

Machine Learning Powered PPC Optimization

The Modern Methodology to Best-In-Class Bidding

QuanticMind



Introduction

This guide will walk you through the best-in-class approach to optimized PPC bidding automation. The best performing programs will have keyword bids calculated using complete data sets, machine learning models, and a suite of artificial intelligence algorithms. The steps in this guide follow QuanticMind as the case study, as it was built in a fundamentally different manner than legacy PPC bidding optimization tools. It has become the exemplar in maximizing paid search performance due to two elements: its data and infrastructure solution, and its advanced machine learning-powered bidding process.

Before diving into step one of the bidding process itself, we'll take a brief look at the prerequisites for successful search engine marketing bidding.



BEFORE STEP 1

Data Unification Infrastructure

For a very long time there has been a core problem with marketing data, which still exists today. Advertisers and brands find it difficult to access and use clean data; they deal with disparate data sources each tracking various parts of the customer journey. There is too much data to work with, much of it inconsistent. This problem needed a solution as it is the very foundation of fully optimized bidding.

To put it simply, the architectural concepts of existing technologies failed to conceive the scale or complexity necessary for the paid search data environment, which ultimately means they aren't able to unlock the power of that data.

The solution to this problem was a platform that could capture brand interactions as a series of events happening in real-time. These events build and inform an actionable, context-rich data gold mine. So QuanticMind built a system flexible enough to ingest all of the data sources that track, measure, or influence the customer journey. The platform then ties them back to both dollars invested in ads and to unique consumer profiles across both the known, and unknown, stages of the customer journey. QuanticMind's data model can adapt to assimilate anything.

Given this infrastructural foundation, QuanticMind's active bidding process leverages the latest advances in Data Science—including machine learning algorithms, Bayesian modeling, predictive performance methodology, and natural language processing—to optimize SEM performance toward specific business goals.

The following steps walk through this bidding process.





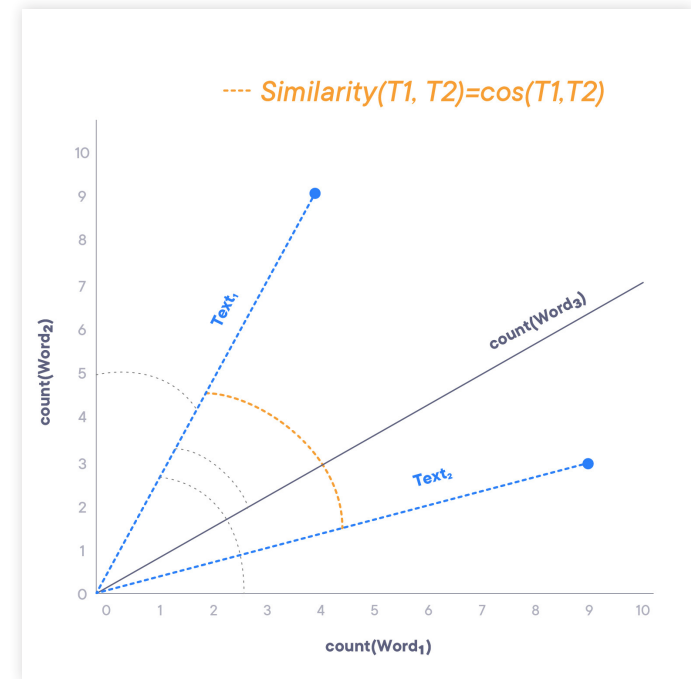
STEP 1

Estimate the Value of Each Keyword

At the start of the process for any bidding optimization solution, the dollar value of each keyword must be determined. QuanticMind generates a revenue-per-click (RPC) model for each keyword to find the best revenue estimation for that specific keyword. There are two notable pieces at play here: the “machine” that builds the model, and the data you feed that machine.

