Chapter III

Influence Diagram for Investment Portfolio Selection

Chui-Che Tseng
Texas A&M University, USA

ABSTRACT

The goal of an artificial intelligence decision support system is to provide the human user with an optimized decision recommendation when operating under uncertainty in complex environments. The particular focus of our discussion is the investment domain—the goal of investment decision making is to select an optimal portfolio that satisfies the investor’s objective or, in other words, to maximize the investment returns under the constraints given by investors. The investment domain contains numerous and diverse information sources, such as expert opinions, news releases, economic figures and so on. This presents the potential for better decision support but also poses the challenge of building a decision support agent for selecting, accessing, filtering, evaluating and incorporating information from different sources, and for making final investment recommendations. In this study we use an artificial intelligence system called influence diagram for portfolio selection. We found that the system outperform human portfolio managers and the market in the year of 1998 to 2002.
INTRODUCTION

Twenty years ago, most people had very little daily exposure to the investment world. Perhaps the only reminder was hearing a 10-second announcement on the radio about the fortunes of the Dow Jones Industrial Average that day. Today, radio, TV and the exponential growth of the Internet have created many sites specializing in business and investment coverage. An investment is simply any vehicle into which funds can be placed with the expectation that they will generate positive income or that their value will be preserved or increased. There are different types of investments; they can be categorized based on the following:

- **Securities or Property**: Investments that represent evidence of debt or ownership or the legal right to acquire or sell an ownership interest are called securities. The most common types are stocks, bonds, and options. Property, on the other hand, consists of investments in real property or tangible personal property.
- **Direct or Indirect**: Direct investment is one in which the investor purchases stocks, bonds, homes or precise metals. Indirect investment is when the investor purchases a mutual fund.
- **Debt, Equity or Derivative Securities**: Debt is like a bond in which you lend money to the issuer. Equity represents ongoing ownership in a specific business or property; the most popular type is common stock. Derivative securities are those in which the investments derive their value from an underlying security or asset. Options are an example of derivative securities.
- **Low or High Risk**: Investments can sometimes be differentiated based on risk.
- **Short or Long Term**: The life of an investment can be described as either short or long term. Short term typically matures within a year, whereas long terms are those with longer maturities.
- **Domestic or Foreign**: Investment can be made on either the domestic markets or the international markets.

The investment process is the mechanism for bringing together suppliers of extra funds with demanders who need funds. The investment process adapted from Gitman and Joehnk (1998) is shown in Figure 1. In the diagram, financial institutions are organizations that channel the savings of governments, business, and individuals into loans or investments, and financial markets are forums in which suppliers and demanders of the funds make financial transactions. The ultimate goal of an investor is an efficient portfolio, one that provides the highest return for a given level of risk or that has the lowest risk for a given level of return. With today’s market and investment environment, an investor has to consider a lot of internal and external factors as well as numerous financial information. The investment process has become a complex and computationally demanding task for a human to perform. Thus, it provided a motivation to develop a decision support system that will aid the investor in pursuit of their wealth.

The investment domain, like many other domains, is a dynamically changing, stochastic, and unpredictable environment. Take the stock market as an example; there are more than 2,000 stocks available for a portfolio manager or individual investor to select. This posts a problem of filtering all those available stocks to find the ones that
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