identify the fraudulent records up front, the analyses are called *unsupervised*. In either event, Bolton and Hand (2002) suggest that we should view the fraud predictions as *suspicion scores*.

**When the Fraud Happened Is Very Important to Its Detection**

The temporal dimension of fraud provides a rich source of information related to fraud. The occurrence of a fraud event at a given time may be highly related to the pattern of events that happened in the past. These historical data are the most important source of attributes needed to sufficiently define the fraud signature in the data set. Many derived variables can be constructed with various time dimensions (e.g., time since the last transaction). These variables are forms of temporal abstractions we met in Chapter 16. The same principles that apply to customer behavior in response models also apply to behavior of fraudsters. We might even expect that many of the most powerful predictor variables in fraud models are temporal in nature, as is the case in customer response models.

**Fraud Is Very Complex**

Fraud events involve much complexity. In addition to the data complexity listed in the preceding sections, the series of events associated with the fraud event may be quite complex. This complexity is partly due to the fraudster’s need for stealth and secrecy, and partly due to the intentional obfuscation of the trail of evidence indicating fraud.

**Fraud Detection May Require the Formulation of Rules Based on General Principles, “Red Flags,” Alerts, and Profiles**

Fraud modeling requires the construction of reference objects based on relationships that have been drawn in the past between various conditions and the incidence of fraud. Examples of such rules that suggest fraud include

- **General principle**: The incidence of fraud is more likely when the opportunity is high and the potential gains are large.
- **A “red flag”**: A large number of accidents or claims is made by one individual.
- **A “red flag”**: The same professional service person is involved with the claim (e.g., a doctor).
- **An alert**: A new product is introduced before fraud management systems are put in place.

Fraud profiles will be discussed separately later in the chapter.

**Fraud Detection Requires Both Internal and External Business Data**

Most companies have some sort of internal data describing their business events (selling things or providing services). But the forms of data gathered for internal purposes most often are related to billing and account service purposes. Many potentially predictive variables are not gathered by internal systems (e.g., years in business), but must be gathered