The machine itself. The calculations for this RPC model are generated using various types of machine learning algorithms. At its core, the QuanticMind platform employs a non-linear, supervised learning model that virtually represents the millions of interactions at play and determines their influence on one another. Clearly processing at this magnitude is an issue with any standard approach (a multitude of keywords x a multitude of data points). However, QuanticMind’s machine learning algorithm represents the problem in a lower dimensional space that reduces the complexity while maintaining accuracy and granularity. The impact of these multiple parameters on each other is mapped based on the data fed into the model and it estimates a highly accurate and data-driven value for each individual keyword.

Legacy solutions use a simpler way to calculate the RPC called a time-series model. This looks at the prior values of RPC and that series over



Keyword similarity model for sharing data with long-tail terms

time, and then predicts the next RPC based on that. This is similar to making a bet on the stock market based on the upward and downward trends of the stock price graph, assuming it will reproduce what has happened previously. QuanticMind operates under a predictive model, which means that we incorporate the business-relevant data as attributes into the model to factor into the value calculation. Each calculation is based on the statistical data about costs and revenue related to that keyword in addition to time-series trends.



STEP 1 (CONTINUED)

What you feed the machine. The data fed-in is likely even more of a secret weapon than the algorithms and modeling. QuanticMind's database and infrastructure enables any data source to be integrated into the platform for optimization purposes. Some examples, for clarity: any publisher data regarding costs, Campaigns, AdGroups, Match Type, Keyword Type, etc; years of historical revenue, click and conversion data; any third party analytics or tracking data source; any deep funnel or offline revenue data (like CRM); and any LTV data or internal metrics or hybrids that are custom collected. In short, any data source that's meaningful to business outcomes can be integrated, used in modeling, and applied in the algorithms for precise calculations.

For keywords without enough data to properly feed the model—low volume, or long-tail keywords—QuanticMind uses deep learning, text-recognition and analytical algorithms in the field of Natural Language Processing (NLP). These effectively create a similarity matrix between keywords and semantically match data-poor keywords to those with more clicks, conversions, and data. Semantic similarity scores are then applied based on that mapping. By taking a weighted average of active keyword RPCs using similarity scores from the NLP algorithm,

QuanticMind then estimates the RPC for each low-data or long-tail keyword. It can then meaningfully move forward in the bidding process with an individual keyword value. These RPCs are adjusted over time as activity accumulates.

Keyword	Similar Keyword	Similarity Score	RPC
commercial flooring	commercial flooring repair	0.815	1.91
commercial flooring	commercial flooring installation	0.731	1.67
commercial flooring	custom flooring	0.670	1.99
commercial flooring	wood flooring	0.635	2.60
commercial flooring	cedar flooring	0.594	2.24
commercial flooring	express flooring	0.582	2.27
commercial flooring	twin cities flooring	0.579	1.39
commercial flooring	bath room flooring	0.579	2.04
commercial flooring	cheap wood flooring	0.570	6.31
commercial flooring	new flooring	0.563	3.70
commercial flooring	inlaid flooring	0.558	1.61
commercial flooring	flooring install	0.557	3.33
commercial flooring	1 800 flooring	0.556	3.01
commercial flooring	hard wood flooring	0.556	1.44
Rpc Estimate			2.49

An example of long-tail keyword similarity and RPC



STEP 2

Understand Click and Cost Responses to CPC Changes

Once the value of each keyword is determined by the RPC calculation, QuanticMind models and maps elasticity between changes in CPC (bid) and the resulting impact on clicks and costs. The goal at this stage is to understand what the potential costs are, and the resulting click volume predicted at each hypothetical cost.

Google makes available their Bid Landscape Data (BLD) that can support this mapping and calculation, which introduces auction dynamics from the publisher into the picture. Other custom models are weighed against the BLD available from Google, particularly when that BLD is unavailable for certain keywords or attributes.

With these models, the machine can examine performance statistics of existing bids alongside bid performance simulations with multiple other bid amounts. The performance analysis of different bids paints a colorful picture of which bids drive which results.

Ultimately, this array of bids and their potential output is fed into QuanticMind's decision engine. It is used in conjunction with the other modeling and calculations for final bid selection.

