and foremost, *understand the mechanics* of what drives future value.

2. Focus on increasing the future value of your customers. It's not about labeling customers...it's about *managing the future*.

Use Case: Rental Car Company

Key challenge:

- Over 50% of customers had only one transaction within the last 24 months.

Approach:

- Build CLV model based on frequent and infrequent transactors.
- Build look-alike model to determine which infrequent transactors *look like* they are really high-CLV (but are probably doing a majority of their business elsewhere).
- Target infrequent transactors with a strategy to gain share-of-wallet.

Outcome:

- New strategy to target not only the frequent transactors for loyalty membership conversion, but to also target infrequent transactors based on a "CLV look-alike" segmentation.

Use Case: Video Entertainment (stores vs online)

Key challenge:

- Video chain launches DVD distribution via web & postal mail; pressure from online competitor.
- Executives disagree on the best investments: build more brick-and-mortar locations? ramp-up in-store coupons? more distribution centers? increase online inventory? more advertising?

Approach:

- Build macro CLV models, by geography by time (metrics for both online & conventional business).
- Quantify incremental customer equity as a result of various strategic investment scenarios.

Outcome (recommendations to executives):

- completely cancel the in-store coupon program;
- invest heavily in online inventory;
- fund the online inventory by closing 10% of brick-and-mortar stores.

Recommendations presented in 2007.
Executives opted to ignore.
Company filed bankruptcy in 2010.

§sas

Third Cardinal Rule for Using CLV Output

3. Avoid the "death spiral":

    Consider this scenario:

    - churn = f (trend in purchases, customer service calls, etc)

    - margin = f (product portfolio, customer service calls, etc)

    - CLV calculated from predicted churn & margin; converted to a simple four-star rating system.

    - 3- and 4-star customers are given priority customer service. 1- and 2-star customers are given less than stellar customer service (higher wait times, routing to junior reps, etc).

    - New cable box model sent out; one that (unfortunately for the customers) has a lot of technical issues...resulting in many calls to customer service to report issues.

    - Over the next few months, customers are calling and complaining. Those calls result in a higher predicted churn, and a lower predicted margin. CLV is decreasing for anyone calling customer service repeatedly. As their CLV decreases, 3- and 4-star customers become 1- and 2-star customers. Which causes their customer service experience to get worse.

