The CRM–KDD Nexus

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INTRODUCTION OF KNOWLEDGE DISCOVERY IN DATABASES AND CUSTOMER RELATIONSHIPS

Customer relationships are increasingly central to business success (Kotler, 1997; Reichheld & Sasser, 1990). Acquiring new customers is five to seven times costlier than retaining existing customers (Kotler, 1997). Simply by reducing customer defections by 5%, a company can improve profits by 25% to 85% (Reichheld & Sasser, 1990). Relationship marketing—getting to know customers intimately by understanding their preferences—has emerged as a key business strategy for customer retention (Dyche, 2002).

Internet and related technologies offer amazing possibilities for creating and sustaining ideal customer relationships (Goodhue, 2002; Ives, 1990; Moorman, 1992). Internet is not only an important and convenient new channel for promotion, transactions, and business process coordination; it is also a source of customer data (Shaw et al., 2001). Huge customer data warehouses are being created using advanced database technologies (Fayyad et al., 1996).

Customer data warehouses alone offer no competitive advantages; insightful customer knowledge must be extracted from such data (Kim, 2002). Valuable marketing insights about customer characteristics and their purchase patterns, however, are often hidden and untapped (Shaw, 2001). Data mining and knowledge discovery in databases (KDD) facilitate extraction of valuable knowledge from rapidly growing volumes of data (Mackinnon, 1999; Fayyad et al., 1996).

This chapter provides a brief review of customer relationship issues. The chapter focuses on (1) customer relationship management (CRM) technologies, (2) KDD techniques, and (3) key CRM-KDD linkages in terms of relationship marketing. The chapter concludes with the observations about state-of-the-art and future directions.

BACKGROUND: CRM TECHNOLOGIES

CRM is interpreted in a variety of ways (Goodhue et al., 2002; Winer, 2001; Wright, 2002). In some cases, CRM simply entails direct e-mails or database marketing. In other cases, CRM refers to customer interaction centers (CICs) and online analytical processing (OLAP), which are types of online query-driven analyses for examining stored data. Overall, CRM can be seen as a core business strategy to interact with, create, and deliver value to targeted customers to improve customer satisfaction and customer retention at a profit. It is grounded in high quality customer data and enabled by information technology (Ang & Buttle, 2002).

Three core dimensions characterize buyer-focused CRM systems: customers, management, and technologies. *Customer* service and related issues must be included in the design, implementation, and operation of any CRM system. Organizations benefit from CRM particularly when such systems benefit their customers; using CRM merely as a sales or customer service solution is a recipe for failure (Davids, 1999). *Management*'s articulation and tracking of customer relationship goals, plans, and metrics is an essential CRM component (Ang & Buttle, 2002; Greenberg, 2002). Successful CRM implementations rely on management goals, strategies, and plans that reflect customer commitment and promote a customer-responsive corporate culture at all levels of the organization (Ang & Buttle 2002; Smith 2001). *Technologies* for facilitating collaborative, operational, and analytical CRM activities are the manifest aspects of CRM (Goodhue, 2002).

Figure 1. Alignment of three dimensions of CRM
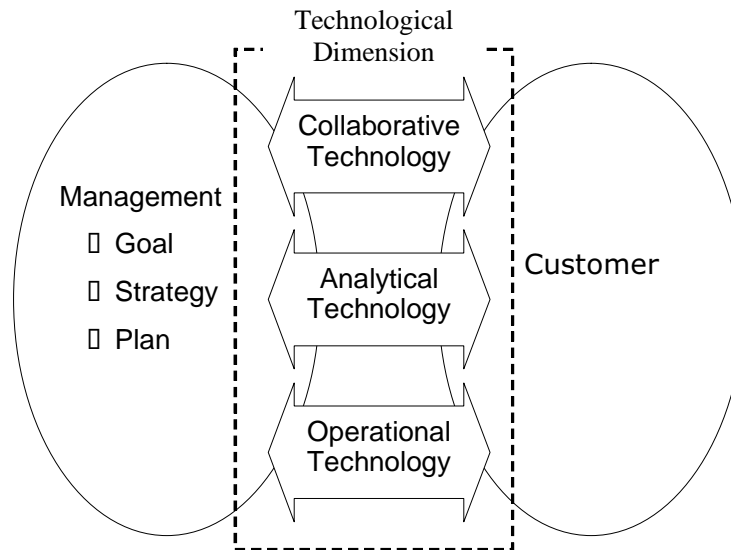
A collaborative CRM system is any CRM function that provides a point of interaction between the customer and the marketing channel (Greenberg, 2002). E-commerce and, in some cases, mobile commerce systems, offer multiple "touch points" for reaching the customers. In employing the Web and mobile technologies, it is important to ensure that such technologies enhance older, preexisting channels (Johnson, 2002). *Operational CRM* systems are technologies that span the ordering-delivery cycle (Goodhue et al., 2002). Operational CRM is concerned with automating the customer-facing parts of the enterprise (Ang & Buttle, 2002). Since the sales process depends on the cooperation of multiple departments performing different functions, integration of all such functions is critical for operational CRM systems (Earl, 2003; Greenberg, 2002). *Analytical CRM* systems analyze customer data warehouses so that the firm can detect valuable patterns of customers' purchasing behaviors. Offline data mining of customer data warehouses as well as online analytical processing (OLAP) can aid in applications such as campaign management, churn analysis, propensity scoring, and customer profitability analysis (Goodhue et al., 2002). It is this component of CRM that has a clear linkage to KDD methods.

BACKGROUND: KDD TECHNIQUES

Since multiple data formats and distributed nature of knowledge on the Web make it a challenge to collect, discover, organize, and manage CRM-related customer data (Shaw et al., 2001), KDD methods are receiving attention in relationship marketing contexts (Fayyad et al., 1996; Mackinnon, 1999). Massive databases are commonplace, and they are ever growing, dynamic, and heterogeneous (Mackinnon & Glick, 1999). Systematic combining of data mining and knowledge management techniques can be the basis for advantageous customer relationships (Shaw et al., 2001).

KDD is defined as the process of data selection, sampling, pre-processing, cleaning, transformation, dimension reduction, analysis, visualization, and evaluation (Mackinnon, 1999). As a component of KDD (Fayyad et al., 1996), data mining is defined as the process of searching and analyzing data in order to find latent but potentially valuable information (Shaw et al., 2001).

KDD constitutes the overall process of extracting useful knowledge from databases. It is a multidisciplinary activity with the following stages (Brachman et al., 1996; Bruha et al., 2000; Fayyad et al., 1996)

- Select the problem area and choose a tool for representing the goal to be achieved
- Collect the data and choose tools for representing objects (observations) of the dataset
- Preprocess the integrating and cleaning data
- Data mine—extract pieces of knowledge
- Postprocess the knowledge derived: test and verify, interpret and apply the knowledge to the problem area at hand

In Web-based relationship marketing, three distinct categories of data mining have emerged: Web content mining, Web structure mining, and Web usage mining (Jackson, 2002). Web usage mining is also referred to as clickstream analysis (Edelstein, 2001). Valuable informa-

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