Unconstrained Demand Forecasting in the Car Rental Industry

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Background

One important technique that AVIS uses in its revenue management system is to set booking limits for early booking, low value customers to reserve enough capacity for late booking, high value customers. The very use of booking limits, however, constraints the historical demand data. When demand forecasting is completely based on these constrained demand data, the forecasted values will not reflect the actual market demand. Once these constrained demand forecasts are used by the optimiser module in the revenue management system to work out the booking limit into the future, the results will only be considered optimised against the constrained demand, which could well be sub-optimal against the true demand. Moreover, once these constrained booking limits are implemented, the interaction propagates over time, compromises the performance of the revenue management system, and could finally lead to significant revenue loss. In a case study based on hotel/casino booking data, Queenan et al. (2007) demonstrates that failing to unconstrain the demand data could cause up to 10% less revenue.

Challenges

The car rental industry differs significantly from the hotel or airline industries in that the available capacity is very flexible. Unlike aircraft seats or hotel rooms, cars can be moved between stations quite easily. On/defleeting can be used to increase/decrease the overall capacity if necessary. The capacity will thus be different between now and then. The booking limit controls might be turned on and off multiple times. Furthermore, the forecast is required to provide information on seasonality, no shows, cancellations, car return distribution (often cars are returned earlier or sometimes later than the agreed return date)… The resulting complexity poses the main challenge in car rental demand forecasting.

Research Objective

The research objective is to identify a heuristic methodology for demand unconstraining suited to the high complexity of demand forecasting in the car rental industry.

Deliverables

Since there are only 12 weeks to spend in this mini project, it could be too challenging for the student to achieve the final objective mentioned above. In light of this, we would like the student to work against the following deliverables step by step.

1. Understand the basic forecasting techniques, especially the Winter's method.
2. Understand the demand pattern and availability restrictions used in the car rental industry.
3. Review of the unconstrained demand forecasting methods already available in the literature. Study the feasibility to apply them to AVIS demand data.
4. Choose promising methods and apply them to AVIS demand data. Compare the results between them and those without unconstraining demand.
5. Develop new unconstrained demand forecasting methods for AVIS or in general the car rental industry.

End Users

Car rental companies would benefit from this research, as well as other industries to which the developed unconstraining heuristic can be applied.

Outline of potential follow-up PhD project:

Further research could build on the developed method to measure impact of the improved forecasts on revenue performance of the optimisation module, and its application to other industries such as railway.

References

Queenan C. C., et al, A comparison of unconstraining methods to improve revenue management systems, *Production and Operations Management*, 16(6), 2007, 729-746