Individual Keyword Auction Dynamics



Cost vs click elasticity mapped with bid landscape data



STEP 3

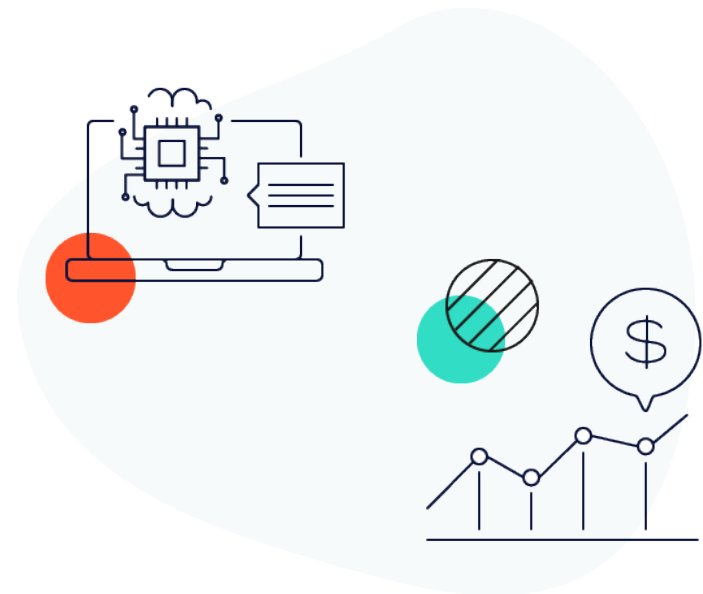
Determine the CPC that Maximizes Your Goal

Next in the process, QuanticMind plots the predicted cost and predicted revenue for each keyword by CPC. An optimization routine is run to determine the ideal bid for each keyword based on the type of goal you have specified. At this point, the goals and bidding strategy defined by the advertiser now takes over as the enforcer of which intersection of cost and revenue best aligns with the goal and target metric.

By way of example, if your goal is to maximize profit margin, the overall maximum margin for a group of keywords is obtained by finding the CPC at which each individual keyword achieves its maximum margin. For a Portfolio revenue goal (e.g. 200% ROAS), bids are calculated such that the goal is hit in aggregate across the bid policy, with some keywords above or below the target. An assortment of goal-strategies with accompanying target metrics can be selected to steer this part of the bid calculation process.

This step in the bidding process is where many legacy solutions lag behind QuanticMind. Any modern bid optimization technology utilizes a Portfolio approach, which involves driving towards a target while maintaining an efficiency metric across a group of keywords. With this

methodology, the goals of the group take precedence over any specific keyword-level goal: some keywords will perform poorly to maintain the efficiency metric (e.g., better ROAS), while bids on other keywords will be increased to drive the target goal (e.g., higher revenue). As a whole, the group lands where it's meant to (provided prior steps were accurate). The divergence between legacy solutions and QuanticMind starts to show in the rigor and complexity that's possible with the artificial

