

# An Outline of Big Data Emerging from Food Supply Chain and Potential Value in Food Management

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**Abstract--Big data is a data group with a huge amount of data that cannot be easily captured, managed and processed in a certain time. The paper concerns the development of big data in food industry, introduces overview of big data, discusses three big data mining technologies, and outlines its potential value in food management.**

**Keywords:** Food big data, Food management

## I. INTRODUCTION

With the growing popularity of the network and information technology, the amount of data generated by human beings is growing exponentially, and the birth of the cloud computing, as well as the coming of big data era. At the same time, food safety issue occurs frequently in China, which posing a serious threat to public healthy and negative social effects. An effective early warning method can greatly improve the level of food safety management, and big data mining technology is such an effective way of early warning.

The term 'big data' was defended as the size of data group beyond capture, storage, management and analysis of traditional database tools(Zhang,2014). Additionally, big data refers to massive, diverse transaction data, interactive data and sensor data that through fast acquisition, processing, analysis, and extracted from a huge database (Guo, 2013).Grobelink(2012)claimed that the characteristics of big data would be divided into three classify(3V): Volume; Velocity; Variety. Based on 3V, IBM (2012) presented 4V definitions adding a new feature" Value"on the basis of existing 3V.as showed in

Table 1.

Table 1. Four Characteristics of "Big Data"

Characteristic	Key words
Volume	huge volume*, from TB level to the EB level. (1PB=210TB;1EB=210PB)
Velocity	fast processing speed, Sensor networking, every corner
Variety	various different types
Value	low value density, low accurate and believable

\*However,"huge amount" is just a relative concept compared with data level now.

## II. TERMS of FOOD BIG DATA

### A. The conception of food big data

From the perspective of food hygiene legislation and management, the generalized concept of "food" is related to the production of food raw materials, the planting and breeding of food materials, food additives, all direct or indirect contact with food packaging materials, facilities and environment(Qu,2011).It is proposed to define "Food Big Data" as the real-time and so large data related to the whole process of food production, operation and consumption beyond traditional data processing applications. Data groups related to food includes data from the whole food supply chain which include food production, food distribution, food retailing and the consumer end. The diversity of data type can be divided into structured and unstructured data. Structured data consist of temperature, time, humidity, pH, water activity and so on, while the unstructured data contains geographic location information, pictures, video or audio and others (Zhang, 2014). Food big data is a huge

amount of database which response to the changes through the whole supply chain and even the laboratory

testing or consumer survey.

### B. Mining technique of food big data

The potential hiding information had been extracted by big data mining, and automatic digging in the database by computer exploiting. There are many mining techniques using now, while the common data mining

technologies using in food area is Bayesian network, decision tree and BP network as showed in Table. 2 (Liu and Zhang, 2015).

Table 2. the principle and application of three mining technique. (Source from: Corney, 2012; Zhao, 2011; Yang and Huang, 2015; Yang, 2011, He and Li, 2006)

MiningTechnique	Principle	Application
<b>Bayesian</b>	● can be used to build the inner structural characteristics of the image, and	● food product design
<b>Networt</b>	● it is benefit to mix multi features for uncertainty inference	● high level semantic modeling,
	● It is one of the most effective theoretical models in the field of uncertainty knowledge representation and reasoning	● scene analysis,
	● Rigorous reasoning process, clear semantic expression, flexible learning mechanism	● video image analysis
<b>Decision Tree</b>	➤ A decision-supporting tool has been used in operation decision analysis to help identify strategies and achieve the goal.	➤ Project risk evaluation
	➤ good readability and descriptive, high efficiency, using repeatedly	➤ Feasibility judgment of the project
<b>BP</b>	■ a kind of information system which include structure and function of	■ support risk assessment and make the risk strategies.
<b>Neural Network</b>	real physiological neural networks to disposed the uncertainly problems; get simple judgment	■ measure water consumption of wheat
		■ estimate amylose content of rice.

