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Chapter XI

Predicting Automobile Insurance Losses Using Artificial Neural Networks

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INTRODUCTION

The core of the insurance business is the underwriting function. As a business process, underwriting has remained essentially unchanged since the early 1600's in London, England. Ship owners, seeking to protect themselves from financial ruin in the event their ships were to be lost at sea, would seek out men of wealth to share in their financial risk. Wealthy men, upon accepting the risk, would *write* their name *under* (at the bottom of) the ship's manifest, hence the name "underwriters." The underwriters would then share in the profits of the voyage, or reimburse the ship's captain for his losses if the ship were lost at sea. This practice lead to the founding of Lloyd's of London, the most recognized name in the insurance business today (Gibb, 1972; Golding & King-Page, 1952).

Underwriters today perform essentially the same function on behalf of their employers. After analyzing all the pertinent information for a given risk, they determine whether or not they are interested in underwriting the risk, and the

premium they would require for doing so. To aid the underwriter in his decision-making process, insurance companies employ actuaries to analyze past insurance experiences. They use traditional statistical methods to look for characteristics within the risk that appear to contribute to the likelihood of a loss (Webb, Harrison, Markham & Underwriters, 1992). When they find positive relationships between the policy characteristics and the resulting losses, they create underwriting guidelines for the company's underwriters (Malecki & Underwriters, 1986).

According to the American Institute for Chartered Property Casualty Underwriters, the most common considerations found in underwriting guidelines are: age of operators, age and type of automobile, use of the automobile, driving record, territory, gender, marital status, occupation, personal characteristics of the operator, and physical condition of the vehicle. These factors are fundamental in determining the acceptability, classifying, and rating of private passenger automobile insurance policies (Malecki & Underwriters, 1986).

Traditionally, each policy is considered on its own merits and analyzed in relation to the underwriter's prior experience, training, and company guidelines. Even as insurance companies employed actuaries, it was a long time before they had the help of even a mechanical adding machine, let alone the use of a computer. As recently as 1981, computers were not considered important to the underwriting process. Robert Holtom examines the use of computers in his 1981 book, *Underwriting Principles and Practices*. In his chapter, "The Impact of Computers," he writes, "computers cannot replace underwriters. The judgment factor is so complicated that no computer which can be imagined today would be able to perform underwriting functions as effectively as human underwriters" (Holtom, 1981).

In the time since this statement, computers and the field of artificial intelligence have made tremendous gains in speed and applications. The time may have come for computers to take on a significant role in the insurance underwriting process.

As far as the underwriting process is concerned, private passenger automobile insurance is well suited to artificial intelligence applications. There is a fixed set of finite data with which the underwriting decision is made, policies are highly standardized, and deviations from the standard coverage are rare.

Several studies have considered the use of computers in the automobile insurance underwriting process. Two studies attempted to predict the acceptability of a policy from an underwriting standpoint (Gaunt, 1972; Rose, 1986). Two others looked at the possibility of predicting the incident of a loss on an individual-policy basis (Retzlaff-Roberts & Puelz, 1966; Lemaire, 1985). Another study focused on the relationship between premium and customer