Outline of Today's Talk

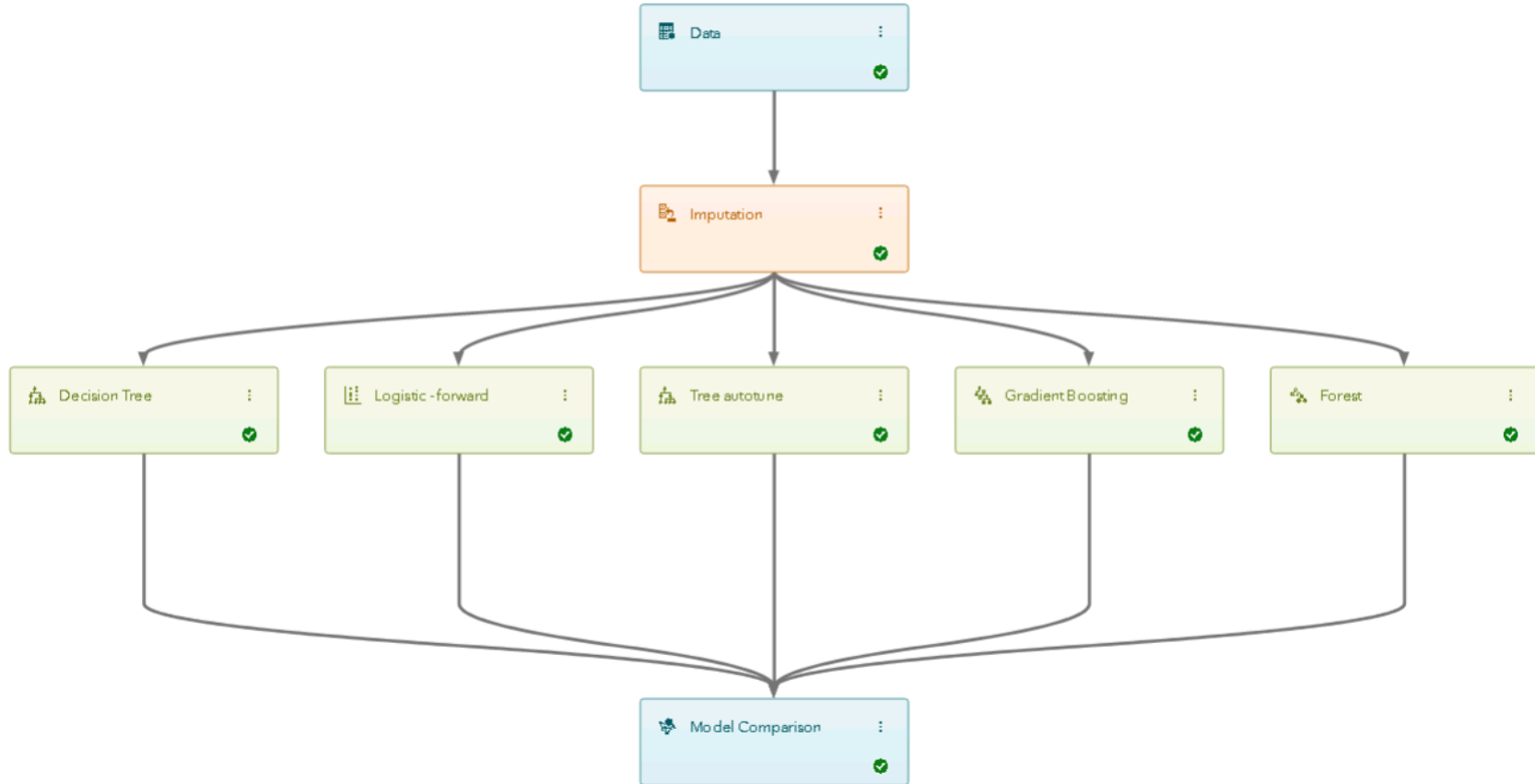- Motivating the need for CLV.

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> This short demo is just a taste of the capabilities in SAS® Viya®.
> If you'd like more information, please come visit the Innovation Hub.

