Predicting tail performance more accurately while controlling the risk-reward trade-off

The long tail, a concept popularized by Chris Anderson in a 2004 article in *Wired* magazine, refers to businesses in which many low-volume items cumulatively account for a large portion of revenue. When applied to search engine marketing (SEM), this concept describes the way consumers search for products and services. In a typical campaign, 80% of search volume is dominated by 100 or less generic, high-frequency queries, and the remaining 20% comes from unique and highly specific low-frequency queries. A savvy search marketer leverages this information when building out a campaign. The smart marketer bids on high-frequency queries, such as *cheap flights*, but also bids on thousands, and sometimes millions, of queries, such as *cheap flights to Estonia* that are rare but highly targeted.

### Tail terms

Tail terms have unique properties that make them both interesting and challenging to manage. When contrasted with the high-frequency terms (head terms), tail terms are more numerous and almost impossible to keep track of manually. They are also volatile, and performance can vary dramatically from one day to the next. Table 1 expands on this point.

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Clicks</th>
<th>CPC</th>
<th>Spend</th>
<th>Conversions</th>
<th>Revenue</th>
<th>ROI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake parts</td>
<td>1,000</td>
<td>$0.5</td>
<td>$500</td>
<td>40</td>
<td>$1,500</td>
<td>300%</td>
</tr>
<tr>
<td>Ceramic brakes</td>
<td>600</td>
<td>$1.00</td>
<td>$600</td>
<td>10</td>
<td>$300</td>
<td>50%</td>
</tr>
<tr>
<td>Cheap brake parts for 2006 Mazda 6</td>
<td>2</td>
<td>$0.2</td>
<td>$0.4</td>
<td>1</td>
<td>$30</td>
<td>750%</td>
</tr>
<tr>
<td>Cheap brake parts for 2001 Mazda 323</td>
<td>1</td>
<td>$0.4</td>
<td>$0.4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1. Cumulative 7-day data for four keywords. The first two keywords are typical, high-volume head terms. The last two keywords are low volume tail terms. It’s easy to determine the performance of the head terms. The same cannot be said for the tail terms because of the low number of clicks they have received.
An ROI-centric advertiser looks at the performance of these keywords and sees that the ROI on the first keyword is good, the second poor, the third fantastic, and the fourth nothing. However, is this all that is needed to evaluate performance? The data on the first two keywords appears sufficient—brake parts is a profitable keyword, and ceramic brakes is not. But the third and fourth keywords with two and one clicks each don’t offer much data.

The search engine manager is faced with two issues when managing the tail. First is the number of tail terms: A typical campaign has tens of thousands of tail terms, and larger campaigns have millions of them. Manually managing these terms would be intractable. Second is the performance volatility. Is the third keyword good? Is the fourth keyword bad? Clearly, a sophisticated tail management approach is needed.

**Tail term management: A risk-reward trade-off**

Tail terms can be thought of as microcap stocks. They are individually volatile, but when managed together, they can be profitable. Figure 2 is an example of where tail management was done well. While only 4% of the spend goes on the tail, 19% of revenue is generated from it. This disproportional revenue contribution helps lift the overall performance.

![Figure 2. Head, mid, and tail breakout of a well-managed campaign. The tail spent only 4% of the overall budget, but contributed 19% of the revenue.](image)

On the flip side, poor management of the tail can drag the performance of the entire campaign down. Conventional approaches to tail management address the automation problem but not the risk. A common approach, exposure maximization, lets the manager use automation tools to bid all tail terms up to an arbitrary number, such as the average portfolio cost per click (CPC), to encourage exposure of all keywords. The problem with this approach is that there is absolutely no risk assessment or control. For example, if a keyword is getting few clicks, not because it is a tail term but because it is on the second page of search engine results, bidding it to the first page could lead to a big spend. Many tail terms on the first results page might even get a few clicks which, on a term-by-term basis might not be a large amount but cumulatively could amount to a big spend.

To illustrate the point, consider a scenario where $3,000 is spent per day for a large keyword campaign. An exposure maximization approach is tried, with all keywords bid to position eight. If 10% of 100,000 tail terms get a click at a $0.50 CPC, you end up spending $5,000 or 167% of the daily budget. With this approach, the marketer loses control of the budgeted advertising spend. This problem is exacerbated when the excess money is spent without any performance lift.
Another common approach is to monitor tail terms frequently and bid keywords up or down based on their ROI. This approach has several problems. Tail-term performance is hard to measure individually, and it’s also difficult to determine the amount to bid up or down. A heuristic strategy of bidding keywords with a positive ROI up by 10% and those with a negative ROI down by 10% offers no guarantee of success and no control of risk. An ideal solution gives marketers control over the amount of risk they are willing to take.