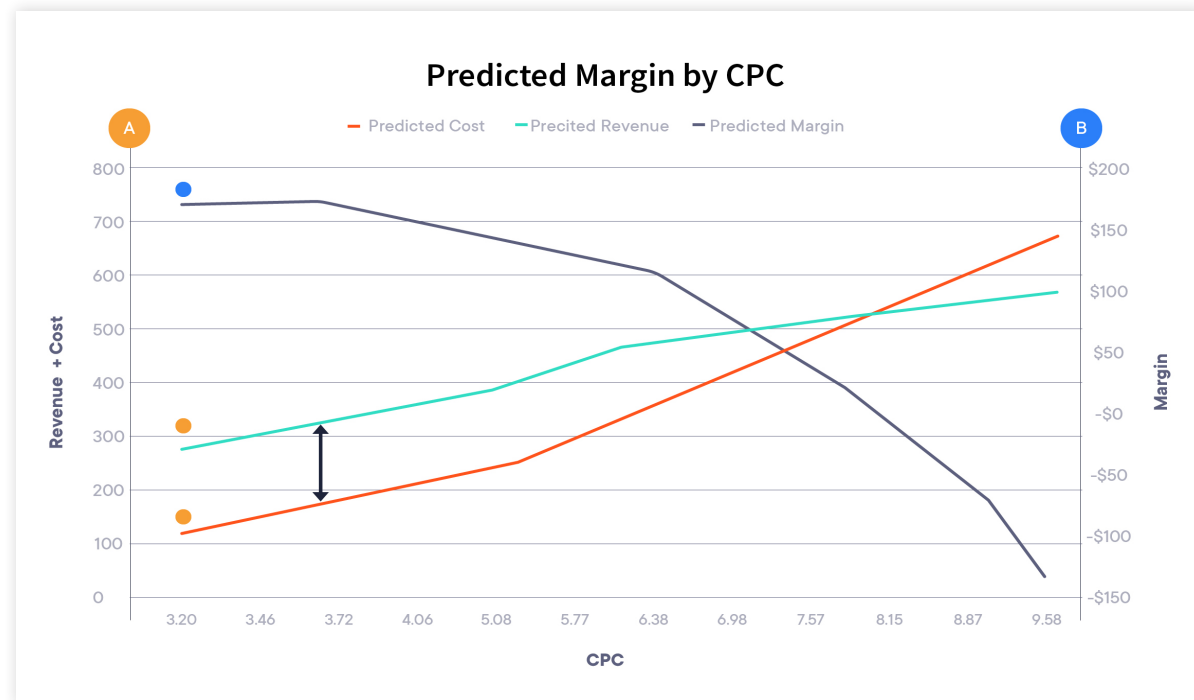




STEP 3 (CONTINUED)

intelligence Portfolio calculations. It also splits where advertiser goals focus on driving pure maximum profit margin, which isn't done through Portfolio techniques. Only QuanticMind is both able to bid at the keyword level using accurate revenue estimation for data rich and data poor keywords, and has the infrastructural underpinning and algorithms to maximize profit on every single keyword. With this unique strategy, if the keyword isn't driving maximum profit, it shouldn't even enter the bidding auction. It's not a Portfolio approach, but more granular and specific.

One other notable separation occurs here between QuanticMind's approach and other bidding procedures. A smoothing mechanism is employed daily to quickly react to performance trends, since predictions aren't always 100% perfect at first. If ever the forecasted performance results aren't closely aligned with the actual performance (as a trend, not per-day), QuanticMind's algorithms will automatically make very slight adjustments to bids. This ensures quick iteration, the correction of potential bias in bids, and continuous adjustment to drive the best performance possible.



CPC is selected at the value that best achieves program goals



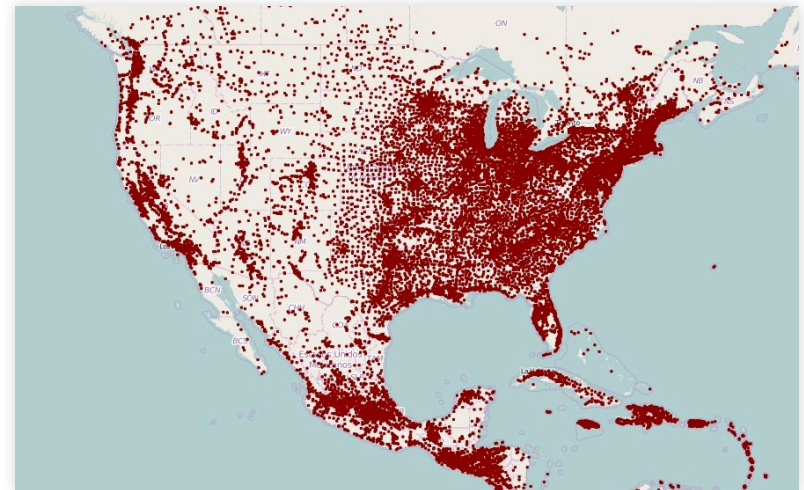
STEP 4

Calculate and Automate Bid Modifiers

At this stage in the bidding process, QuanticMind takes all of the work already done on calculating the best possible bid and pushes it to the next level by utilizing bid modifiers to make adjustments based on a new dataset not relevant in prior steps. The platform leverages the historical performance of each location, device, audience, etc, to determine how to get better results by adjusting bids based on which are more efficient.

