Models for Customer Valuation

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This is a commented list of literature related to various aspects of customer valuation, which I found useful for my own understanding of concepts like customer-centricity, customer lifetime value (CLV), and stochastic models for predicting future customer activity.

1 General and managerial aspects of customer lifetime value


2 Overviews of stochastic models of buyer behavior

Here are some useful review articles featuring a specific class of probabilistic models of buyer behavior. For a given customer cohort acquired at time $t_0$, these models propose that (i) while active, each customer makes purchases according to the specific assumptions of a repeat-buying process and (ii) remains active for a "lifetime duration", which follows the assumption of a dropout process (thus, "buy-till-you-die" or BTYD). For each of these two process components, BTYD models allow for heterogeneity across customers, which is modeled using (typically independent) mixture distributions. For model estimation, BTYD require only condensed information of the complete customer purchase, which is compressed into a set of individual-level sufficient summary statistics $(x, t_x, T)$: (1) the number of past transactions $x$ (frequency), (2) the timing of the most recent transaction $t_x$ (recency), and (3) the total observation time $T$ since the customer was acquired.

3 A selection of BTYD models

The most widely recognized benchmark BTYD model is the Pareto/NBD. It assumes a Poisson purchase process and an exponentially distributed lifetime for the dropout process. The related parameters vary across customers following independent gamma distributions. The gamma-exponential mixture results in a Pareto distribution and the gamma-Poisson
mixture leads to a negative binomial distribution (NBD), thus the model is referred to as Pareto/NBD.

Extensions of the Pareto/NBD model mostly modify the dropout process. For example, the Betageometric/NBD model (BG/NBD) adjusts the dropout story by restricting defection to repurchase incidents [18]. The MBG/NBD [15] and the CBG/NBD [20] modify this variant by allowing for an additional dropout opportunity immediately after the initial purchase. Other extensions include the periodic death opportunities (PDO) model, which decouples the discrete dropout opportunities from the purchase process [21]. The gamma-Gompertz/NBD model allows for a non-constant hazard rate in the dropout process [16]. The beta-geometric/beta-Bernoulli (BG/BB) model is a discrete-time analog of the Pareto/NBD [19].


4 Extending BTYD models towards a CLV model

BTYD models typically focus on making individual-level predictions of the expected number of future transactions, which can easily be discounted to yield a net present value towards a fully faceted CLV model, which a sub-model for the purchase amount per transaction [25]. Extending BTYD models toward a fully faceted CLV model requires a sub-model for the purchase amount per transaction, for example by assuming a standard normal [26], a log-normal [23], or a gamma-gamma [24] sub-model for purchase amounts.


5 Further extensions and recent developments

Recent contributions to the literature on BTYD models include (but are not limited to) the following topics: (1) Incorporating time-invariant and/or time-variant covariates [27, 35].
(2) Bayesian estimation of the Pareto/NBD model parameters and variations [30, 27, 28].
(3) Allowing for more flexibility of the underlying interpurchase timing model [36, 29, 34].
(4) Incorporating non-stationary repurchase behavior in a broader class of hidden Markov models [33, 32]. (5) Studying the impact of "clumpiness" and regularity in the timing process on the predictions of future activities [37, 31].