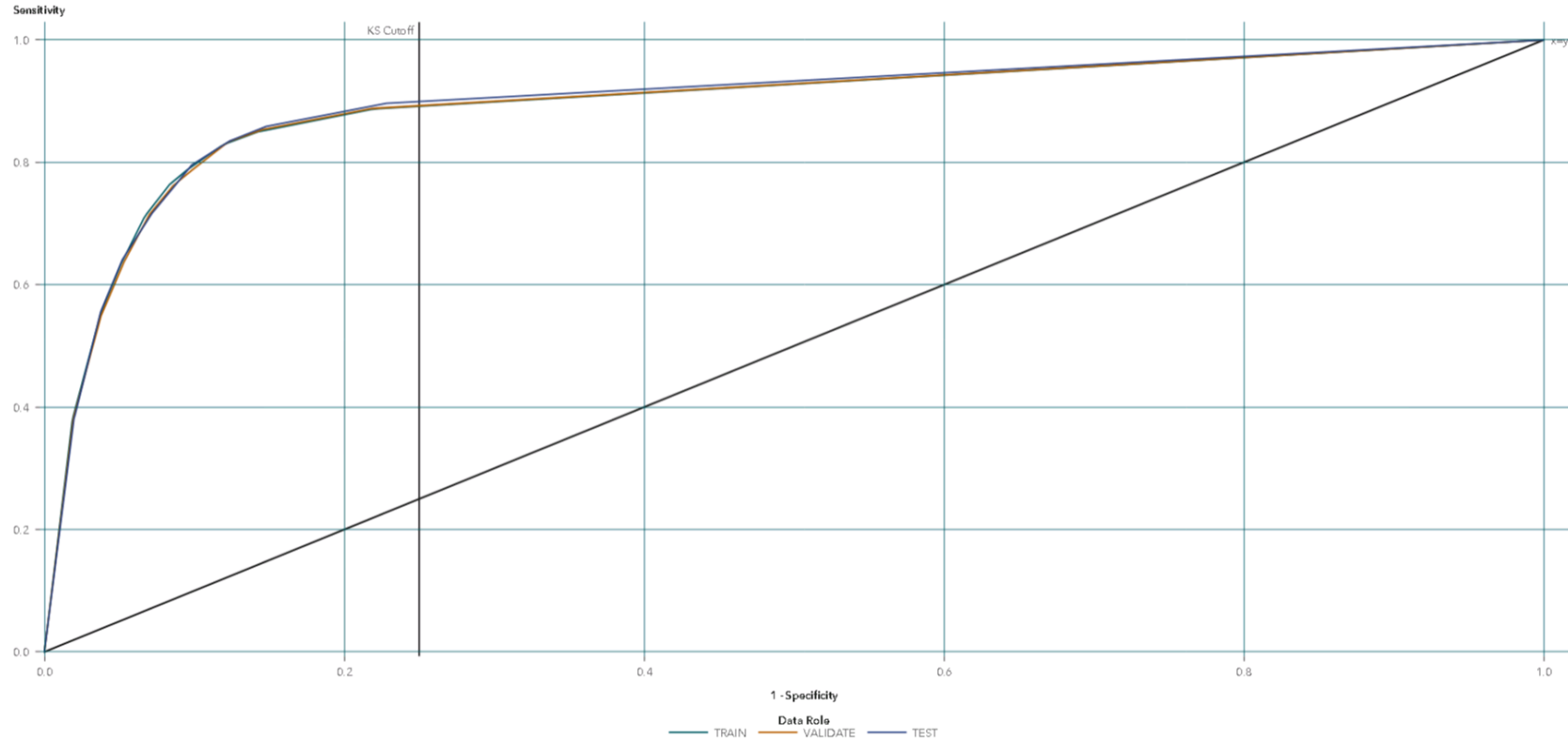- Demo of CLV implemented via SAS® Viya®.

# VDMML – Model Studio pipeline

VDMML – Model Results

VDMML – Model Comparison

Model Comparison

Champion	Name	Algorithm Name	KS (Youden)	Misclassification Rate
🔖	Tree autotune	Decision Tree	0.7108	0.1260
	Gradient Boosting	Gradient Boosting	0.7106	0.1273
	Forest	Forest	0.7094	0.1296
	Decision Tree	Decision Tree	0.6985	0.1296
	Logistic - forward	Logistic Regression	0.6752	0.1377

