Pattern Theory and Its Applications

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Pattern theory is a discipline initiated by Ulf Grenander in the late 1960s as a mathematical representation of complex systems of combinatory nature. It assumes that certain atomic entities (generators) can combine together, by means of selective bonds, into multiple configurations. The theory studies regularity of such configurations, from both algebraic and probabilistic viewpoints, distinguishes between latent configurations and their observable images, and introduces on the latter the concept of patterns. A close relationship exists between the configurations in pattern theory and Markov random fields and Gibbs distributions in probability theory. The abstract nature of pattern theory can explain its still relatively low acceptance in practice. In this talk, we will attempt to present pattern theory in simple, intuitive terms and then illustrate it through applications in statistical physics (Ising model), image analysis, and market modelling.