

Predictive Operational Risk: a Proposal based on Bayesian Models ¹

Predizione del Rischio Operativo: Proposta di Modelli Bayesiani

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Riassunto: I rischi operativi sono presenti in qualunque settore e, per loro natura, hanno un elevato impatto e possono portare a conseguenze catastrofiche. Nel presente lavoro si propongono modelli bayesiani di natura previsiva per valutare la probabilità di accadimento di un evento avverso e il conseguente impatto su strutture e fornitrici di servizi a forte contenuto tecnologico. Le cause generanti il rischio e gli effetti di maggior interesse sono stimate con reti Bayesiane, integrate da opportune distribuzioni a priori e analisi di scenario. I risultati previsionali permettono l'attivazione di efficaci controlli che eviteranno il ripetersi degli accadimenti e ridurranno i rischi.

Keywords: Operational Risk, Bayesian Network, Scenario Analysis

1. Introduction

Operational risk (OR) involves all activities [Cornalba (2007)] within an organizational control environment and the “operational” term stresses the role of pertaining to the service delivery. The category includes risks involving human resources, controls and processes: human error, system failures, inadequate procedures, communication systems, execution, information, people, business interruption, and technology. In general, deficiencies in information systems or internal controls may generate unexpected loss.

Every organization is interested to assess own ORs, mainly for employing better their available resources and avoiding hazardous situations. Risk is a set of scenarios, each of which combines uncertainty and exposure, quantified both by probability of the frequency with which an event might take place (uncertainty about the frequency) and probability of the severity of the consequence (uncertainty about the severity of the consequence). As the result, we estimate over the risk distribution the worst scenario in term of increasing severity of the consequences.

Each adverse event has at least one top cause generating the risk and an effect as well. Only few models can predict more than one response variable; furthermore, ORs are usually rare and the lack of data needs the use of expert opinions and information over observational experiments. Bayesian Networks (BNs) appear a good solution for our

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domain of application; see Heckerman (1996) and Jensen (2001) both for theoretical and applied discussion.

2. Operational Risk and Bayesian Methods

The present work is aimed at assessing and estimating the major causes of harm and possible effects on clients (i.e. banking, health organization, . . .) and telecommunication interruption as well. In Figure 1.A the general schema of collected data and the learned BN are depicted. The learning process updates, by Bayes' Theorem [Bernardo and Smith (1994)], the prior distributions which are gathered from experts. In Figure 1.B scenario analysis is applied to banking client: we identify the most important cause of risk (i.e. security "SEC01") by posterior risk distributions.

In conclusion, the proposed methods are useful for the prediction of adverse events. Moreover, the ranking of risks from the worst case to the best one allows to introduce new controls over a specific problem, such as security, hardware or software. As a result, the customer's available (human and economic) resources will be allocate in a better way.

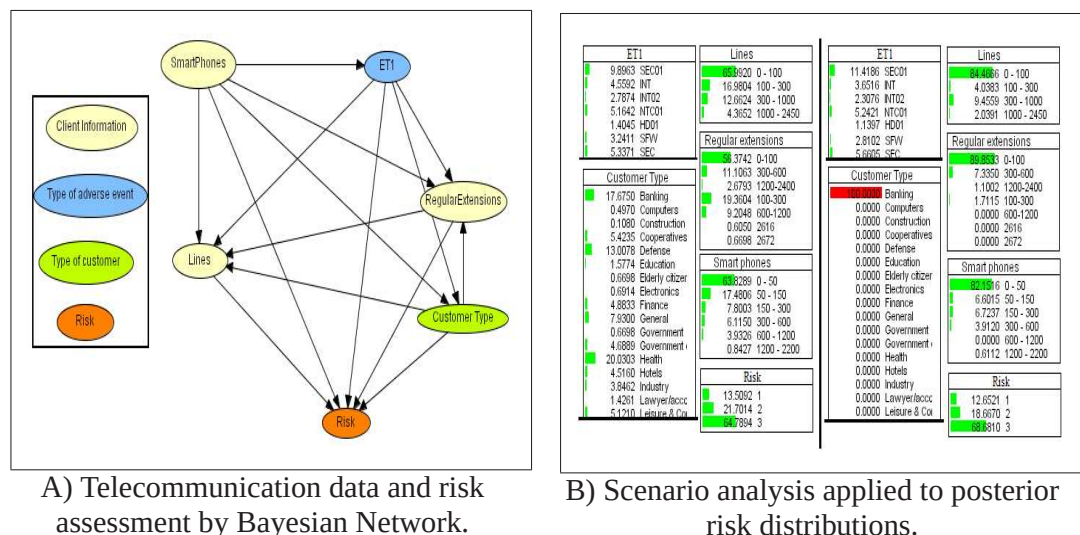


Figure 1: Prediction of adverse events and operational risks by Bayesian methods.

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