QuanticMind's data science approach shines at this stage, using similar models to prior calculations—and a notable introduction of Bayesian modeling—to discern what application of bid modifiers has the best impact on the defined goals. Effectively the same machine learning and predictive models are applied at this point, nearly replicating the past steps, but using Location, Device, and Audience data. These modifiers are notable for the calculation portion because they are able to be automatically adjusted through QuanticMind's platform. The Time-of-Day Modifier will soon be a part of the process of calculation, optimization, and automatic application. This is a highlighted differentiator between other platforms, which typically cannot automate adjustments to any bid modifiers—or only a maximum of one.

This type of data isn't absolute, but is a relative comparison based on your program's history and where your ads have been served. To be clear, it is the relative difference between various geographic locations or between devices that are noted and built into the model so that the calculation of bid modifiers is done for the relevant locations in your program. This ultimately heightens the impact of more valuable locations or devices towards your goals. With bids modified again, the process is nearly complete.



Geography data - amongst others - is used to calculate bid adjustments

Image Source: Jeff Desjardins, Mapped: Population With a Dot For Each Town, Visual Capitalist, October 18, 2018



STEP 5

Anomaly Detection

To ensure only bids based on accurate data are pushed to the publishers, QuanticMind employs multiple anomaly detection techniques to check for outliers or other unexpected behavior that may indicate a data issue. This means on a daily basis, all key metrics (e.g., Cost, Revenue, Clicks, CPC, etc.) are compared for that day against what was forecasted by our models. If a large enough difference is found, a flag is called out as a potential outlier. If an outlier is detected, an alert is generated and bidding will not be updated based on the potentially inaccurate or deviant data. Once the issue is resolved or corrected, bidding can be rerun.

This anomaly detection is possible because of the way QuanticMind's infrastructure is designed and built. With distributed cloud servers, all data isn't stored in one computer but rather in a way that makes retrieval, reporting, and calculation both lightning-fast and scalable. Here is an example we've seen and corrected regarding this type of infrastructure: if five servers are recording pixel hits, for load balancing, but one server is failing and not being monitored, then 20% of the data being pushed back for calculation and optimization isn't available, therefore rendering calculations inaccurate. With QuanticMind, everything can be pulled and monitored in one place, despite being distributed across a cloud net-

work, so monitoring is powerfully enabled. A notable degree of performance benefits over other solutions are driven from the infrastructure developed for consistency, accuracy, and completeness of data availability for optimization calculation and reporting. In the final analysis, even the best algorithms working from incomplete data will still produce poor results.





