Creation and Technique with Causal Model

Aryut Ruangtong
Department of Computer Engineering,
Faculty of Industry Education,
Rajamangala University of Technology Suvarnabhumi, Thailand
r.aryut@hotmail.com

Abstract **- This article is a review of a principle, an analysis process, a design method, a casual model development process, and a result discussion. A casual model is one of a tool using in a research process. Moreover, this model is widely used in this kind of research by this time. Since, a casual model uses logic and a statistical process to develop. In consequence, it is reliable and reasonable enough. Almost, researchers use a casual model as a tool for their researches. This model can find a relationship between variables or indicators in that research. In this article, it gathers and presents an academic knowledge also an experience. Furthermore, it represents an opinion of the author for this kind of research in a form of typical article.**

Keywords **- Casual Model**

I. INTRODUCTION

Nowadays, academics develop their researches in various forms. They use many kinds of interesting methods and solutions. As a result, those researches are useful for a social as well as develop new researches a lot. In addition, many organizations adjust these researches to use for a social development or a development in their organizations themselves. In consequence, the organizations have a better quality also the researchers can develop their works and their progresses themselves. Incidentally, the researches which often see in any academic meetings or journals are the ones using a constructional tool or a model. This model is an objective of a research in order to search for something from a database or a data set as a researcher word. For example, a motivation searches, a prediction in a form of a structural equation, a variable relation search, and a proof of an indicator relationship direction. So, it refers to a cause and an effect by a method and a solution in different ways according to each of those researches.

There are two kinds of model referring in any researches this time as Structure Equation Model (SEM) and Casual Model. As for a structure equation model, the researcher represents this model already in an academic journal of the 9th National Conference and 2016 International Conference on ACTIS and NCOBA at Language and Computer Center of Nakhon Pathom Rajabhat University.

In this article, the researcher mentions only in a part of casual model by own experience, study, and research. Also, the researcher explains in a variety of methodology and solution for a casual model development. As well, the model can prove for cause and effect. After that, it compares between methods from an experience of the researcher ever using in the previous researches. And then, there are three methods to create a casual model as Information Theory, Bayes' Theorem, and Association Rules by Kardi Teknomo. The researcher also suggests an implementation of these three methods.

II. CASUAL MODEL DEFINITION

A casual model is a logical model that is created by any processes or methods to develop. For instance, a principle in statistics, an information theory, or any developed rules. They describe cause and effect by simulating in a structure form. The form expresses a cause thing and an effect thing. As well, an effect

will vary by a cause.

Almost, a casual model is usually found in a database having a lot of data inside. The model analyzes a relationship between variables. Moreover, it analyzes about a form and a direction of that relationship. Furthermore, it searches that which variables are causes and which ones are effects. Then, the effect variables will depend on the cause ones.

III. CAUSAL MODEL TYPES AND RESEARCH

A. Example Development

In this situation, the researcher explains by using the researches from the researcher by experience. The researcher creates and develops a casual model by three methods.

1) Casual Model Development Using Information Theory.

2) Casual Model Development Using Bayes Theorem.

3) Casual Model Development Using Association Rule.

In addition, these three methods have different in principles, computations, making decision processes. However, these three methods can create a casual model the same. It depends on which one any researchers use in their researches.

1) Casual Model Development Using Information Theory

In the research, [1] the researcher tries to increase a prediction precision of dependent variables. It tries to prove a proof method or searches a relationship of an independent variable group. After that, it finds a direction of a relationship between variables as well as which variables are causes and which ones are effects. Since, any indicators have an influence also a correlation altogether. This kind of problem usually is effective for using these indicators (X_i) to predict dependent variables (Y). Because of some wrong agreements of assumption, the researcher makes a statistical

calculation by an information theory with a casual model. As well, information theory and casual model are used in order to reduce a dislocation also increase a precision of a dependent variable prediction.
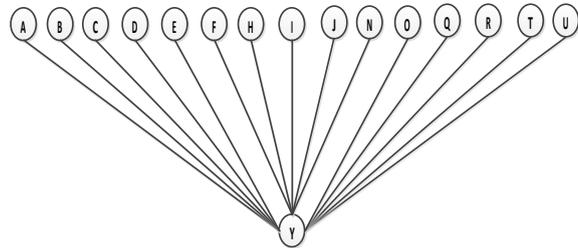

Fig. 1 Relationship between Variables before Dimension Reduction

In the research [1], the researcher mainly uses a principle of an information theory. The theory reduces a dimension of variables. It evaluates a statistical value called entropy to consider for elimination just one variable. Since, an entropy value is a contamination value in this theory. If an evaluated variable has high entropy, it will eliminate that feature out. In the same way, if it gets high entropy after calculation, the system will consider to eliminate that variable at first. Also, an entropy value can evaluate from:

$$H(X) = - \sum_{x_i \in X} p(x_i) \log_2 p(x_i)$$

(1)

X is a variable to measure for an entropy value.

