Quantum in Production:
Maximizing TV Commercial Reach

Using quantum to optimize the assignment of TV commercials to time-slots delivers value for advertisers and TV networks

A few minutes spent browsing the web is enough to expose most internet users to lots of advertisements, most of which have been targeted to some extent based on the viewer's preferences and interests. But even if this has become one of the predominant form of marketing in the 21st century, the global market value for TV advertising exceeded $225B in 2022.

Recruit Group is a global technology company transforming the world of work by simplifying hiring, helping businesses work smarter, and creating a social impact that enables everyone to prosper together. Operating in more than 60 countries, their key subsidiaries include Indeed, Glassdoor, and its worldwide staffing business. In Japan, Recruit Group is also focused on streamlining business essentials from sourcing to marketing through its cloud-based smart solutions and matching platforms.
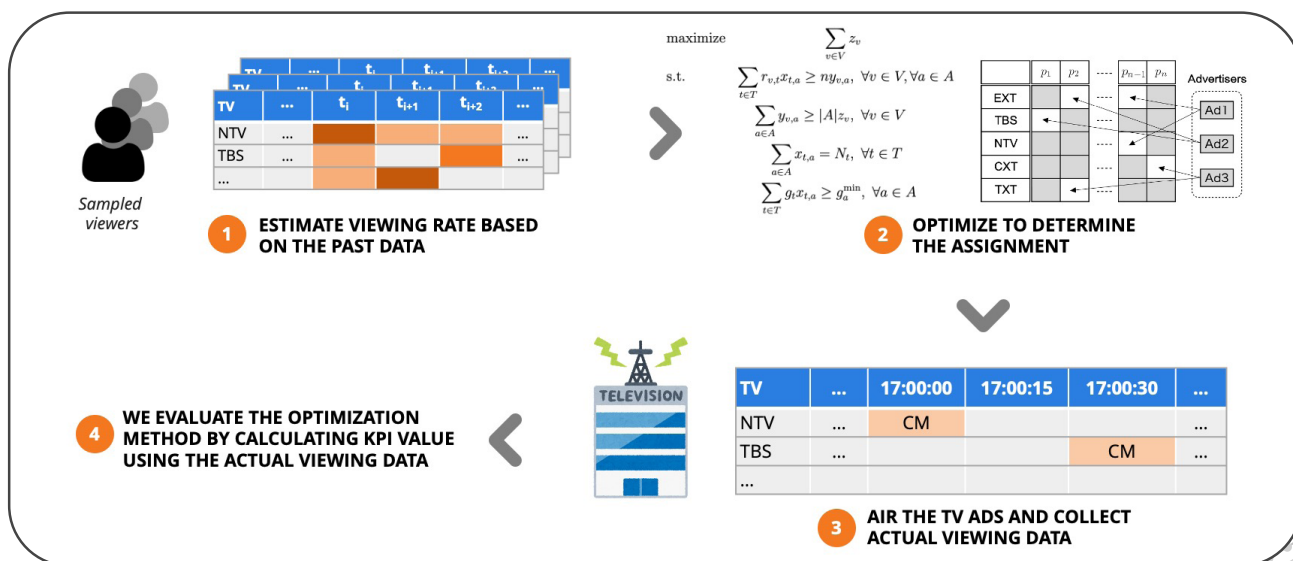
MEASURING ROI FOR TV ADVERTISING

Recruit has been a pioneer in exploring the application of quantum computing in support of its mission to match users and businesses in the optimal way for both parties. Recent work on optimizing the timing of TV ads using D-Wave's quantum hybrid solver 'constrained quadratic model' (CQM) was so successful, it is now being used in production to determine when these broadcast ads run.

For many advertisers, the principal goal of TV ads is to promote brand or product awareness. This means that they want to be sure that they're getting the maximum exposure for their investment.

One way to measure a campaign's success is 'reach', which describes how many people see a company's ad at least once. But many advertisers will release a series of distinct ads that promote their products and services in different ways, such that the goal now becomes to expose viewers to the full set of ads. To account for this, the Recruit team developed an alternative version of the reach metric, called n-all-reach, that quantifies how many people see all of the ads from a given client a certain number of times.

> "I think the most exciting part of this project is that millions of people in Japan watch TV commercials optimized by the D-Wave machine."

