**Converting Graphic Relationships into Conditional Probabilities in Bayesian Network**

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**Abstract**

Bayesian network is a powerful mathematical tool for prediction and diagnosis applications. A large Bayesian network can be constituted of many simple networks which in turn are constructed from simple graphs. A simple graph consists of one child node and many parent nodes. The strength of each relationship between a child node and a parent node is quantified by a weight and all relationships share the same semantics such as prerequisite, diagnostic, and aggregation. In the first goal, the research focuses on *converting graphic relationships into conditional probabilities* in order to construct a simple Bayesian network from a graph. Relationship conversion is adhered to logic gates such as AND, OR, and XOR, which is essential feature of the research. Especially, SIGMA gate is introduced to convert aggregation relationship into conditional probabilities of Bayesian network for applications of diagnosis and assessment. Note that the *SIGMA gate inference* was discovered by two authors Eva Millán and José Luis Pérez-de-la-Cruz in their research paper “A Bayesian Diagnostic Algorithm for Student Modeling and its Evaluation” in 2002. Because diagnostic relationship is the important subject, the second goal of this research is to propose the *diagnostic condition* for validating a relationship conversion within context of diagnostic application. The *diagnostic theorem* is proposed and proved, which gives facilities for testing such diagnostic condition.

**Keywords**: Bayesian network, relationship conversion, diagnostic relationship, SIGMA gate, diagnostic condition, diagnostic theorem.