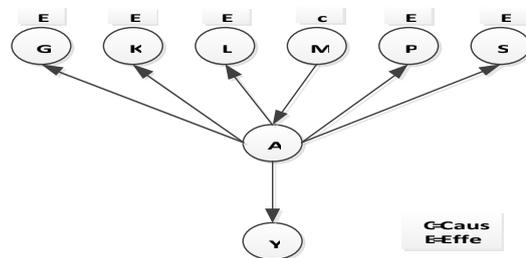X_i is a data set in a variable $p(x_i)$ is a probability value of event X_i.

Fig. 2 Dimension Reduction Using Causal Model

2) Casual Model Development Using Bayes Theorem

In the research [2], the researcher aims to prove and search a relationship in a group of

independent variables. Also, it finds for a relation direction as well as which variables are causes and which variables are effects. As well, it helps to consider for a prediction precision of a dependent variable value. It selects a variable to predict a dependent variable (Y) too.

After that, the researcher creates a casual model and a coefficient of correlation between independent variables. The technique using in this research is Bayes Theorem in order to find a logical relation.

Moreover, the Pearson Correlation technique is used to find a coefficient of correlation between cause variables and effect variables. It is a guideline for a selection of independent variables in order to predict dependent variables.

And then, the research [2] samples variables from a data set for a casual model development testing. There are four variables to consider a relationship.
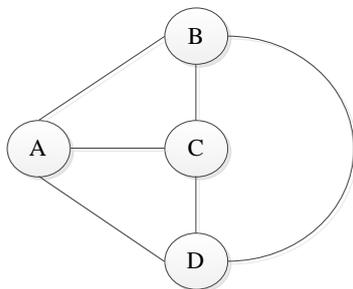

Fig. 3 Before Bayes Theorem Relation Searching

In the research [2], the researcher evaluates a probability to occur a relationship between a pair of variables (A|B) and (B|A). It calculates in statistics by the theory as a probability. Furthermore, the researcher uses a probability value for decision. If a relationship between variables has a higher value, the system will remain a form of relationship between a pair of those variables. As well, a probability can evaluate from:

$$P(\text{E}) = \underset{x\,E}{f(x)}$$

$f(\text{x})$ is a Probability Density Function (PDF) (2)

And

$$P(\text{A} \mid \text{B}) = \frac{P(\text{B} \mid \text{A})P(\text{A})}{P(\text{B})} \qquad (2)$$

Or can find from the equation as shown below.

$$P(\text{B} \mid \text{A}) = \frac{P(\text{B} \mid \text{A})P(\text{B})}{P(\text{A})} \qquad (2)$$
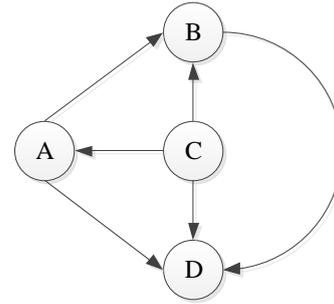

Fig. 4 Casual Model from Bayes Theorem

3) Casual Model Development Using Association Rule

In the research [3], the researcher aims to develop a casual model and a coefficient of correlation between independent variables. It uses an association rule to search a casual model. In addition, it uses techniques of Generating All Possible Association Rule, Computing Support and Confidence, and Filter Association Rule by Kardi Tenomo between cause and effect variables. They are guidelines to select independent variables for a prediction of dependent variables.

In the research [2], the researcher samples variables from a data set in order to test a casual model creation by four variables. It considers searching a relation between groups of independent variables. As well, it searches for a form of relation direction that which variables are causes or effects. Also, an occurring probability of Kardi can calculate from:

$$R = 3^{\text{d}} - 2^{\text{d}+1} + 1 \qquad (3)$$

R is an amount of all outcome event.
d is an amount of outcome variable.

Moreover, an assignment of an association rule by Kardi can implement from:

$$\text{support}(X \rightarrow= Y)\frac{n(X \cup Y)}{N} \qquad (3)$$

n is an amount of case.
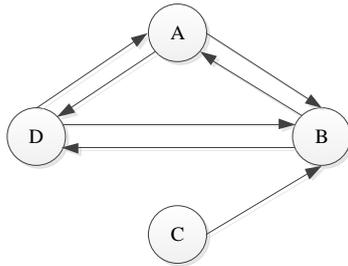N is an amount of observation.

