

Grid Dynamics Portfolio

PRICE OPTIMIZATION FOR VIDEO GAMES USING MACHINE LEARNING

CASE STUDY OF A VIDEO GAME PUBLISHER

www.gridynamics.com



MARCH 2020

Price Optimization for Video Games Using Machine Learning

Business Problem

The client sells video games in more than 70 countries via multiple digital and physical sales channels. The games published by the client are usually available on several gaming platforms, including PlayStation, Xbox, and PC, and are sold by a large number of digital distribution partners, such as Steam, PlayStation Store, and Xbox One, as well as traditional retailers such as Best Buy and Walmart. This extensive distribution network requires that price managers set hundreds of individual price points for different combinations of game edition, territory, platform, and retail partner.

The price-setting problem is further aggravated by the common use of high-low and dynamic pricing in the video game industry, high price transparency due to the high proportion of digital sales, the need to coordinate price promotions with retail partners several months in advance, and uncertainty about the performance of new game releases. Price managers must therefore change prices and promotions frequently and plan changes in advance while accounting for multiple factors (e.g., competitor pricing, initial reception of a game from critics and the market, etc.) These issues make it challenging to achieve optimal profitability without an advanced decision support tool that provides long-term demand forecasting and price optimization capabilities.

To address the challenges described above, the client company engaged Grid Dynamics to develop a platform for omni-channel demand forecasting and price optimization using data science and machine learning methods.

Business Solution

The project focused on delivering the following business capabilities:

- Accurate long-term (up to 24 months) forecasting for the main performance metrics of a game, such as sell-in and sell-through units, number of installations, and revenues.
- What-if analysis of possible pricing scenarios. The main use case is the evaluation of weekly price promotions.
- Effective evaluation of pricing scenarios and breaking down of forecasts by region, franchise, game edition, gaming platform, and retailer.
- The ability to create forecasts and evaluate pricing scenarios for new game releases.

About the Client

The client is a leading video game company that develops and publishes interactive entertainment for PC, console, and mobile platforms.

The company entered the video game industry in the early 1990s and currently employs more than 5,000 people. The studio's portfolio includes multiple critically acclaimed franchises. The company has multiple offices worldwide and holds strong market positions in the US, Europe, and Asia.

The first three goals are standard in most price optimization projects, while the fourth is unique to the video game industry, where two releases in the same game series can be very different products with very different sales performance.

Figure 1 shows how the core functionality of the solution looks from the end-user standpoint. The long-term forecasts for multiple scenarios help the price manager to determine the optimal promotion time frames, discount depths, and other pricing parameters.

Technical Solution

The solution was implemented on top of a cloud machine-learning platform using an open-source technology stack for data processing, model training and evaluation, and workflow management.

One of the first implementation steps was setting up the technical infrastructure: the development and production environments in the cloud machine-learning platform, connectivity to the main enterprise data sources, and job scheduling tools. Once this technical infrastructure was established, several baseline forecasting models were quickly prototyped. These models helped to identify the limitations of the immediately available data sets, educate the data science team on how to use the publisher's domain knowledge, and refine the project plan accordingly.

The prototype phase revealed several data issues, so considerable effort was spent on creating a data layer sufficient for accurate forecasting. The following steps outline this process.

- As raw non-aggregated data did not always accurately roll up to the overall financial metrics, these discrepancies were investigated and reconciled.
- Multiple issues with mislabeled and dirty data were investigated and fixed through outlier removal and other techniques.
- Multiple external data sets, such as competitor pricing, sport event calendars, and YouTube and Twitch statistics, were collected from public and proprietary sources. The importance of features derived from each source was gauged, and impactful data elements were incorporated into the data layer and ultimately into the forecasting models.

Another important finding during the prototype phase was that different periods of the game life cycle have very different business significance due to seasonal demand spikes and other considerations. Thus, the risks associated with forecasting errors for regular and mission-critical periods also differ, an issue addressed through the development of custom composite model quality metrics.

The forecasting models were developed in several iterations, each incorporating additional data elements, data quality improvements, and investigation and fine-tuning of forecasting errors and outliers. Sample model outputs were provided to the business users as a preview.

From the data science perspective, a major challenge was forecasting for new game releases. Because different releases of the same game franchise can be received differently and exhibit significantly different sales dynamics, historical data for previous releases have limited predictive power for new releases. This issue was mitigated by incorporating on-going data, so that the first sales data observed for a new release are efficiently used to adjust forecasts.

The final models and data processing scripts were deployed onto the production environment and scheduled for regular retraining and reevaluation, so that forecasts are automatically and regularly updated and become immediately available to the business users.

Business Outcome

The engagement was structured as a six-week pilot project followed by several additional projects.

