

Research on Design Features of Intelligent Product based on Big Data

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Abstract. At present, the products design and development of enterprises are facing more complex internal and external environment, the specific performances are the technological and economic changes, the endless innovation of competitor, the constant changing of consumer's demands. To the enterprise management, these are not only crises, but also opportunities and challenges. Previously, entrepreneurs and designers designed and developed new products in a traditional way, which is grasping the trends through their personal experience, feelings or intuitions, trying to figure out customers' psychological through market research, customer feedbacks, and this pattern is not suitable for the current situation. Fortunately, big data, data mining, data analysis, cloud computing, sensors and other new technologies can be used to analyze the deep level relationship between the data and the data through massive data, so that we can see into the future basing on historical data, and then we can accomplish the following things in product design, comprehensive collection of relevant data, data driven to achieve product design, real-time dynamic accessing to the using data, accurately forecasting user's needs. Thus we can reduce the risk of product design, realize the maximization of enterprise benefits.

Introduction

With the development of productive forces, the relationship between market supply and demand is constantly changing. Many production areas begin to having surplus products, and the market has gradually shifted from the seller's market to the buyer's market. When in a seller's market, since lack of materials, the consumers buy what the producers manufacture, the producers only need to make their production in a low cost, high efficiency way. When in a seller's market, since overproduction, consumers have a lot of choices, and the products which meet the needs of consumers have competitive advantages, a good product design must be recognized by consumers. The complexity and variability of consumer preference has brought great risks and challenges to product design and development.

From the original closed, fixed, single, determined design goals, to the current dynamic, diverse, complex, risk design goals, we need more data and analysis computational models for decision making. Big data, data mining, cloud computing and other new information technologies have provided technical means for solving those problems.

Among which the relationship between the data and the data will make our understanding of the world, the use of resources and the creation of value, rise to a new height. U.S. President Barack Obama's success in the election and re-election has the support of big data mining, and the United States government believes that big data is the future new oil, and will rise the study of big data to the national will, which will have a profound impact on the future of science and technology and economic development[1]. Big data and the new information technology have built a real-time, true, two-way, comprehensive and interactive bridge for product designers and consumers, the past and future of consumer preferences.

In the background of large data applied to design, some of the traditional ideas and practices will be changed. First, it is the design of a product that needs to be changed from the traditional method with experience and intuition to the decision model with data driven. Secondly, it is the mode of data acquisition that needs to be changed from the one-sided, mechanical, discrete traditional mode to the

comprehensive, real-time data collecting mode. Finally, the data and ideas of the product design will become an open mode, and need a broad participation of users. The intelligent design bases on big data, using data analysis and mining to explain and predict the relationship among the data, applying these results to practice. Through establishing the collection module, the analysis module and the evaluation module of product information, we can finish information collection, data analysis, effect evaluation respectively, and then enhance the product design, customer satisfaction.

The definition of intelligent design based on big data

Definition of Intelligent Design Gestation Period. Wisdom, according to the development can be divided into three levels, the first one is the correct understanding and response to the local situation, for example, when you are playing chess, someone wants to eat your horse, and you can correctly understand his attention and take the correct response, jumping the horse. The second one is the correct understanding and response to the overall situation, at this time, there is a link between each element, and we make the right decisions in space to achieve the overall maximum benefits. The third one is the prediction of the future and making a correct understanding and response, and we should carry out a comprehensive measure from space and time. To achieve the third levels of wisdom, we should need strong sense of perception, computing power, forecasting and response ability. Intelligent design is putting the soul of wisdom into the idea of design.

We will have a sense of convergence for the design of all kind of products, including buildings, cars, and daily necessities and so on. Plagiarism, imitation and the lack of protection of intellectual property rights are important factors. But another important reason is the traditional product design technology path. The traditional design pattern is relying on the designer's personal experience and intuition, and where is this come from? It comes from books, products around us, and works of other famous designer, and a small amount of creative submerged in the traditional power. Intelligent design has inherited the idea of the traditional design, but it has wings in the fields of full sense, forecast ability and mass participation.

Big Data Definition. In 2008 "science" magazine published monographs, big data is defined as "Represent the progress of human cognitive processes, the size of data set is too big to exquisite, manage and deal with using current technology, method and theory "[2].

