
FIT5186 Intelligent Systems

Week 12 Tutorial

Business Intelligence Modelling - Decision Trees

Exercise 1

Erica is going to fly to London on December 5, 2010 and return home on December 20, 2010. It is now November 1, 2010. On November 1, 2010, she may buy a one-way ticket (for \$350) or a round-trip ticket (for \$660). She may also wait until December 1, 2010 to buy a ticket. On December 1, 2010, a one-way ticket will cost \$370, and a round-trip ticket will cost \$730. It is possible that between November 1 and December 1, her sister (who works for the airline) will be able to obtain a free one-way ticket for Erica. The probability that her sister will obtain the free ticket is 30%. If Erica has bought a roundtrip ticket on November 1 and her sister has obtained a free ticket, she may return "half" of her round-trip to the airline. In this case, her total cost will be \$330 plus a \$50 penalty. Use a decision tree approach to determine how to minimize Erica's expected cost of obtaining round-trip transportation to London.

- Construct a decision tree structure (using Excel's Treeplan) that reflects Erica's decision problem above as accurately as possible.
- If Erica's goal is to minimize her expected cost of obtaining round-trip transportation to London, what should she do?
- What is her optimal expected cost?

Exercise 2

Reminder:

The expected value of perfect information (EVPI) is obtained by assuming we have an expert who can tell us with 100% accuracy what will happen in the future, but cannot alter the probabilities of the possible outcomes. Refer to Lecture 11 material.

Monica Britt has enjoyed sailing small boats since she was 7 yrs old, when her mother started sailing with her. Today, Monica is considering the possibility of starting a company to produce sailboats for the recreational market. Unlike other mass-produced sailboats, however, these boats will be made specifically for children between the ages of 10 and 15. The boats will be the highest quality, and extremely stable and the sail size will be reduced to prevent problems of capsizing.

Because of the expense involved in developing the initial moulds and acquiring the necessary equipment to produce fibreglass sailboats for young children, Monica has decided to conduct a pilot study to make sure that the market for the sailboats will be adequate. She estimates that the pilot study will cost her \$10,000. Furthermore, the pilot study can be either successful or not successful. Her basic decisions are to build a large manufacturing facility, a small manufacturing facility, or no facility at all. With a favorable market, Monica can expect to make \$90,000 from the large facility or \$60,000 for the smaller facility. If the market is unfavorable, however, Monica estimates that she would lose \$30,000 with a large facility, while she would lose only \$20,000 with the small facility. Monica estimates that the probability of a favorable market given a successful pilot study is 80%. The probability of an unfavorable market given an unsuccessful pilot study result is estimated to be 90%. Monica feels that there is an 80% chance that the pilot study will be successful. Of course, Monica could bypass the pilot study and simply make the decision as to whether to build a large plant, small plant, or no facility at all. Without doing any testing in a pilot study, she estimates that the probability of a successful market is 60%.

- Using Excel's TreePlan, what is your advice to Monica using the expected value criterion?
- Determine the expected value with perfect information (Show workings or cell reference).
- Determine the expected value without perfect information (Show workings or cell reference).
- Determine the expected value of perfect information (Show workings or cell reference).
- What is the maximum price Monica should pay for the pilot study?
- Is there a problem with using this technique in this particular situation?

23. Johnstone & Johnstone (J&J) has developed a new type of hand lotion with a distinctive fragrance. Before distributing it nationally, J&J will test market the new product. The joint probability of a successful test market and high sales upon national distribution is 0.5. The joint probability of a successful test market and low sales nationally is 0.1. The joint probabilities of an unsuccessful test market and either high or low sales are both 0.2.
- Use this data to construct a joint probability table.
 - What is the marginal probability of a successful test market?
 - What is the conditional probability of high sales given a successful test market?
 - What is the conditional probability of a successful test market given that the product is destined for high sales nationally?
24. Eagle Credit Union (ECU) has experienced a 10% default rate with its commercial loan customers (i.e., 90% of commercial loan customers pay back their loans). ECU has developed a statistical test to assist in predicting which commercial loan customers will default. The test assigns either a rating of "Approve" or "Reject" to each loan applicant. When applied to recent commercial loan customers who paid their loans, the test gave an "Approve" rating in 80% of the cases examined. When applied to recent commercial loan customers who defaulted, it gave a "Reject" rating in 70% of the cases examined.
- Use this data to construct a joint probability table.
 - What is the conditional probability of a "Reject" rating given that the customer defaulted?
 - What is the conditional probability of an "Approve" rating given that the customer defaulted?
 - Suppose a new customer receives a "Reject" rating. If that customer gets the loan anyway, what is the probability of default?
25. From industry statistics, a credit card company knows that 0.8 of its potential card holders are good credit risks and 0.2 are bad credit risks. The company uses discriminant analysis to screen credit card applicants and determine which ones should receive credit cards. The company awards credit cards to 70% of those who apply. The company has found that of those awarded credit cards, 95% turn out to be good credit risks. What is the probability that an applicant who is a bad credit risk will be denied a credit card?