The demands placed on an ideal tail term management system are unique and demanding. The system must be scalable and able to place thousands, and even hundreds of thousands, of bids per day on the tail terms. The system needs to ensure that despite sparse data, tail terms are bid in a way that maximizes the advertiser’s goal. Finally, the system must be able to control the risk-reward outcomes. However, no human system can meet these demands. An algorithmic automated approach is required.

Adobe’s unique algorithmic approach to tail-term bid management manages over 120 million keywords daily. The solution is scalable, with controls to manage the risk-reward trade-off. The crux of its algorithmic approach lies in building sophisticated tail-term models that predict performance accurately despite the scarcity of data.

Adobe’s tail-term confidence model

To understand Adobe’s tail model, let’s revisit Table 1. The first and second keywords have enough historic data to make a sound decision, but there’s not enough data to decide if the current bids are appropriate for the other two keywords. We don’t have much confidence in the historic data.

When enough data is not available, one strategy is to use aggregated data to estimate the ROI of a keyword. Table 2 shows the same data aggregated by ad group. Keywords 1 and 2 belong to the first ad group, and keywords 3 and 4 belong to the second. The ad group data appears more robust because there is more volume. You could use this data along with historic data, of an individual keyword, to make a prediction on revenue. When more data is available, there is more confidence in the historic data, and it is used almost exclusively. When there is less data, the aggregated data is used with greater significance to make revenue estimates.

<table>
<thead>
<tr>
<th>Ad group</th>
<th>Clicks</th>
<th>CPC</th>
<th>Spend</th>
<th>Conversions</th>
<th>Revenue</th>
<th>ROI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generic brakes</td>
<td>10,000</td>
<td>$0.5</td>
<td>$5,000</td>
<td>100</td>
<td>$8,000</td>
<td>160%</td>
</tr>
<tr>
<td>Mazda brakes</td>
<td>100</td>
<td>$1.00</td>
<td>$100</td>
<td>10</td>
<td>$300</td>
<td>300%</td>
</tr>
</tbody>
</table>

Table 2: Ad group data

Aggregated and historic data are merged with sophisticated statistical methods to build a confidence model based on the properties of the keywords present in a campaign, an example of which is shown in Figure 3. Keyword models are then built with historic data and aggregated data coupled with the confidence models. This is schematically shown in Figure 4.

Figure 3. When keywords have fewer clicks, the confidence in historic data is less. When keywords have more clicks, the confidence is high. Historic keyword data, along with aggregated data are coupled to build keyword models.
The tale behind the tail

Guide

Figure 4. The model for keyword 7 is built using aggregates at the ad group and campaign level, along with its own historic data and the confidence model.

While modeling is the first critical step in the tail-term management puzzle, a complete solution must also accomplish the following objectives at a tactical level.

a) Ensure that tail keywords spend effectively and perform close to a campaign’s goals.

b) Expose keywords with low-click volume to learn more about the keywords’ behavior.

c) Expose keywords in the campaign that have not seen any impression, presumably due to low historic bids or search activity.

These goals pose unique challenges because they’re contradictory in nature. Aggressively exposing keywords (items a and b) induces volatility in performance, which makes it difficult to achieve the first objective.

**Learning budgets: Balancing risk and return**

To understand Adobe’s model of managing tail terms, let’s first look at where the best opportunities for discovering new profitable keywords might lie. Figure 5 shows a set of keywords from an advertiser campaign of 10,000 words. Of these, only 1,470 keywords have enough data to make highly accurate predictions solely based on historic performance. While the trust model helps improve accuracy, the aim is to reduce reliance on aggregated data for all tail terms. You want to look into tail keywords without much data to find new opportunities. However, among these keywords, many have been exposed to page 1 results and been given a chance to perform. The real opportunity lies with the keywords not exposed to page 1 results. Many of the keywords have already been bid high. Bidding them higher poses a greater risk. The best opportunities lie with keywords that have had low bids and with some or no impressions. These keywords present the best trade-off between risk and return.
A tail-term algorithm should preferentially bid keywords with the highest potential and lowest risk over keywords with lower potential. If the algorithm is model-based, it should provide a reasonably accurate view of the potential risks involved with the strategy.

