Merlin Predictive Engine

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The issue

Having the right quantity of the right items on the shelf at the right time is critical to retail success, cash flow and earnings.

This is a non-trivial task as retail sales are fickle, driven by many factors including seasons, product life cycles, new product introduction, and changing customer tastes which in turn are influenced by advertising and fads.

Demographics mean that every retail store (and the local supply chain that supplies them) will have a different product mix from every other.

But despite these difficulties, the commercial buyer must make decisions in real time, and does not have the luxury of waiting until all facts are available. The decision not to make a decision is in itself a decision.

The solution

The approach adopted by Parklea Software Ltd was to apply a modified form of Bayesian inference using internal feedback mechanisms, in order to produce at the start of each month a forecast of the sales of every item in every site for the coming month. The approach 'learns' and scores itself gradually refining it's forecasts and develops a known degree of confidence in each forecast. I.e., on a particular product in a particular store it may know that there is a 92% probability of selling between 900 and 1100 units in the next 30 days.

With this decision support data available the buyer is able to make better decisions resulting in improved rate of stock-turnover, less out-of-stocks, and less dead stock. In many retail sites in NZ, Australia and Britain the approach has proved able to correctly forecast sales of between 90% and 96% of line items for 30 days ahead.

In Parklea's own retail pharmacy implementation of this approach, the system itself produces suggested orders based on the economics of the particular business, suggesting an order for the quantity of each line that give the greatest probability of the greatest return on capital. However the largest improvements are obtained where an experienced human buyer uses the data for decision support applying human knowledge of fashions, fads, competing product introductions etc to the computer analysis. Or where the system is used to reset the max/min levels on an existing system to improve its performance.

Development approach

By the mid 1990s there were some 1000 sites running the Parklea forecasting analysis on around 10,000 line items every month, giving 10 million forecasts a month. As the forecasting software was linked directly to the Point-of-Sale package that Parklea was supporting at the time, the actual sales were observed by the forecasting software during the month and the result for each line compared to the forecast. This 100% accurate feedback was used to refine the system and develop better algorithms. For 3 or 4 years (around 500 million forecasts and refinements) the system continued to improve, levelling out with around 92% of items being forecast to good accuracy.

There is nothing inherently retail-specific about the sales forecasting method, and it has been found to work well in other types of business, and wholesalers. To date the larger the business, the better the approach has worked as the sales are more predictable (an individual customer's unusual purchase has less effect)

With ever shorter product lives and ever more fickle customers, the classical statistical approach has difficulty. A modified Bayesian inference appears to be particularly well suited to forecasting sales where a decision must be made but insufficient data is available for a classical analysis.

Results

In almost all retail stores use of the forecasting software has resulted in an improvement of around 15% in stock efficiency (15% more turnover for the same capital employed), and a 50% reduction in both out-of-stocks and dead-stock compared with conventional computerised stock control systems. Users advise that this has a significant effect on the bottom line.

Development is continuing with Genetic Algorithms being used to 'breed' the best fitted forecast for each item and site.

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