Predictive Skill Based Call Routing Using Multi-Label Classification Techniques

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ABSTRACT
This article is in the context of a call centre whose agents possess a heterogeneous skillset. The significant challenge for such a call centre would be skills based call routing: to match an inbound customer call to a call centre agent possessing the relevant skillset. This article will present an alternative to the usual Interactive Voice Recording (IVR) menu based approach to skill based call routing. This article will also make use of a multi-label classification techniques to predict the purpose of the customer call in advance and route it to the appropriate call centre agent without the customer’s intervention. This hassle-free call routing technique produces efficient interactions and helps enhance customer experience, resulting in higher customer satisfaction and better cross-sell opportunities.

KEYWORDS
Heterogeneous Skillset, Multi Label Classification, Predictive Analytics, Skill Based Call Routing

INTRODUCTION
Modern services industry has witnessed an exponential growth in the diversity of services that are offered to customers (Deloitte, 2015). This burgeoning diversification is complicated by intense competition which characterizes the industry. Competition has forced service firms to leave no stone unturned in building effective customer relationships and endeavouring for high quality customer experiences. In this process, the company’s customer service personnel i.e. the frontline employees play a significant role in determining the overall opinion of the service provided (Fitzsimmons & Fitzsimmons., 2006). Therefore, service firms expend a lot of energy trying to ensure the availability of well-qualified, well trained and skilled customer contact personnel.

Ideally, a company would want its customer contact personnel to be able to skillfully handle the universe of all possible customer requests. However, increasing complexity, diversity and an explosion of number of possible services has rendered this infeasible. Customer contact personnel typically try to specialize in a limited set of activities relating to the customer. This helps them focus and develop expertise only in specific categories of calls and service requests rather than spreading themselves thin across the plethora of possible activities. This phenomenon is more prevalent industries like the financial services industry where customers usually possess limited financial knowledge and the contact personnel play a major role in guiding the customers. In these situations, contact personnel have very little flexibility in terms of their skill sets and are closer to what is known as the fully dedicated (FD) architecture of call centers (Legros, Jouini, & Dallery, 2015).

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The quality of service in a call center depends on both how long the customer must wait to receive service (also known as service process) and the value that the customer attributes to the information and service that is received (also known as service outcomes) (Akşin, Armony, & Mehrotra, 2007). This heterogeneity in contact personnel skillsets, however, directly impacts service quality on both these fronts. A typical customer call to a financial services call center would involve the customer choosing from a long list of possible service requests from an Interactive Voice Response (IVR) system. Usage of IVR system directly increases the amount of time it takes to acquire the service. Further, some customers are not adequately equipped to decide the skillset necessary for their service requests. This might result in an incorrect choice or whichever choice leads them to speak to a call center agent directly. This results in the customer either not getting the requisite information and/or re-routing to agents with relevant skillsets and a higher waiting time. All these lead to frustration, dissatisfaction and eventual abandonment resulting in a deterioration of service quality. Finally, call center interactions have been increasingly used as an opportunity to cross-sell/up-sell other relevant offerings to the customers (Rongala, 2015). A cross-sell pitch right after a bad quality service experience can prove to be more counter-productive, further adding to the customer’s woes.

Services are characterized by heterogeneity and variability. Every arriving customer has their own set of expectations from the service and possesses varying capabilities that require different handling from the customer contact personnel. The unpredictability of the type of the customer arriving is the key challenge in the services domain and effectively navigating this unpredictability is essential to build sustainable competitive advantage for the firm. Today’s companies are able to capture customer data like never before through various touchpoints like social media, web clickstreams, text data and other touchpoints that provides a rich source information regarding customer requests and behavior. Recent advances in predictive analytics has enabled companies generate very powerful insights to help enhance the customer experience. In this study, we make use of a family of predictive analytics techniques named multi-label classification techniques (Tsoumakas & Katakis, 2007) in the context of a financial services call center.

The key objective of our work is to improve the quality of the customers’ service process as well as the service outcomes while enhancing the cross-sell opportunities. Our methodology makes use of available structured and unstructured customer information to predict the purpose of the call in advance and route it directly to the agent with the requisite skill. We evaluate the various available multi label classification techniques using historical data from an existing call center and choose the one that fits our data best. Further, we present the impact of deployment of the system on the call center’s performance metrics.

In what follows, we review relevant literature and position our paper relative to previous work done in this regard. We then present the methodology followed to arrive at the multi-label classification technique that best suits the available customer data. We conclude with limitations and scope for future research.

**LITERATURE REVIEW**

Call center operations management has been a fertile area of research spanning across various sub-domains like call forecasting, personnel acquisition, staffing, scheduling, call routing and call center performance evaluation (Akşin, Armony, & Mehrotra, 2007). Incorporating heterogeneous skillsets into workforce planning has also been a topic of interest in past research. De Bruecker et al. (2015) present a comprehensive review and classification of literature dealing with workforce planning problems incorporating skills. We position our paper in the De Bruecker et al.’s classification scheme as follows: this paper’s application area is in the call center domain where Individual categorical task skills which are determined by degree of technical knowledge/capability and result in higher quality service. There is limited flexibility in the tasks and the primary focus is on skill specialization rather
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