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Relationship of Weights-of-Evidence and Logistic Regression Models in Terms of Markov Random Fields

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Mathematical methods of potential modeling are considered from the point of view of generalized linear models and Markov stochastic graphs. In particular, weights-of-evidence and logistic regression models will be discussed in terms of stochastic graphs possessing a Markov property, where the notion of conditional independence is essential, and will be related to log-linear models. While weights-of-evidence and logistic regression model conditional probabilities of an indicator random variable, the subject of generalized models is the joint probability of random variables. Referring to log-linear models provides a test of conditional independence. Then weights-of-evidence, logistic regression without interaction terms, and logistic regression including interaction terms can be put into a hierarchy of methods, where each former method is a special case of the consecutive latter method. Additional modeling assumptions involved in more special methods restrict their application, but may yield not surprisingly better results in terms of estimation errors.