In the "big data era" written by Maier Victor Berg Schoen and Kukye Kenneth, big data refers to using all data to analysis and processing instead of using random analysis method (sample survey) as a shortcut. 4V refers to volume, variety, velocity and value, and the version of the fourth V is different. The International Data Corporation (IDC) believes that the big data should also have value[3].

For "big data" research institute Gartner gives such definition that "Big data" is the massive, high growth rate and diversity information assets which need a new processing mode to make them have stronger decision-making power, insight power and process optimization ability.

According to Wikipedia, Big data is a broad term for data sets so large or complex that traditional data processing applications are inadequate.

According to the book "big data white paper (2014) year" written by Telecommunications Research Institute of the Ministry of industry and Telecommunications, the big data is a large amount of data with the characteristic of diversity structure, strong timeliness and etc.; the processing needs use new computing architecture and intelligent algorithms and other new technologies[4].

The strategy significance of the big data is not grasping the huge data information, but the specialized processing of these meaningful data. In other words, if we treat the big data as an industry, the key to achieve profits is to improve the data processing capabilities, to achieve value added of the data through processing.

From the technical view, the relationship between big data and cloud computing is inseparable like the positive and negative side of a coin. We cannot use a single computer to process big data, and a distributed architecture should be used. Its characteristic lies in the distributed data mining on the massive data, but which must rely on the distributed processing, the distributed database and the cloud storage, the virtualization technology of the cloud computing.

With the advent of the cloud era, big data has attracted more and more attention as well. The analysts team of "the PTZ" believe that big data is usually used to describe the massive non structured data and semi-structured data created by a company; downloading these data to the relational database for analysis will spend too much time and money. Big data analysis is often associated with cloud computing, because the analysis of real-time large data set needs framework like the MapReduce to assign works to tens, hundreds or even thousands of computers.

Big data needs special technology which can process massive data in tolerance time. The technology including large-scale parallel processing (MPP) database, data mining grid, distributed file system, distributed database, cloud computing platform, the Internet and scalable storage system are suitable for Big data.

According to the prediction of market research organization IDC, big data technology and services market will rise from \$3200000000 in 2015 to \$16900000000 in 2010, and achieve the 40% of the annual growth rate (7 times of the IT and communication industry growth rate) [5]. Some people likened the data to the coal mine. According to the properties of coal, there are coking coal, anthracite coal, fat coal, lean coal and other classification, and the cost of open pit coal mine and deep coal mining is not the same. Similarly, the point of big data is not "big", but "helpful". Value content, mining cost is more important than the amount. For many industries, how to take advantage of these massive data is the key to win the competition.

Relationship between Design and Big Data. Who will design, the traditional product design is done by the designer. And the wisdom design includes the user's participation. The designers make decision according to the analysis of the user's big data. In intelligent design, the designer can open up models of different integrity to different users in order to collect data. For example, for fancier, you can collect the data in the hardware, software architecture. And for the general user, you can gather data in color, shape and material. To the designers of the wisdom design, they are more like bees, taking the essence from the flowers.

Design process: The general process of traditional product design has intermittent time difference, including market research, product design, trial production, trial sales, and comprehensive production sales. All of these links need certain time, especially data collection and analysis, which will cause the time difference between the process of collecting information for product design and the process of collecting information about market, the idiom "carve on gunwale of a moving boat" can brilliantly summed up this point. The data of intelligent design is the real-time data for the user's data center through a series of sensors and touch devices. Pre analysis and decision making module can analyze these data and draw conclusions in real time, and then provide assistant help for real-time continuous product design.

The traditional product design depends on the human brain. The human brain is heavily dependent on experience and memory. And compared with computer network, the memory capacity and data processing capacity of the human brain is not sufficient. In other words, the human brain is more inclined to qualitative analysis, and the computer is more suitable for quantitative analysis. And a major bright spot in the wisdom design is the prediction based on historical data, which requires the ability to memorize massive data and analyze accurately, which is almost impossible for the human brain. Thus, the data driven decision model of big data have provided a possibility to find the best design scheme with seeking trend through data.

