Advances is Algebraic Statistics

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Abstract

Progress in Algebraic Statistics (AS) has been rapid in recent years and it is possible to describe the broad categories into which it has separated, but also the connections between them. The main idea is that some statistical and probability models can be described algebraically and that therefore in at least some of the developments abstract algebra should be used. Another way of saying this is that the models are described by algebraic varieties: the solution of a set of simultaneous polynomial equations. Even before AS took off we were familiar with polynomial regression models, the use of groups (eg group invariance in hypothesis testing) and multiplicative probability models to describe independence and conditional independence. The last of these is critically important in studying causation. To this basic collection has been added other mathematical objects such as graphs and networks. The talk will describe in each of these areas how AS has given real insight. From an algebraic point of view the single most useful method has been polynomial ideal theory, so a very brief description of this will be needed. A good reference is:

Drton, M., Sturmfels, B. and Sullivant, S., 2008. *Lectures on algebraic statistics* (Vol. 39). Springer Science & Business Media.