VDMML – Model Studio pipeline
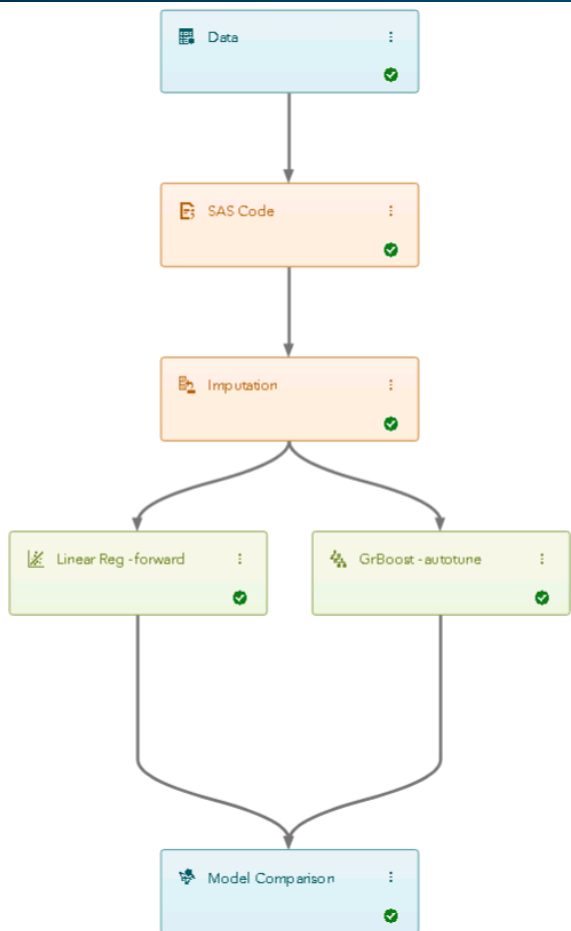
Parameter	t Value	Sign	Estimate
purch_amt_36mo	145.0513	+	0.3463
margin_Y_neg_2	52.4841	-	-0.3683
marg_expctd_ann_v1	36.1631	+	0.5193
purch_amt_life	27.3699	-	-0.0089
purch_cnt_tt_36mo	25.0602	-	-10.0535
purch_avg_36mo	21.6906	-	-0.2052
tier_prev 5-Diamond	16.7459	+	1,018.6807
call_out_mo_36mo	16.4595	-	-31.1185
scheduled_purchase_flg 0	16.2271	-	-179.2938
IMP_demog_inc_fine $ 250000 or more	15.4262	+	1,157.2779
Intercept	13.8637	+	661.7029
tier_prev 3-Gold	13.3006	+	358.9913
purch_cnt_ck_36mo	11.1002	+	4.6746
call_in_mo_36mo	10.7695	-	-0.8586
tier 4-Platinum	10.4303	-	-470.0420
margin_Y_neg_1	10.3733	+	0.0657
tier_prev 4-Platinum	8.0992	+	354.3811
tier 1-Bronze	7.5375	-	-336.4402
tier 3-Gold	7.3222	-	-329.0016
tier 2-Silver	7.3114	-	-330.5600
tier_prev 2-Silver	5.9123	+	119.9580
tier_prev 1-Bronze	4.4527	+	60.6102
IMP_demog_inc_fine $ 150000 - $174999	1.6537	+	79.6605
IMP_demog_inc_fine $ 200000 - $249999	1.2222	+	98.3359
IMP_demog_inc_fine $ 125000 - $149999	1.0886	+	30.0934
IMP_demog_inc_fine $ 15000 - $ 19999	0.8976	-	-17.6690
IMP_demog_inc_fine $ 40000 - $ 49999	0.7736	+	13.7450

