A Probabilistic Model that Estimates the Probability Distribution of Potential Random Fluctuations

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Description

"Probabilistic" means being or having a random variable. A probabilistic model is a tool for estimating the probability distribution of potential outcomes given the random variation of one or more inputs over time. Random fluctuations are usually based on observed fluctuations in historical data over a selected time period using standard time series techniques. The distribution of possible outcomes is derived from a large number of simulations (probabilistic predictions) reflecting random variations in the inputs. Its application first began in physics. It is now applied to engineering, life sciences, social sciences, and finance. See also economic capital. Probabilistic modeling is creating predictive models that look at a single policy, an entire portfolio, or an entire company. For example, instead of setting the ROI according to the best guess, the model uses random variations to see what the investment terms would be. Based on a set of random variables, policy/portfolio/firm experience is predicted and results recorded. This is then done again with a new set of random variables. Finally, a distribution of results is available that indicates which range is reasonable, as well as the most probable estimate. The most probable estimate comes from the centroid of the distribution curve (formally known as the probability density function). This is also usually the peak (mode) of the curve, eg for an asymmetric distribution. This is useful when policies or funds provide guarantees. Minimum return on investment of 5% per annum. Deterministic simulations using various scenarios of future investment returns do not provide an adequate way of estimating the cost of providing this guarantee. This is because it does not take into account the volatility of the investment return in future periods or the possibility that the investment return may fall below the guarantee due to extreme events in any particular period. Stochastic modeling incorporates volatility and variability (randomness) into the simulation, allowing it to better represent real life from multiple perspectives. Probabilistic modeling is used in various industries around the world. For example, the insurance industry relies heavily on stochastic modeling to predict what a company's balance sheet will look like at some point in the future. Other sectors, industries, and fields that rely on stochastic modeling include equity investing, statistics, linguistics, biology, and quantum physics. Stochastic programming is an optimization problem in which some or all of the problem parameters are uncertain but follow known probability distributions. This framework contrasts with deterministic optimization, which assumes that all problem parameters are known exactly. The goal of stochastic programming is to find a decision that optimizes some criterion chosen by the decision maker and that adequately accounts for the uncertainty of the problem parameters. Because many real-world decisions are subject to uncertainty, stochastic programming has applications in a wide variety of fields, from finance to transportation to energy optimization. Random processes can be classified into several categories based on their mathematical properties: random walks, martingale, Markov processes, Levy processes, Gaussian processes, random fields, update processes, and bifurcation processes. The study of stochastic processes uses mathematical knowledge and techniques from the fields of probability theory, analysis, linear algebra, set theory, topology, and mathematical analysis such as real number analysis, measure theory, Fourier analysis, and functional analysis. The theory of stochastic processes is considered an important contribution to mathematics and remains an active research topic for both theoretical and practical reasons.

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Conflict of Interest

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