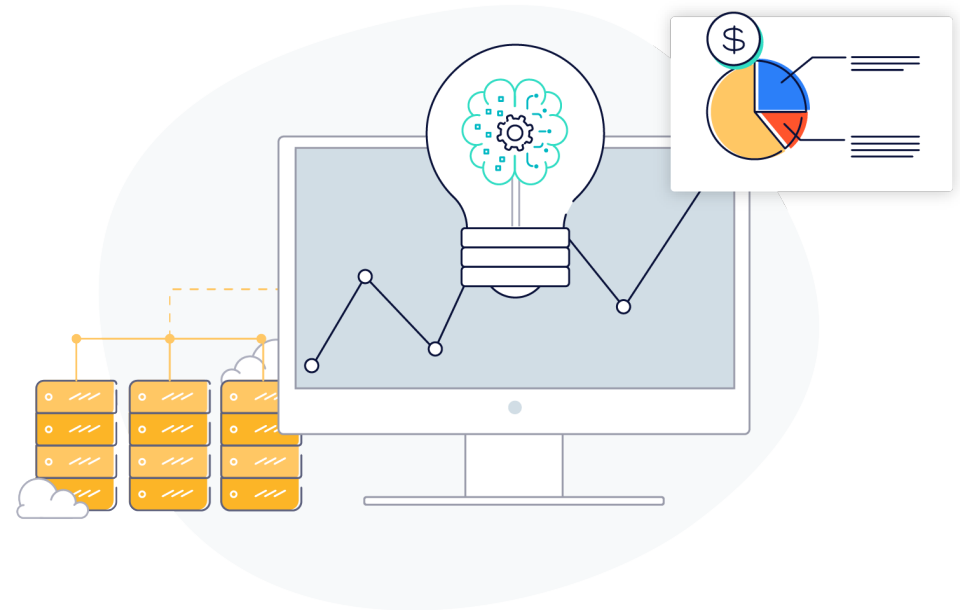
STEP 6

Bid Push

After all of these steps have taken place, bids and bid modifiers are pushed and applied to the Search Engine publishers. The best bids possible have been applied based on your historical performance, all or your data, your SEM and business goals, and the help of modern infrastructure and algorithms.

Certain advertisers have additional data that helps to optimize bidding throughout the day, for example, by using inventory data or other capacities or limitations to costs, leads, or revenue. QuanticMind's solution is able to ingest this data and apply logic to optimize and eliminate wasted spend in these types of situations.

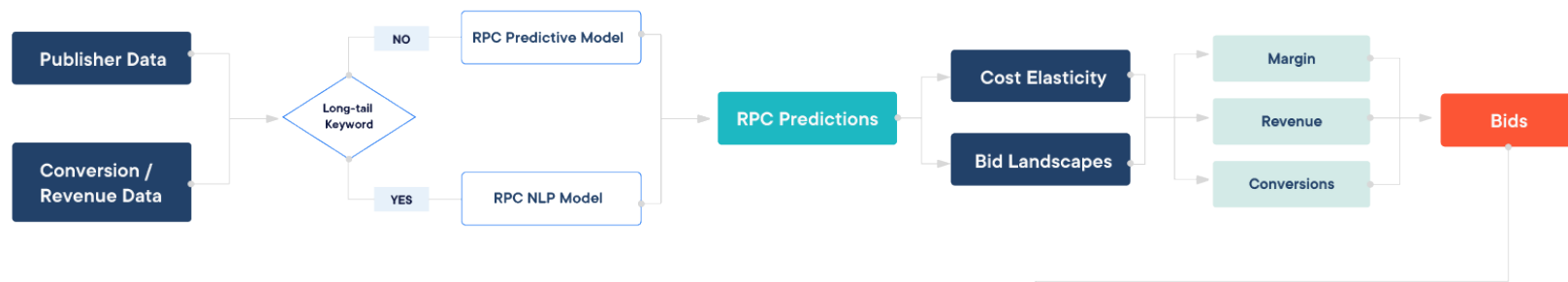
Throughout the day, every day, data is collected from publishers, 3rd parties, and offline sources and then fed back into the system for further calculations and optimization efforts. The cycle continues—on repeat—with the aim of driving peak performance to at-scale paid search programs.



