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Compound point processes to model aggregate catastrophic losses

Abstract

Compound point processes are useful for modeling catastrophic events, such as natural disasters, cyberattacks, pandemics, and other emerging risks. These events can have a signifficant financial impact on businesses and individuals, and modeling their frequency and severity is important for developing e¤ective risk management strategies or transfer the risk. The compound Poisson process is a basic type of compound point process that combines a Poisson process with a deterministic constant intensity. This model is often used in insurance and finance to model aggregate losses from an event. To extend the compound Poisson process, advanced compound point processes have been developed, such as the compound Cox process with exponentially decaying shot-noise intensity, generalised compound Hawkes process, and compound dynamic contagion process. These advanced models provide more flexibility and can capture more complex dynamics, such as contagion e¤ects, which are becoming increasingly relevant in today's environment of emerging risks. As an application of the compound point processes, numerical comparisons of value-at-risk and tail conditional expectation are made based on the Monte Carlo simulation method. This study provides a range of compound point processes to quantify aggregate catastrophic losses, in light of the growing challenges posed by new risks arising from climate change, cyberattacks, and pandemics.