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Hawkes processes modeling, inference, and control: an overview. (English) Zbl 07683987
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Summary: Hawkes processes are a type of point process that models self-excitement among time events. They have been used in a myriad of applications, ranging from finance and earthquakes to crime rates and social network activity analysis. Recently, a variety of different tools and algorithms have been presented at top-tier machine learning conferences. This work aims to give a broad view of recent advances in Hawkes process modeling and inference suitable for a newcomer to the field. The parametric, nonparametric, deep learning, and reinforcement learning approaches are broadly discussed, along with the current research challenges for the topic and the real-world limitations of each approach. Illustrative application examples in the modeling of retweeting behavior, earthquake aftershock occurrence, and malaria outbreak modeling are also briefly discussed.

MSC:
60G55 Point processes (e.g., Poisson, Cox, Hawkes processes)
62M20 Inference from stochastic processes and prediction
68T05 Learning and adaptive systems in artificial intelligence

Keywords:
Hawkes processes; point processes; machine learning

Full Text: DOI arXiv

References:
F. Figueiredo, G. R. Borges, P. O. S. V. de Melo, and R. Assunção, Fast estimation of causal interactions using Wold
D. Daley and D. Vere-Jones, An Introduction to the Theory of Point Processes, Volume I: Elementary Theory and Methods,
S. Flaxman, M. Chirico, P. Pereira, and C. Eoffler, Scalable high-resolution forecasting of sparse spatio-temporal events with
I. J. Goodfellow, J. Pouget-Abadie, M. Mirza, B. Xu, D. Warde-Farley, S. Ozair, A. C. Courville, and Y. Bengio, Genera-
A. Helmstetter and D. Sornette, Diffusion of epicenters of earthquake aftershocks, Omori’s law, and generalized continuous-
S. Flaxman, M. Chirico, P. Pereira, and C. Loeffler, Scalable high-resolution forecasting of sparse spatiotemporal events with
A. Gozlan, Y. Ma, Y. Wang, S. GÃ¶nmemann, and V. Tresp, Graph Hawkes neural network for forecasting on temporal knowledge
A. J. Holbrook, X. Ji, and M. A. Suchard, Bayesian mitigation of spatial coarsening for a Hawkes model applied to gunfire,
A. J. Holbrook, X. Ji, and M. A. Suchard, Bayesian mitigation of spatial coarsening for a Hawkes model applied to gunfire,
A. J. Holbrook, X. Ji, and M. A. Suchard, Bayesian mitigation of spatial coarsening for a Hawkes model applied to gunfire,
A. J. Holbrook, X. Ji, and M. A. Suchard, Bayesian mitigation of spatial coarsening for a Hawkes model applied to gunfire,


J. Shang and M. Sun, Geometric Hawkes processes with graph convolutional recurrent neural networks, in the Thirty-Third


A. Zarezade, U. Upadhyay, H. R. Rabiee, and M. Gomez-Rodriguez, RedQueen: An online algorithm for smart broadcasting


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