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Research in Progress

The enterprise of my research is to apply modern mathematical concepts to industry focused problems. These problems were presented by the Future of Marketing Initiative, the Centre for Corporate Reputation, and their industry partners. In summary, my research provides a new paradigm for analysing multidimensional datasets which provides actionable, measurable, and verifiable answers to complex questions.

Hypertrend Topic Analysis

We propose an algorithm for determining which topics in a conversation space are likely to trend. The implications of this algorithm are far reaching and depend on the underlying conversation space. When applied to product development our algorithm forecasts consumer behaviour; moreover, when applied to reputation our algorithm can predict the effects of a reputational shock. The aforementioned process invokes spectral hypergraph theory to model multidimensional data. In this way, our conversation space is defined as a hypergraph whose nodes are topics, users, platforms, sentiment, etc. and an edge is defined to be a post including the appropriate nodes. This model fully utilizes the richness of a dataset to score all nodes in the conversation space. These scores, combined with a variety of statistics defined within the research, provide insight into the long-term behaviour of the conversation space. We provide various examples to demonstrate the effectiveness of our method.

Multi-dimensional Attribution Models

Attribution is a methodology for determining the contribution of each step in a multistep process. As an example, market attribution quantifies the contribution of each advertisement in an advertising campaign. Market attribution models are used to determine the effectiveness of spending and for real-time bidding on online advertisements. This methodology can be applied to measure the contribution of each step in a reputation disruption. Generally speaking, there are two types of attribution models: marginal and Shapley value. Marginal attribution describes the process of assigning a predetermined weight to each advertisement according to some rule. The Shapley value considers the problem of attribution from a game-theoretic perspective. We argue that the Shapley value is ill-suited for attribution by showing that the underlying mathematical framework does not support the proposed analogy. Finally, we present a hypergraph-based approach to attribution which retains the desired properties of the Shapley value and addresses our concerns with current methods. We compare our method to the aforementioned models and provide a numerical comparison as motivation for our method.

On the Flow of Conversation in a Network

We present a graph-based model for the transmission of a message across a network over time. This model is a function of transmission probabilities (defined as the probability of sending and receiving a particular message), meaningfulness of the message, and global network statistics. Using this model, we quantify the effects of shocks on reputation. In particular, we consider two types of shocks (so called content-shocks and network-shocks) and discuss which properties of a network make them resilient (or susceptible) to the aforementioned forces. Finally, we provide a quartile classification of reputation and define a reputation score based on the rate of message transmission.