MIT Demand Forecasting and Price Optimization Tool for Rue La La

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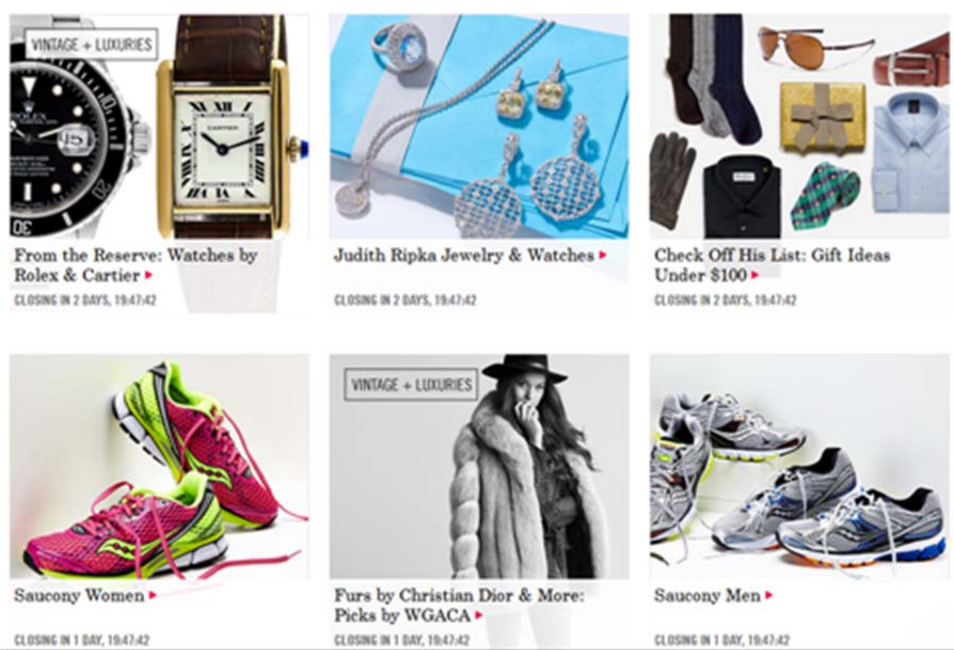
Rue La La and Its Revenue Management Challenges

The project we worked on with MIT was to optimize our primary pricing for fashion products and I'd like to reiterate that this was a really great project. It was fun working with the team, but it was a very useful tool that is going to fundamentally impact our business.

Rue La La is a half a billion-dollar retailer primarily focused in the US. We cover a few different product categories, primarily women's fashion, apparel, contemporary, traditional, accessories and luxury fashion. We also carry men's fashion, home goods and kid's products. We have a member base of about 9 Million. Primarily US based but recently started shipping to international locations as well.

Snapshot of Rue La La's Website

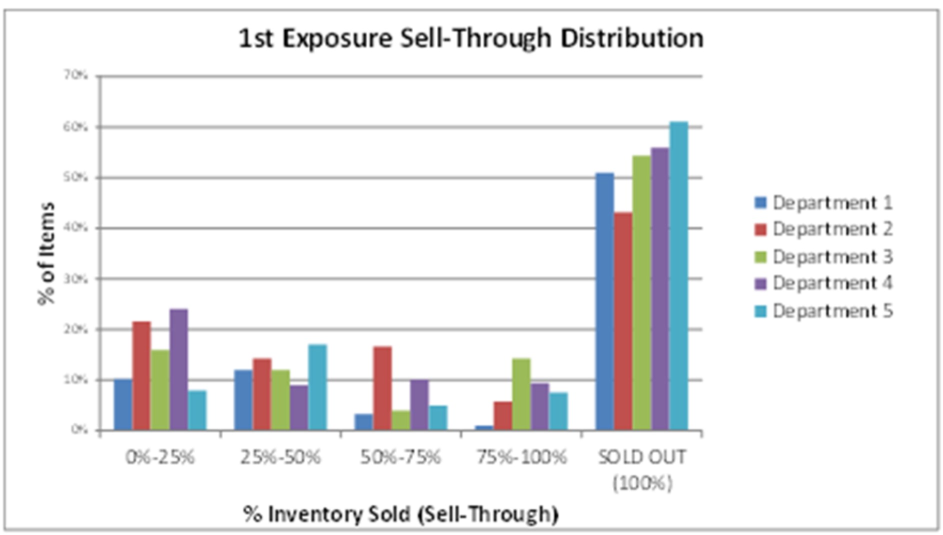


Now let me get into the pricing process itself.
The first challenge is: what is competitive pricing? It requires us to go mine price data from competitive websites and sometimes, physical stores as well in order to figure out the price point of a similar style. In fashion, it is very hard to find that

same product on any website because of the way the industry works. Brands make the products differently for different retailers and it is very hard to find the exact same product somewhere else. The problem that it is not well studied and well understood and there are no good tools for is “how do you set the price of the first exposure for fashion products?” That is the fundamental problem we were tackling.