Fig. 5 Initial Model from Calculation
by Association Rules

After that, the researcher does a correlation significant test between variables that are related or influent together. It evaluates that there is a significance or not in order to verify a correction and a precision. Also, it can calculate from:

$$H0: \quad = 0$$
$$H1: \quad = 1$$
$$t = r\frac{\sqrt{n-2}}{1-r} \qquad (3)$$

r is a correlation value between two sample variables.
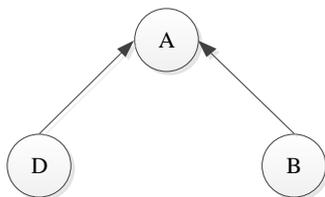
n is a notification value.

t is a score t.

Fig. 6 Casual Model from Using Association Rule

IV. COMPARISON OF CASUAL MODEL DEVELOPMENT USING THREE METHODS

TABLE I
COMPARISON OF CASUAL MODEL DEVELOPMENT USING THREE METHODS

Method	Calculate with	Decision with	Remark
Information Theory	Entropy	Max Entropy Value	Cut off
Bayes Theorem	Probability	Max Probability Value	Keep
Association Rule	Support and Confidence	Rule	Occur / Not Occur

V. CAUSAL MODEL USE

A casual model is a method using an analysis principle also a statistical calculation. The model finds and proves for cause and effect things. As well, effects vary by causes.

Technically, a casual model can bring the outcomes to help for making a decision. For example, a dimension or variable reduction that is not related or a relationship between variables that which variables are dependency together. In consequence, a casual model can create and increase an efficiency of a prediction research. It is up to a researcher that which method or rule will be used for development and making a decision.

VI. CONCLUSIONS AND SUGGESTIONS

1) A casual model can search for a relationship between variables.

2) A casual model can explain for cause and effect.

3) A casual model can use as a reason for making a decision.

4) A casual model can increase a precision in a prediction research.

5) A casual model can be created by a calculation in mathematics and statistics. Then, it can develop by other methods up to

those inquiries or researches such as Discriminant Analysis, Part Analysis, Neural Network, etc.

VII. ACKNOWLEDGEMENTS

REFERENCES

(Arranged in the order of citation in the same fashion as the case of Footnotes.)

[1]   Ruangtong, A., Porrawatpreyakorn, N., and Prakancharoen, S. (2018). "Causal Model of Variable by Information Theory". International Journal of the Computer, the Internet and Management, Vol. 26(1), ISSN: 0858-7027.

[2]   Ruangtong, A., Porrawatpreyakorn, N., and Prakancharoen, S. (2018). "Causal Model of Variables by Bayes Theorem". International Journal of the Computer, the Internet and Management, Vol. 26(2), ISSN: 0858-7027.

[3]   Ruangtong, A. (2019). "Causal Model of by Association Rule". International Journal of the Computer, the Internet and Management, Vol. 27(1), ISSN: 0858-7027.

[4]   Massy, J.L. (1996). "Causal Model, Translat from Problemy Peredachi Informatsii". Vol. 32(1), pp. 131-136.

[5]   Cover, T.M. and Thomas, J.A. (1911). "Elements of Information Theory". John Wiley & Sons, Inc. Print ISBN: 0-471-06259-6, Online ISBN: 0-471-20061-1.

[6]   Keller, F. (2006). "Entropy, Joint Entropy, Conditional Entropy". University of Edinburgh.

[7]   Zellner, A. (2017). "Generalizing the standard product rule of probability theory and Bayes's Theorem". Journal of Econometrics, Vol. 138(2007), pp. 14-23.

[8]   Teknomo, K. (2017). "Association Rules". <http://people.revoledu.com/kardi/tutoria l/M arketBasket/AssociationRules.htm>. Accessed 5 October 2017.

[9]   Teknomo, K. (2017). "Support and Confidence". <http://people.revoledu.com/kardi/tutoria l/MarketBasket/SupportConfidence.htm> . Accessed 5 October 2017.

[10]   Teknomo, K. (2017). "Filtering Association Rule". <http://people.revoledu.com/kardi/tutoria l/MarketBasket/Filtering.htm>. Accessed 5 October 2017.

[11]   Teknomo, K. (2017). "Conditionnal Probablity". <http://people.revoledu.com/kardi/tutoria l/Questionnaire/Conditional%20Probabil ity>. Accessed 5 August 2017.