Estimation of the Customer Life Value



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Insurance context

- ▶ Providing Insights in a Complex Industry:
 - ▶ Insurance operations involve numerous variables, from risk assessment to customer behavior.
 - ► Customer Lifetime Value (or CLV) offers a comprehensive metric encompassing these factors.
- ► Efficient Decision-Making:
 - ► CLV consolidates diverse information, streamlining decision processes.
 - ► Enables optimized resource allocation, customer engagement, and tailored product offerings.

Customer Life Value (CLV)

- ▶ CLV represents the total expected profit a company expects from a client throughout their entire relationship.
- ▶ Used in multiple industries in order to evaluate the financial value of a customer and better tailor the approach of the company towards customers (pricing, marketing, etc.)
- ▶ Mathematically, we can define CLV as

$$CLV(a) = \mathbb{E}\left[\sum_{t=1}^{T} \gamma^{t} Profit(S_{t}) \mid S_{0} = a\right]$$

where:

- \triangleright γ is a discounting factor to account for time-value of money;
- ▶ $Profit(S_t)$ is a function that gives the expected profit from a client given their state S_t .

The model

- ightharpoonup Problem: how to model S_t ?
- ightharpoonup Natural to think of $\{S_t\}$ as a sequence of r.v.
- ▶ We assume the Markov property for simplification:

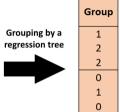
$$\mathbb{P}(S_{t+1} = s \mid S_t, S_{t-1}, \dots, S_0) = \mathbb{P}(S_{t+1} = s \mid S_t)$$

We used a method from Haenlein et al. (2007) that involves 3 steps:

- 1. Fit a regression tree on the data to identify groups (i.e. the states of the Markov chain);
- 2. Estimate the transition probabilities between each group/state;
- 3. Compute the CLV by Monte Carlo.

Details

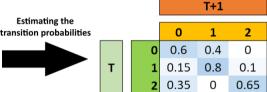
ID	Features			Profit	Time	
	X1	X2	ХЗ	Piolit	Time	
Α	13	14	9	250	0	
В	18	16	4	570	0	
С	32	27	2	-50	0	
Α	23	16	11	50	1	
В	43	8	2	-100	1	
С	12	22	7	240	1	



- ▶ Step 1: Combine data from all time steps into a single dataset (we assume time independency) and fit a regression tree;
- ▶ Result : that creates a new feature **Group** (there is a sense of order by profit). We can "forget" the other features from now on.

Details (continued)

ID					
	0	1	2		Es transi
Α	1	0	0		
В	2	1	2		
С	0	1	1		



- ▶ **Step 2**: Build the transition matrix with empirical transition probabilities (assuming time homogeneity);
- ▶ **Step 3**: Compute the CLV by simulating Markov chains (Monte Carlo method).

Other approaches

Extended Pareto/NBD Model

- ▶ Combines Pareto/NBD and Gamma-Gamma models.
- ► Pareto/NBD Model:
 - ▶ Uses two main components: Pareto and Negative Binomial Distribution.
 - ▶ Estimates parameters that describe customer behavior, such as transaction rate and the expected number of future transactions.
- ► Gamma-Gamma Model:
 - ► Assumes that customer transaction values follow a gamma distribution.
 - ► Estimates parameters for average and variability in transaction values.
- ▶ Gives **CLV** predictions by multiplying results from both submodels.
- ► Challenges Faced:
 - ► Attempted implementation, but faced technical hurdles.
 - ► The dataset provided for the workshop was not suited for implementation (missing variables).



References

▶ Haenlein, Michael & Kaplan, Andreas & Beeser, Anemone. (2007). A Model to Determine Customer Lifetime Value in a Retail Banking Context. European Management Journal. 25. 221-234. 10.1016/j.emj 2007.01.004.