### III. Source of big data in food supply chain

#### A. Big data in food production

The data collected during food production such as sensory evaluation, physical and chemical properties, microorganisms, temperature, time, humidity, pH, water activity and content of microorganism, net weight, calories and fat. For example, each batch of whole milk production process need to be tested through 4 parts supervision which cumulative 899 indicators by agricultural department and quality supervision department (Qu,2011). There are hundreds of batches has been tested frequently to guarantee the quality and to cumulative a real-time and reliable data. It is obviously that big data technology is playing more roles in construction of food safety supervision model, detection and supervision of toxic substances that hazard human health produced by the food in the production.

#### B. Big data in food distribution

The environment (such as humidity, temperature, light

strength, etc.) of storage and transportation is closely related to the food quality. The food big data can collect real-time data from various sensor monitor as environment temperature, humidity, pressure, ventilation, physical, chemical, physical hazard, light strength or other indexes to control the food quality in time. Simply, the loss of food caused by improper temperature control is up to 35% (Wang and Chen, 2010). The real-time monitoring of environmental conditions during storage and transportation can ensure product quality and greatly reduce the economic loss of supplier by big data technique.

The information of environment and food quality index, which collected by wireless sensor, could be collected and analyzed by big data. The quality of fresh food and packaged food can be monitored and managed immediately during storage and transportation. Food distribution center will remove the decomposed or spoiled food timely to improve the environment of storage or transportation. Besides, using big data can predict arriving time of vehicle more accurately. Big data

can connect satellite location information, real-time traffic congestion information to predict the arrival time accurately, reduce the uncertainty of the transport processing. Then, using big data can optimize transportation line. The analysis of traffic running real-time data can help choose the best lines to improve transportation efficiency. Additionally, using big data can evaluate the vehicle operating conditions which be recorded as historical operation data to improvement the design of vehicle (Deng and Liu, 2012).

### C. Food big data in food retailing

A highly competitive in retail industry, in order to attract more consumers, age, sex, education level, monthly income and other consumer characters have been collected and analyzed to segment consumers in the past. Now, using big data in food retailing to evaluate the consumer behavior and develop marketing strategy to increase their competitiveness. In food retailing, commodity sales, customer information, inventory information, shops information, procurement staff, marketing staff and advertisers access can be collected by bar code, coding system, sales management system, customer information management, sensor machine and Wi-Fi probe to analyze these data and provide scientific decision-making. For example, Andrew Sen is a Japan pastry production and retailer, they used food big data to improve effectiveness of the production and reduce the excess daily losses successfully. Food big data analyzes retail store sales data and demand information from terminal POS machine with different and predicts consumer buying tendency and purchase quantity of different sub periods (Xu, 2013).

### IV. Food big data raising from consumer

As one of UK leading retailer, Tesco has used Food big data technology to collect data and analyzed their consumer behavior already. Firstly, Tesco makes a specific number to each customer under food big data system which can collect the amount of customer buying, consumption of goods and service to establish the model(Liu and Liu, 2011). Food big data through customer's data analysis, predict each customer's consumption habits, possible needs recently to develop a targeted marketing plan and adjust sale price timely. Besides, the technique of food big data can be used to

collect the data of total sale and inventory, the rate of consumer purchasing and return, cash flow counter to ranking top products for achieving more profit.

Food big data used by Wal-Mart has been developed from mining customer's need to be able to create consumer's demand. Food big data of Wal-Mart provide the relationship between different commodities, and relate to consumer's background information which include shopping lists, shopping history, shopping basket item as well as the specific purchase time, even the day's weather in order to recommend appropriate purchasing products for customers and create new profit(Tan,2014).

### V. Conclusion

In conclusion, using food big data to achieve the traceability of food quality, identification of data and information technology, it can help food authorities or government to find the key factor and periodic trend influencing food safety regulatory and to support more precise management. In addition, food big data can help enterprises to provide a credible display platform of product quality, and help to development new market as the original evidence. What's more, the information of food origin, composition, nutrition, standards, personalized service and dietary suggestion have been analyzed and showed from food big data to consumers in order to help consumers to choose the food not only safety to eat, but also healthy and nutrition. In a word, food big data have been a powerful and strength weapon for government, supervision authority, food company, mass media and consumer to guarantee the food quality and control the food safety risk.

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