In the absence of a tool, today the merchants would hit their margin targets they would price on a cost plus basis. They take the cost from the purchase order and based on the target and margin we are trying to hit come up with a retail price and show that the retail price calculation is sensible. They want to make sure a category of products is priced in the same range for an off price retailer. That’s about all they do. They try and net out a margin target at the overall event level and they have no ability to differentiate between styles.

In order to optimize prices, our hypothesis was that there are certain absorbable attributes of certain styles that could be used to figure out which ones do well versus others. The first step in this process was to look at our existing data and what the performances of certain styles were. In the chart below you can see the sell through distribution by styles:



*Data disguised to protect confidentiality

Sell through is a metric that we use to understand the sales performance of specific items. It is defined very simply as sales units divided by supply units. Let’s say for a specific sweater, we had 100 units we purchased from the brand and we exposed that sweater at an event and 60 units actually sold out. The sell through in this case is therefore 60 percent. We calculated this sell through for every style and then created a histogram of what percentage of styles fall under various sell through buckets. The graph here shows you the sell through bands 0 – 25, 25-50, 50-75, 75-100 and completely sold out. The Y-axis shows you what percentage of the styles actually fall under that bucket.

This chart showed us that 50% of our styles sell out the first time they are exposed. That showed us that there is incredible value in being able to predict which styles fell into that bucket and that gave us an opportunity to price higher on those styles. It also shows that 50 percent of the styles don't sell out. So when we buy for a certain target sell through our merchants don't really know which styles are actually going to be selling out and which styles are not going to be selling out. They just play a portfolio strategy, buy different styles and 50% work and 50% don't.

So the question was: if the human being cannot find out, which styles will sell out, can a computer find out? That was the question that we posed to the MIT team. That prompted and kicked off the project. The MIT team created a regression model based on observable attributes which helped us build a demand prediction model at a style level. This was the foundational model for the price optimization tool.

Integration of the MIT Demand Forecasting and Price Optimization Tool with Rue La La's Business Processes

Every day the price optimizer suggests recommended prices for the first exposure style events that are starting the next day. It prices all styles for an event together for the next day in a single run. It takes about an hour and at the end of that run an email goes out to all of the merchants with recommendations for prices for the exposure styles for next day's events.

Part of this process is to ensure that a couple of things are accounted for:

1. The model does not utilize competitive prices as its input and therefore, we need somebody to make sure that the prices are not outside normal ranges. Even though we have some of our own internal safe guards in place that limit how much we raise prices, we want to ensure that we are still competitively priced because that is the fundamental value proposition to our customer.
2. We need to educate the merchants in terms of how the prices are actually set. In every retailer, merchants have price control and unless it is completely algorithmic, competitive price based, there is some art to this process and merchants feel that they provide the art of the pricing process. To ensure that they are not completely cut out of this, we share the prices with them and they make sure that the recommendations are sensible.

This helps with the gradual change management process. More importantly, the way the algorithm is set up, it uses the merchants' recommendations in the cost process is used as a starting point. We don't try to set the optimal price over an entire range. We use the merchant prices as a starting point and then just put prices around that range. All in all, the merchant input is the integral part of the algorithm, but sharing the results with them and having them go through the approval process gives them the confidence that we are not doing anything unreasonable.

Discussion of Results and Impact on Rue La La's Business Performance

If you raise prices you're going to raise margin but the question that everyone was concerned with was if you raise prices, is that going to hurt our demand?

The algorithm is set up to maximize the revenue dollars and therefore if the actuals followed the model predictions, then you would see revenue dollars going up, which is what we saw. We saw that our results showed a 10 percent improvement in revenue and therefore the margin rate came at higher margin dollars.

The other goal that we were going after was we should not be impacting demand. You could sell fewer units and make more margin dollars, but selling fewer units means that we also have more unsold inventory in our warehouse that we still need to clear through and it also impacts our relationship with the brands. So there was another objective that was not directly used as an objective function in the model, but it is still a business objective and that was to make sure our sell through rates were not directly affected.

The analysis that we have done using the tool, found that the sell through rates are not impacted through a broad range of price point categorizations except for the really low price points under 45 dollars. If you raise prices by 10-15% that increase in price is still a high increase for a product at that price point and we saw some deterioration in sell through even though margin dollars were higher. This result was interesting so what we did to stem the negative sell through trend was to cap the price increases to no more than 5 dollars.

Overall we were extremely pleased with the outcome of this project, not only because the business impact was there, but it was also a pleasure to work with this team, they really understood our business and it was not normal that you see academics really understand the business problems that we're trying to go after and so this was a breath of fresh air. I have an OR background myself and I completely understand the value of bringing some of these tools and techniques into making business impact. This was a classic case study for how we could make this happen for the pricing problem.