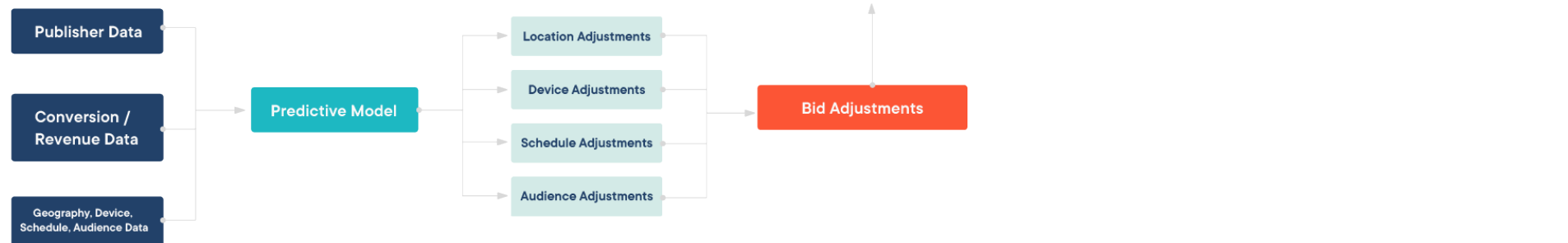
Data Science Bidding Flowchart

This visual representation of the bidding process follows the steps highlighted in the guide.

Keyword CPC Calculations



Bid Adjustment Calculations



Conclusion

Modern bidding automation and optimization for paid search is an immense technical maze. It requires a technical advantage and that all consuming “i” word: innovation. QuanticMind was built to solve the at-scale problems for performance marketers looking to maximize the efficiency of their data and SEM programs.

The six steps outlined here represent the way that fully optimized bidding calculation works in the modern world of paid search. By using machine learning, strong infrastructure, and more data, digital marketers are set up for greater success. Software tools are more powerful than ever, armed with methodologies and logic that make advanced techniques understandable and applicable on SEM programs.

However, the machines can’t do it all themselves; they need to be strategically aimed in the right direction by context-rich human beings. People need to apply their experience and expertise towards the problems that people can solve best: structuring and splitting campaigns, selecting strategic goals and targets, generating thoughtful ad copy, and so forth.

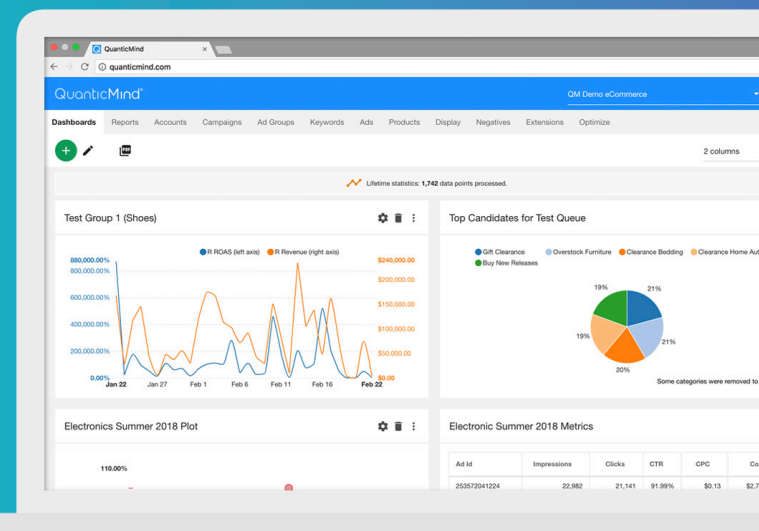
If you want to talk with the QuanticMind team to learn more about this bidding process and underlying data infrastructure, or how it can have an impact on your PPC program, we welcome you to reach out by Email, Phone, Website Chat, Contact Form, or however you prefer. Please feel comfortable in starting a conversation with us to learn and explore!

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Request a Demo

See for yourself how data science and machine learning can optimize your ad spend and maximize ROI. Watch a demo of the QuanticMind predictive advertising platform to see how you can automate optimization for specific keywords and target the highest quality leads using data from every stage of the funnel.

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QuanticMind

QuanticMind, the Platform for Smarter Advertising, is the pioneer of predictive advertising management software for paid search channels. By reinventing ad management point solutions through machine learning, distributed cloud computing, and in-memory processing, QuanticMind delivers the most intelligent, scalable, and fastest platform for maximizing advertising performance for enterprises. A global community of data-driven marketers relies on QuanticMind's data science-powered platform to anticipate and execute the best and most granular advertising investments.

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