Chapter XII
Applying Dynamic Causal Mining in E-Government Modeling

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ABSTRACT

Electronic government or digital government is not a simple or well-defined theoretical construct. Electronic government is a complex phenomenon which involves technical, organizational, institutional and environmental aspects. Researchers from different disciplines are trying to model the E-government using combinations of methods from different areas which can help to deal with complexity and obtain more comprehensive explanations. This chapter uses Dynamics Causal Mining as the technique for modeling and analyzes E-government. Dynamics Causal Mining is a combination of System Dynamics and Data Mining.

INTRODUCTION

Causality plays a central role in E-government and decision-making by making the observation and recognition of the causality. A common scientific approach in recognizing causality is by manipulating attributes through experimentation. However, real world events are often affected by a large number of potential factors and many of these factors are hidden. For example, in manufacturing, many factors such as cost, labor, weather, social events, etc., can all affect the final product. Some of factors, such as cost and labor, have a clear causality with the final product. Other factors, such as weather and social events may not have a clear causality with the final product.

This chapter suggests an integration of *System Dynamics* and *Association Mining* for identifying causality and expanding the application area of both techniques. This gives an improved descrip-

tion of the target system represented by a database; it can also improve strategy selection and other forms of decision making. Such a combination extracts important dynamic causality. This type of causality is very common in daily life. For example, "an increase of productivity in a factory might cause an increase of pollution in the environment" and "the increasing pollution will cause a decreasing level of human health and welfare". In the real world, an occurrence of an event is often affected by a large number of potential factors. The aim is to identify causal factors hidden in the data and discover the underlying causality between the observed data.

In E-government, it is essential to understand the causality between entities, such as investment, human behavior, and revenue, in order to properly manage and understand it. Causality is not the same as correlation. Correlation can be classified as association and none association. Association between two attributes means that there exist a relationship between two attribute where the existence of one attribute lead to the existence of the other. Association can then be classified as cointegration and causality, where cointegration represents a weaker relationship. Causality can then be classified as static causality and dynamic causality as it depicted in Figure 1. This chapter focuses on the dynamic causality and how it can assist in modeling, understanding and manage E-government.

This chapter first reviews the exiting research in E-government with focus on Data Mining and System Dynamics. Then details of Dynamic causal mining are presented. The chapter ends with a practical example and a conclusion.

Literature Review

The Dynamic Casual Mining (DCM) algorithm was discovered in 2005 (Pham et. al, 2005) using only counting algorithm to integrate with *Game theory*. It was extended in 2006 (Pham et. al, 2006) with delay and feedback analysis, and was further improved for the analysis in *Game theory* with *Formal Concept* analysis (Wang, 2007). *DCM* enables the generation of *dynamic causal rules* from data sets by integrating the concepts of *Systems Thinking (*Senge et al., 1994) and *System dynamics* (Forrester, 1961) with *Association mining* (Agrewal et al., 1996). The algorithm can process data sets with both categorical

Figure 1. Classification of causality