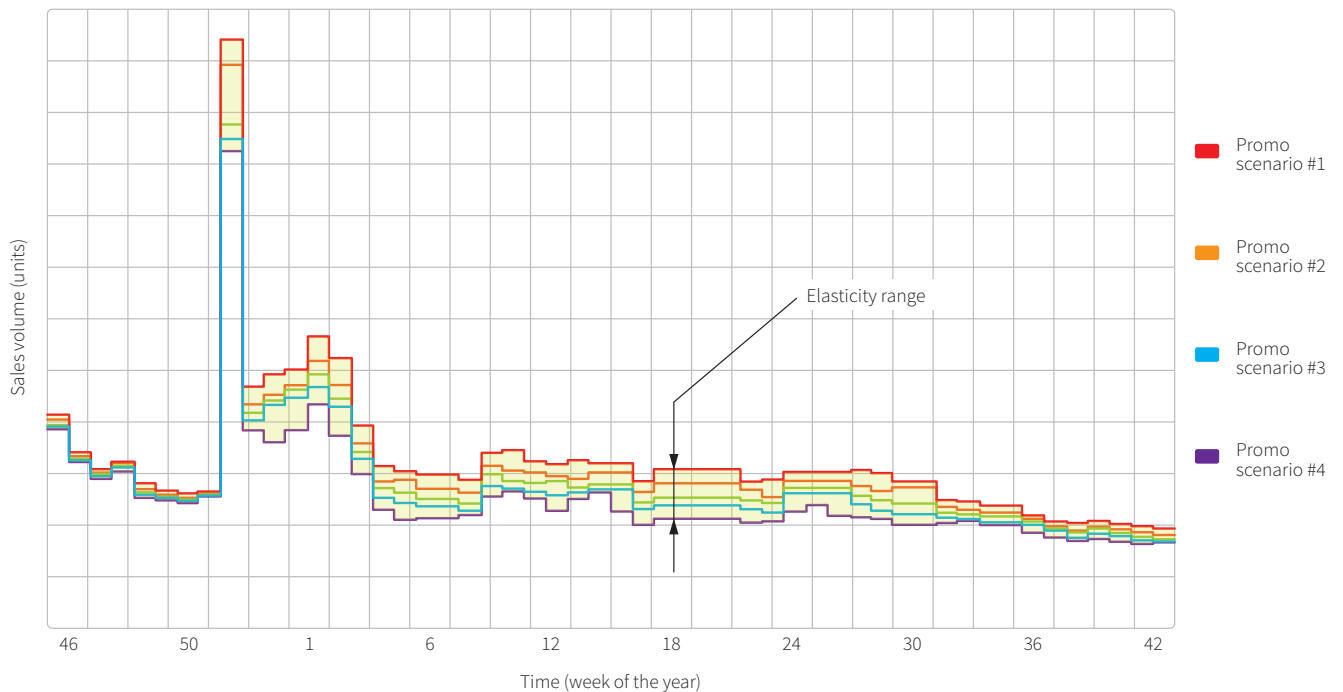
The pilot project aimed to deliver a fully functional solution for a new release of one of the best-selling games. It also established a technology and data framework that can be applied across all game franchises. This scope was delivered on time, right before the new game launch, and the forecasts produced by the model were used by the price management team as a main decision support tool throughout the game release life cycle.

The downstream implementation projects focused on on-boarding additional game series, extending the range of forecasted metrics, and business process automation.

Solution Summary

- Business Capabilities**
Sales volume forecasting, regular price optimization, promo price optimization
- Industry-specific Features**
Forecasting for new game releases
- Forecast Horizon**
Up to 24 months
- Forecast Resolution**
One week
- Forecast Granularity**
By region, platform, retailer
- Data Sources**
Sales data, promotion history, marketing activity, public events, hardware sales, competitor pricing, competitor sales, YouTube and Twitch statistics
- Implementation**
Open source libs and frameworks
- Infrastructure**
Cloud
- Pilot Project Timeline**
6 weeks

Figure 1. Example of what-if analysis of promotion scenarios using a demand forecasting model. The area between the most extreme scenarios corresponds to the promotion price elasticity.



Grid Dynamics Inc.

5000 Executive Parkway, Suite 520
San Ramon, CA

650-523-5000
info@griddynamics.com
www.griddynamics.com

The information in this document is provided as is and does not warrant the accuracy, completeness and fitness for a particular purpose. In no event shall Grid Dynamics International be liable for any damages whatsoever arising from your reliance on any information contained in this document. Except as permitted under the Copyright Act no part of the document may be reproduced, transmitted, stored in a retrieval system, or translated into any human or computer language in any form by any means, electronic, mechanical, magnetic, optical, chemical, manual or otherwise without the expressed permission of Grid Dynamics International.