The learning budget algorithm allows advertisers the amount of spend they want to invest on tail keywords that offer less confidence but could have a high upside potential. Figure 6 demonstrates the effect of different learning budgets. When a small learning budget is set, a smaller amount of budget is spent on higher variance tail keywords. As a result, the variance in expected performance is small. With a higher learning budget, the variance increases. A greater variance does not imply that performance would be poorer; it implies that performance would vary more. Learning budgets enable you to make a classic risk-return trade-off.

**The efficient frontier with learning**

![Efficient Frontier Chart](image)

Figure 6: Learning budget and volatility trade-off. When a lower learning budget is chosen, the revenue prediction has a lower variance. When a higher budget is chosen, the variance is higher. A higher variance does not imply lower performance. It implies that there could be a higher upside as well as a downside.
Building on the tail: Case studies

A steady learning approach
An Adobe client grew from spending $200,000 to over $1 million in a span of three years. The five-fold increase in spend was coupled with a five-fold increase in customer sign-ups, as seen in Figure 7. The reason behind this steady and dramatic improvement in performance was the tail management algorithm. Figure 8 shows the impact of applying 10% of spend toward the learning budget. While the daily rate of conversions from the sparse dataset fluctuated significantly, the cumulative monthly rate of new keywords gaining conversions was steady. As the tail steadily grew, so did profitable spend and sign-ups.

Figure 7: Steady growth over a long time

Figure 8. The blue line tracks the cumulative number of unique keywords that got unique conversion events on a daily basis. The red line tracks the unique conversions per day. Although the daily rate of gaining conversions fluctuates significantly on the tail, the cumulative effect is steadily increasing contribution from the tail.
Aggressive learning

A rapidly expanding business often needs an aggressive tail-learning strategy. In such cases, risk is less of an issue compared to the potential for growth. The learning algorithm can be extremely aggressive with the notion that a short-time hit can deliver a long-term reward. Figure 9 shows an instance where this strategy was used.

![Impact of Aggressive Learning](image)

Figure 9: Impact of aggressive learning

An aggressive learning strategy was deployed on May 1, causing spend to shoot up from a daily average of $150 to $800. The ROI dropped from a daily target of 70% to 40%. However, many keywords gained clicks due to the aggressive learning algorithm. As better keyword models were built, the ROI quickly stabilized to former levels, but the campaign was not generating five times as much revenue. While this strategy was risky and did indeed take a short-term hit, the model-based algorithm was able to leverage off learning from several new keywords that saw click and conversion activity. In the long run, this strategy paid off in the form of greater revenues.

Other approaches

While Adobe’s proprietary tail management models and algorithms work for almost any scenario, a heuristic approach might be desired for some situations. For instance, if an advertiser wants to take a high degree of risk in return for gaining exposure on tail terms quickly, an exposure maximization rule can be used. These rules come in various flavors, including bidding keywords to Google’s recommended first-page CPC, or bidding all tail terms to a high CPC and waiting for a certain number of clicks before making a bidding decision; bidding all tail terms to a certain position. Adobe can provide the requisite automation tools to perform these tasks efficiently.

Summary

Tail term management is complex and places special demands on automation and risk management. While simple heuristics will take care of small campaigns, big campaigns need an algorithmic approach. Adobe’s unique models predict tail performance with a good deal of accuracy, and coupled with risk management algorithms, can help you grow your tail in a controlled and profitable manner.
About the Adobe Digital Marketing Suite
The Adobe Digital Marketing Suite offers an integrated and open platform for online business optimization, a strategy for using customer insight to drive innovation throughout the business and enhance marketing efficiency. The Suite consists of integrated applications to collect and unleash the power of customer insight to optimize customer acquisition, conversion and retention efforts as well as the creation and distribution of content. For example, using the Suite, marketers can identify the most effective marketing strategies and ad placements as well as create relevant, personalized and consistent customer experiences across digital marketing channels, such as onsite, display, e-mail, social, video and mobile. The Suite enables marketers to make quick adjustments, automate certain customer interactions and better maximize marketing ROI, which, ultimately, can positively impact the bottom line.

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