

Stochastic Programming Optimization When Uncertainty Matters

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Darinka Dentcheva (Bulgarian: Даринка Денчева) is a Bulgarian-American mathematician, noted for her contributions to convex analysis, stochastic programming, and risk-averse optimization.

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Mathematical optimization

optimization is, like stochastic programming, an attempt to capture uncertainty in the data underlying the optimization problem. Robust optimization aims

Mathematical optimization (alternatively spelled optimisation) or mathematical programming is the selection of a best element, with regard to some criteria, from some set of available alternatives. It is generally divided into two subfields: discrete optimization and continuous optimization. Optimization problems arise in all quantitative disciplines from computer science and engineering to operations research and economics, and the development of solution methods has been of interest in mathematics for centuries.

In the more general approach, an optimization problem consists of maximizing or minimizing a real function by systematically choosing input values from within an allowed set and computing the value of the function. The generalization of optimization theory and techniques to other...

Dynamic programming

In the optimization literature this relationship is called the Bellman equation. In terms of mathematical optimization, dynamic programming usually refers

Dynamic programming is both a mathematical optimization method and an algorithmic paradigm. The method was developed by Richard Bellman in the 1950s and has found applications in numerous fields, from aerospace engineering to economics.

In both contexts it refers to simplifying a complicated problem by breaking it down into simpler sub-problems in a recursive manner. While some decision problems cannot be taken apart this way, decisions that span several points in time do often break apart recursively. Likewise, in computer science, if a problem can be solved optimally by breaking it into sub-problems and then recursively finding the optimal solutions to the sub-problems, then it is said to have optimal substructure.

If sub-problems can be nested recursively inside larger problems, so that...

Dynamic stochastic general equilibrium

future uncertainty makes the models dynamic and assigns a certain relevance to the expectations of agents in forming macroeconomic outcomes. Stochastic: The

Dynamic stochastic general equilibrium modeling (abbreviated as DSGE, or DGE, or sometimes SDGE) is a macroeconomic method which is often employed by monetary and fiscal authorities for policy analysis, explaining historical time-series data, as well as future forecasting purposes. DSGE econometric modelling applies general equilibrium theory and microeconomic principles in a tractable manner to postulate economic phenomena, such as economic growth and business cycles, as well as policy effects and market shocks.

Sensitivity analysis

uncertainty in the output of a mathematical model or system (numerical or otherwise) can be divided and allocated to different sources of uncertainty

Sensitivity analysis is the study of how the uncertainty in the output of a mathematical model or system (numerical or otherwise) can be divided and allocated to different sources of uncertainty in its inputs. This involves estimating sensitivity indices that quantify the influence of an input or group of inputs on the output. A related practice is uncertainty analysis, which has a greater focus on uncertainty quantification and propagation of uncertainty; ideally, uncertainty and sensitivity analysis should be run in tandem.

Monte Carlo method

00553.x. S2CID 12074789. Spall, J. C. (2003), *Introduction to Stochastic Search and Optimization: Estimation, Simulation, and*

Control, Wiley, Hoboken, NJ.

Monte Carlo methods, or Monte Carlo experiments, are a broad class of computational algorithms that rely on repeated random sampling to obtain numerical results. The underlying concept is to use randomness to solve problems that might be deterministic in principle. The name comes from the Monte Carlo Casino in Monaco, where the primary developer of the method, mathematician Stanisław Ulam, was inspired by his uncle's gambling habits.

Monte Carlo methods are mainly used in three distinct problem classes: optimization, numerical integration, and generating draws from a probability distribution. They can also be used to model phenomena with significant uncertainty in inputs, such as calculating the risk of a nuclear power plant failure. Monte Carlo methods are often implemented using computer...

Glossary of artificial intelligence

to model the uncertainty; some also build upon the methods of inductive logic programming. stochastic optimization (SO) Any optimization method that generates

This glossary of artificial intelligence is a list of definitions of terms and concepts relevant to the study of artificial intelligence (AI), its subdisciplines, and related fields. Related glossaries include Glossary of computer science, Glossary of robotics, Glossary of machine vision, and Glossary of logic.

Automatic differentiation

finmath-lib stochastic automatic differentiation, Automatic differentiation for random variables (Java implementation of the stochastic automatic differentiation)

In mathematics and computer algebra, automatic differentiation (auto-differentiation, autodiff, or AD), also called algorithmic differentiation, computational differentiation, and differentiation arithmetic is a set of techniques to evaluate the partial derivative of a function specified by a computer program. Automatic differentiation is a subtle and central tool to automate the simultaneous computation of the numerical values of arbitrarily complex functions and their derivatives with no need for the symbolic representation of the derivative, only the function rule or an algorithm thereof is required. Auto-differentiation is thus neither numeric nor symbolic, nor is it a combination of both. It is also preferable to ordinary numerical methods: In contrast to the more traditional numerical...

Vagueness

by tools of vagueness and uncertainty representation: fuzzy sets and fuzzy logic, or by stochastic quantities and stochastic functions, as the exact sciences

In linguistics and philosophy, a vague predicate is one which gives rise to borderline cases. For example, the English adjective "tall" is vague since it is not clearly true or false for someone of middling height. By contrast, the word "prime" is not vague since every number is definitively either prime or not. Vagueness is commonly diagnosed by a predicate's ability to give rise to the sorites paradox. Vagueness is separate from ambiguity, in which an expression has multiple denotations. For instance the word "bank" is ambiguous since it can refer either to a river bank or to a financial institution, but there are no borderline cases between both interpretations.

Vagueness is a major topic of research in philosophical logic, where it serves as a potential challenge to classical logic. Work...

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