Develop SAS Code – SAS Studio

```sas
34  data public.CLV_SCORED;
35      merge work.original
36            work.churn_scored
37            work.margin_scored;
38      by acct_ID;
39
40      format CFV dollar12.2;
41
42      array P_churn_(3) ;
43      array P_margin_(3);
44
45      do i = 1 to 3;
46          P_churn_(i) = 1- (1-P_churn_year_plus1_ind1)**i;
47
48      *** since the margin model is based only on future non-churners       ***;
49      ***    the predicted values need to be adjusted per the risk of churn  ***;
50      *** Note: we are using the same margin in each future year, but a cumulative retention risk ***;
51
52          P_margin_(i) = (1-P_churn_(i))*(P_margin_Y_pos_1);
53
54      end;
55
56    CFV = P_margin_1/((1+&annual_discount)**1) + P_margin_2/((1+&annual_discount)**2) + P_margin_3/((1+&annual_discount)**3);
57  run;
58
59  proc casutil;
60  promote casdata="CLV_SCORED"
61  Incaslib="public" Outcaslib="public" CASOUT="CLV_SCORED";
62  run;
63
```
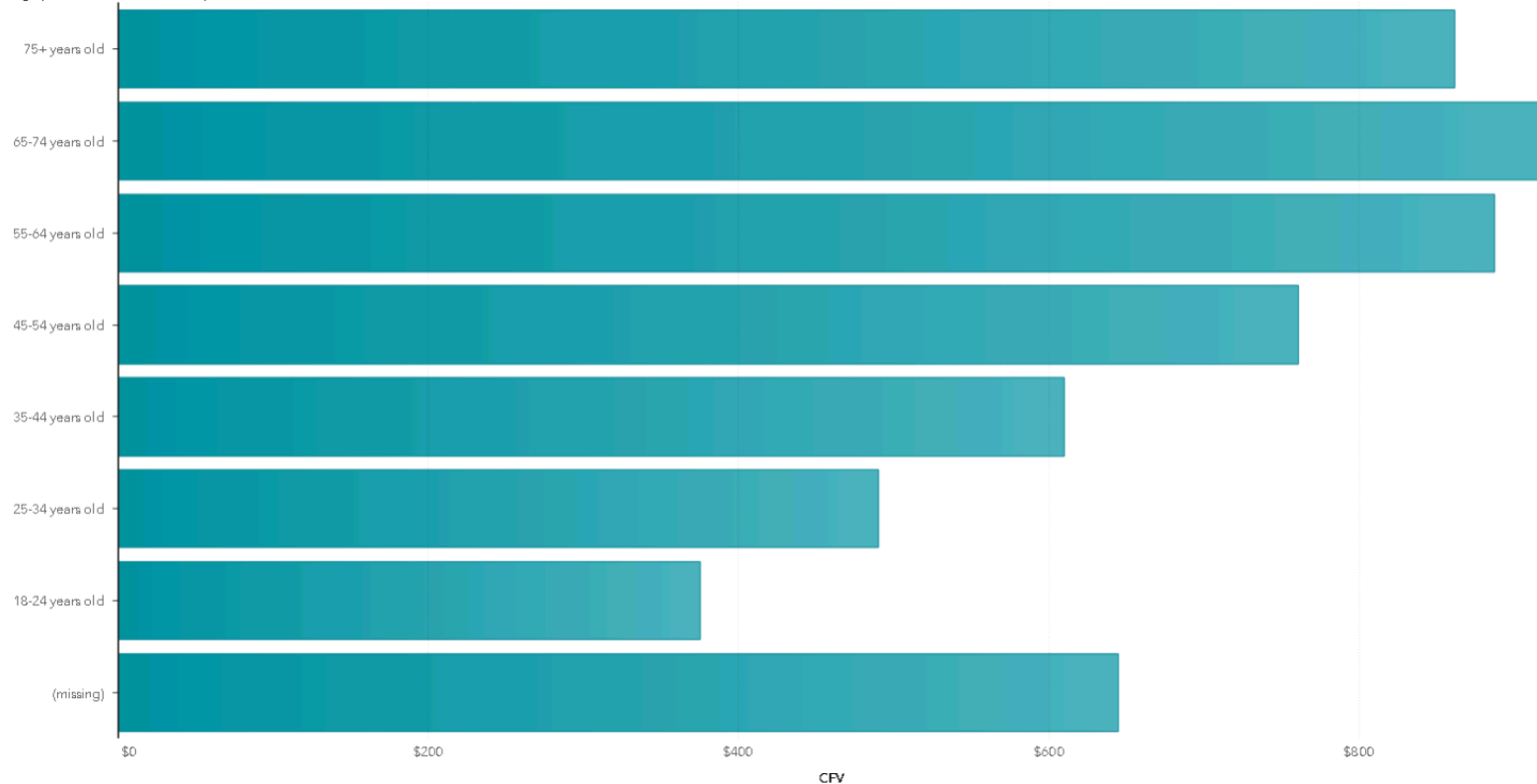
VA – Explore and Visualize Data

