Statistical Information-theoretic Approach Providing an Asymmetric Quantification of Relationships Between Predictor Variables and Pandemic Health Behavior

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Abstract:

Economists, health care professionals, and business researchers are often faced with multivariate relationships involving uncertainty which require mathematical and statistical models for inference. Statistical information theory provides a conceptual framework that can unify the quantification of uncertainty and statistical inference. In the context of this paper, information theory can express the proportion of total information in one set of measures (**Y**) explained by another set of measures (**X**). It can also be used to quantify the extent of redundant or shared information in sets of variables and allows for possible asymmetry in the extent of explained information that X gives about Y versus Y giving about X. When the directionality of the relationship between the variables matters, asymmetric measures of association are preferred. Literature has called for additional techniques for quantifying asymmetric relationships between variables (unlike commonly used symmetric covariance-based statistics), and this paper contributes to this area using the mathematics of information theory. First the general information-theoretic approach is reviewed, its tie to classical statistical methods are provided, and an asymmetric measure of the association between variables is provided. Next, we illustrate the usefulness of these measures in a health behavior context involving a contagious pandemic disease and the factors that are asymmetrically related to the desirable behavioral intent to be vaccinated. We find statistically significant and asymmetric information-theoretic relationships among the predictor and the behavioral intent variables.

Keywords:

Information theory, Asymmetric association measure, disease prevention behavior, information acquisition, prior knowledge.

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