Recruit Machine Learning Engineer

1. ESTIMATE VIEWING RATE BASED ON THE PAST DATA

2. OPTIMIZE TO DETERMINE THE ASSIGNMENT

3. AIR THE TV ADS AND COLLECT ACTUAL VIEWING DATA

4. WE EVALUATE THE OPTIMIZATION METHOD BY CALCULATING KPI VALUE USING THE ACTUAL VIEWING DATA

PUTTING QUANTUM TO WORK

Maximizing this metric for multiple advertisers across a finite number of time-slots in the course of a day's programming is a complex combinatorial optimization problem. These kinds of problems are well-suited to be solved by quantum annealing systems.
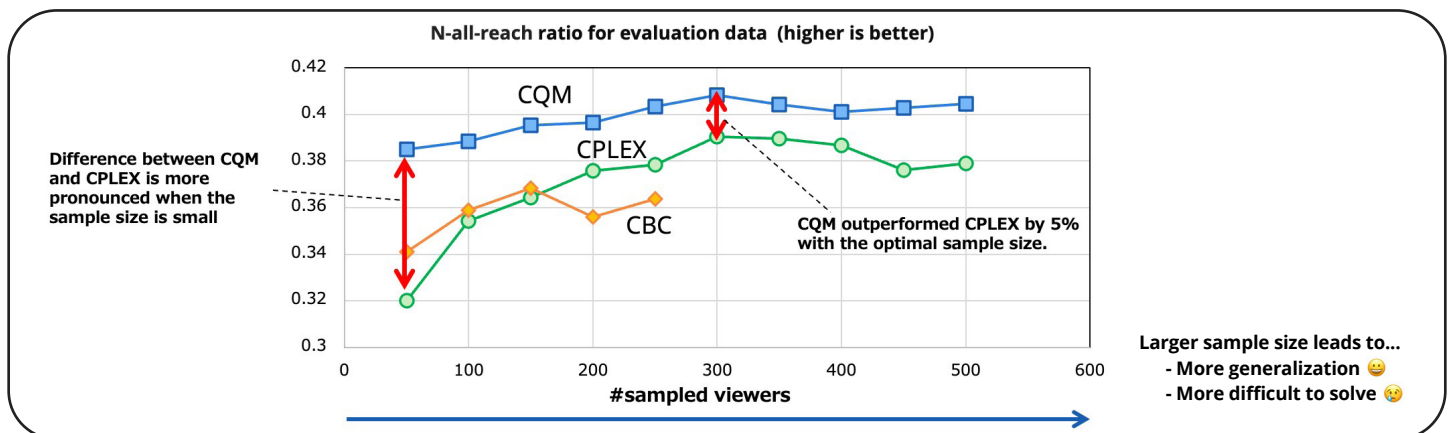
As a training set, the Recruit team collected historic ad-watching data from a sampling of real TV viewers, and then fed this into a machine learning algorithm in an effort to generate an optimized scheduling solution for future broadcasts. Finally, Recruit employed the proposed solutions to actually book ads into specific time-slot and analyzed how these various solutions performed in the real world.

Recruit tested three different computing solutions—CBC solver and IBM CPLEX*, a pair of mathematic solvers based on classical computing, and D-Wave's CQM solver. "Because our problem has very complex constraints, I thought the CQM solver would be very suitable," said Kotaro Tanahashi, a machine learning engineer at Recruit.

A key part of the project was to identify the optimal sample size of the viewer data. If the sample size is large, the problem size gets exponentially larger, and at some point is too large for any of the solvers to generate solutions. However, if the sample size is too small, only a small portion of the viewers are being considered so the solution is far from optimal. By testing with varying sample data sets, the Recruit team came up with the optimal sample size to maximize the n-all-reach metric.

The results showed that the CQM solver consistently outperformed the two classical computing approaches.

Today, the Recruit team reports that the quantum approach delivered reach metrics that were 90% better than those achieved through manual scheduling methods, and Recruit's solution has already found its way into the real world. "I think the most exciting part of this project is that millions of people in Japan watch TV commercials optimized by the D-Wave machine," said Tanahshi. "Our marketing department appreciates these results."

N-all-reach ratio for evaluation data (higher is better)

Difference between CQM and CPLEX is more pronounced when the sample size is small

CQM outperformed CPLEX by 5% with the optimal sample size.

#sampled viewers

Larger sample size leads to...
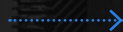- More generalization 😀
- More difficult to solve 😟

D-Wave Launch™: The on-board to quantum computing program

If you are ready to get started but not sure how, the D-Wave Launch program has been designed to help enterprises at every step of their quantum journey, from problem discovery through production implementation.
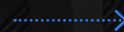
Identify the problem best suited to quantum

Get your team trained and start the development process

Move your application into test and ready for production

Get your application up and running to deliver benefit to your business

Sign Up Now To Get Started: www.dwavequantum.com/d-wave-launch

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