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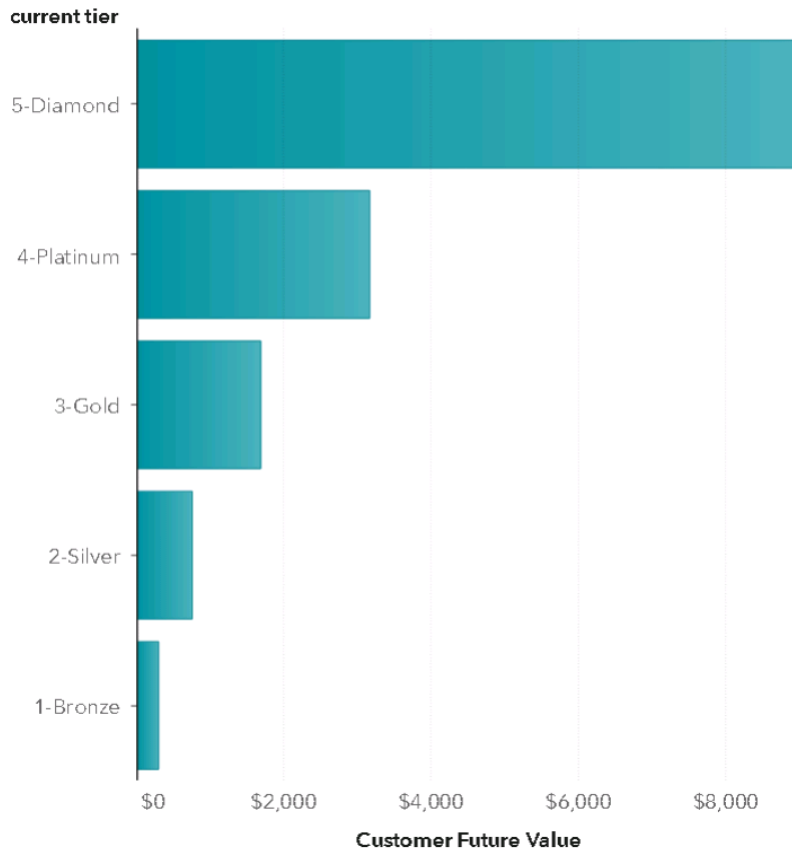Average CFV by Age (Head of Household)
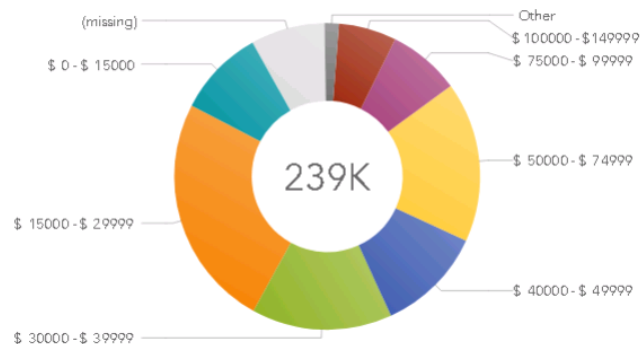
Age (of the Head of Household)

VA – Explore and Visualize Data

Customer Future Value by current tier

Frequency of Total Household Income, course values

Own or Rent the Residence	Annual Churn Probability	Future Annual Margin
	32%	$314
Definite Owner (any type dwelling unit)	23%	$470
Definite Renter	28%	$280
Probable Owner (any type dwelling unit)	29%	$388
Probable Renter	34%	$245

Food for Thought

A client once asked me, "In testing CLV, what is the percentage correct for the dollar-values assigned to customers? How often are the numbers right?"

The answer: "Zero percent. But that's OK. You can still use it to make better decisions."

Is CLV the end-all-be-all measure?

Think beyond customer-specific cashflow.

Example: Social Media Influencers.

Questions?

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3. On the Sessions page, scroll down to Surveys and select the name of the survey.
4. Complete the survey and click Finish.