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Locating lines among scattered points

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Consider a process of events on a line L, where, for the most part, the events occur randomly in both time and location. A scatterplot of the pair that represents position on the line, and occurrence time, will resemble a bivariate stochastic point process in a plane, P say. If, however, some of the points on L arise through a more regular phenomenon which travels along the line at an approximately constant speed, creating new points as it goes, then the corresponding points in P will occur roughly in a straight line. It is of interest to locate such lines, and thereby identify, as nearly as possible, the points on L which are associated with the (approximately) constant-velocity process. Such a problem arises in connection with the study of seismic data, where L represents a fault-line and the constant-velocity process there results from the steady diffusion of stress. We suggest methodology for solving this needle-in-a-haystack problem, and discuss its properties. The technique is applied to both simulated and real data. In the latter case it draws particular attention to events occurring along the San Andreas fault, in the vicinity of Parkville, California, on 5 April 1995.

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