Big data processing tools. In the big data processing platform, we are most familiar with the Hadoop Apache block processing platform, Hadoop is mainly based on the programming framework of MapReduce [6] and HDFS [7]. HPCC (high performance computing cluster) [8] system is also an open source distributed intensive data processing platform, and the mainly components are following: (a) Thor (HPCC data refinery cluster) is a distributed file system, which is capable of parallel processing, it is responsible for receiving, transmitting, connecting and searching of a large amount of data; (b) Roxie (HPCC data delivery engine) has provided a large number of high performance multi-user online query functions (c) ECL (enterprise control language) is a kind of powerful programming language which is suitable for dealing with big data; (d) ECL IDE is used to work for the ECL, such as programming, adjusting and monitoring the ECL program; (e) ESP (enterprise

services platform) has provided an inquiry interface for visiting ECL easily, generally supported SOAP、XML、HTTP and REST and so on. Hadapt [9] is a high performance self-adaptive analysis platform.

Characteristics of Intelligent Design based on Big Data

Comprehensive collection of relevant information. In the process of market investigation, the key factor of success or failure is whether we can collect enough information, and the correction of it. In daily design, the information collected by the product designers is limited, or is second handed, which people call "ungrounded". And in the era of big data, the development of information technology makes the source and collection of information becomes very convenient and cheap. Sensors can collect information for 24 hours without interruption, users can send comments and suggestions at any time, and the use of the existing products also can produce data in real time, which provide a large amount of data to the designer. The arrival of Big data provides adequate information for product design, reduces the risk and cost of design.

The data driven. The data driven method is that product design is determined by the relevant data. Data is the only power to determine product design. Relying on experience and intuition driven product design has a lot of uncertainty, for example, the designer's mood, prejudice, careful consideration and other factors. Showing a state of no rules, no relationship condition, the use of that design method has no doubt bearing a considerable risk of uncertainty. Like Apple Corp, the future of the company will be overshadowed by the death of a genius designer.

The data driven method attempts to build product design based on users' expectations. If the data is provided by potential users, the amount of information provided is sufficient to reflect the potential users' need and desire, the analysis and understanding of the data are also in line with the real needs of potential users, and the potential customers can also represent the entire customer base, thus, the design of this product is scientific and well-founded. The data driven model constructed by using big data, compared with the traditional method, has less human intervention, error, cognitive bias, so it is more realistic to reflect the objective facts.

Real-time dynamic. Real time dynamic means high cost in the past. Real time dynamic data can build a more realistic model, and it will need more data and higher cost. So in the limitation of technology, people use the sample collection way to solve the contradiction between the accuracy and high cost. The previous real-time dynamic system had three bottlenecks: the difficulty of sampling, transmission and storage, processing and feedback. Intelligent design through the mobile terminal equipment collect information in multi dimensional way, use the cloud computing to finish storage, analysis and statistics, according to the results of the calculation adjust the design of product in real-time and update to the display terminal. Through the above system, we can establish a fast and healthy feedback mechanism. Using the industrial display APP mentioned above section to compare the past and the present product design patterns.

Precision forecast. Intel Global Healthcare Solutions Architect, Wu Wenxin, et al. forecast the rapid growth of medical industry data, in particular image data and EMR electronic medical records data[10]. Intel helped UF to finish the reasonable structure analysis and guidance, and deeply explored and researched the solution provided by big data analysis, and developed a construction goal based on Intel data solving scheme of regional health data center: document retrieval, storage mode matching data mode update, transparent expansion capacity and performance. The U.S. Department of transportation (ODOT) used INRIX's cloud computing analysis to deal with large data to understand and deal with the road conditions of bad weather[11], consequently reduced the probability of the occurrence of series crashes in winter, and provided easy travel for people. In the energy industry, the SaaS software company Opower provided consumption of energy efficiency using data analysis[12].

The present is the constant repetition of history. So we should learn from history. However, history is not the simple repetition, and simple imitation would have caused some bad effect, because the imitator didn't understand and grasp the key driving factors and the relationship between each factor.

The intelligent design through the correlation analysis of the data establishes the predictive data model. According to historical data building the simulation model, and find the relationship between the antecedent factors and their interact affects. When the antecedent factors change, we can predict the related factors' changing direction and degree.

Conclusion

The Big data corresponding theory has already been mature, the corresponding computer models and algorithms have been developed and applied. Most people have accepted it and began to apply the theory, and the application prospect of big data in variety industries is very bright. But there are still some problems which need to be solved in product design: (1) what data shall we collect? (2) How can we find a cheap, convenient and accurate data collection way? (3) The real and objective of the data. These three questions are at the process of collecting data, which will be the basis of data processing and application. Without this process, the application of big data in product design will become a mirage. This shows that there is still a wide research space in the application of big data.

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