Research on Aviation Big Data and E-commerce Applications
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Abstract. Based on the environment of civil aviation business, this paper discusses methods of developing e-commerce in big data environment and puts forward three models for building intelligent recommendation system in civil aviation e-commerce with big data technology. Through the practices of an airline, these models are proved that they can help the airline improving its marketing revenue.

Introduction
With the gradually development of national industry policy, electronic commerce in China officially entered the "Internet plus" era. The traditional marketing mode of airlines will gradually change to the operation type. Based on the analysis results in the customer data, it became the direction of electronic commerce to pay attention to different features of customers and carry out accurate personalized marketing with big data technology.

For airlines, passengers are not only satisfied with the flight from one city to another city, but the convenient and comfortable services provided by airlines from ticket-buying, check-in, airport and so on. These services demand are no longer confined to flying itself, it includes shuttle lounge, hotel arrangements, attractions tickets even need. Airlines should provide kinds of different services and products to passengers, according to the innovation sensitivity factors of passengers during contact interaction.

Architecture of the Avionics System Model
To carry out large data precision marketing e-commerce innovation management based on, is built based on big data platform, data acquisition and analysis of passenger flight data, data browsing, booking data, social data and flight capacity data, identification system to establish a set of individual characteristics and needs of the passengers; in this unified data mining based on innovation carried out the various types of e-commerce innovation. The innovation system is expressed as:

In this paper, it shows how to carry out precision marketing management with big data. Build a big data platform which gather data of browsing data, booking data, flying data, social intercourse data, build an identification system to mine individual characteristics and needs of the passengers. The architecture of the model is expressed as:

![Figure 1. Architecture of the avionics system model.](image-url)
Models of the Big Data Platform

With big data platform, the research completed the analysis of passenger behavior analysis, social network and fly flow. It also shows an intelligent recommendation system with self learning ability based on these three models.

Passenger Behavior Model

Passenger behavior model is an important model to carry out intelligent recommendation. Airlines personalized passenger with tags as behavioral analysis, and the intelligent recommendation system reads the tags to associate the passenger and services or products for precise marketing while social network model helps further precise.

Big data platform collects passenger data of every aspect, data should source from website login, ticket searching, booking, paying, check-in, amusement on flight and data source from such server segments. On the other hand, there are many kinds of data in different channels which passenger interact with airlines. And the data with identification algorithm is used to build a passenger tag database of the Airlines which shows passenger in more than 1400 dimensions such as transaction details, travel date details, personal detail, etc.

[Figure 2. Passenger tags.]

Social Network Model

The civil Airline’s social network model in this paper associate individual by its own data which show Potential relationship between two persons by analysing weibo data, wechat data, aviation PNR peer data as well as the assignee data of members etc. This model shows deep-going understanding of passenger and tells the influence on network marketing. There are six relationships in this model: travel peers, assigners, friends, schoolmate, colleague, fans circle.

In the model, someone is the key figure, others connect the key figure in these relationships directly or indirectly from two to six layers. The generated network diagrams are as follows:

Passengers in the social networks have different impacts. The contribution value of passengers to airlines includes direct contribution value (such as the number of times of flight) and indirect contribution value (such as the purchasing power of social circle and demonstration effect). Direct contribution value can be intuitively displayed in the comprehensive view of tourists, while the indirect value is more reflected in passenger social networks: more social network nodes, huger "fans" or with higher value, the higher the indirect contribution value of the passengers. Relying on big data analysis, the cognition of traveler’s indirect contribution value is possible, which is also the inevitable way of social marketing of e-commerce.

Passenger Flying Flow Model

Passenger flying flow analysis, widely collect data of railway passenger transportation, highway passenger transport, aviation passenger transport and passenger traffic based on the data, combining
with the corresponding period of the social activities, such as environmental factors and comprehensive consideration of domestic and international political and economic environment, including history of passenger flow query. This model shows the future trend of passenger flow and it has two levels of analysis: a) The demand forecast of new routes, which will study the changes in the preferences of the passenger groups caused by international domestic political, economic or strategic layout from a macro level. b) The deployment of the flight capacity of the specific airline intervals. It optimizes the shipping capacity of the flights by showing the number of possible passenger in different periods of specific routes and the time of different flights.

Intelligent recommendation system can identify flight capacity change trend based on passenger fly flow model, thus reduce the cost of marketing, and furtherly improve purpose, real-time and accuracy of the marketing. Specifically, it can predict the future sales of air flight allowance, and control the scope of marketing according to passenger demand potential level, such as more marketing to less sales, suggestive services to more sales.

Passenger fly flow prediction, specific to the course, is for the selected route cyclical change rule of passenger flow prediction, so as to optimize the flight capacity distribution decisions and marketing activities more scientific. The first step in this model, is showing a certain period of time within the scope of the passenger traffic forecast by analysing the history of airline traffic data combined with the current trend of passenger order distribution, seasonal, holidays, special events, etc. Taking the Guangzhou to Dalian route as an example, the model predicts general passenger flow and the business class passenger flow of airlines:
The airlines modeling with passenger data of more than four years from 2011 to early 2016 of Guangzhou to Dalian passenger. The dotted line is the passenger flow curve according to the actual historical data drawn, the solid line is the trend of passenger as the model shows, the blue solid line is the prediction of future passengers’ flow and shaded areas said fluctuation range prediction.

In the chart, the prediction model fits historical passenger flow accurately, although at the beginning of 2013, at the beginning of 2014, at the end of the three-period forecast the volatility of some errors, but the overall prediction trend is consistent, accurate prediction results. Historically, model has a high degree of confidence, so this prediction model is trustworthy, and is an important reference basis for the intelligent recommendation system.

**Intelligent Recommendation System**

Intelligent recommendation system modeling with the three business models above is based on clustering technology and real-time collaborative filtering algorithm.

It parameterizes the characters of aviation products and passenger in the intelligent recommendation system and becomes smart by building two modules: one is the recommended model with parameterized characteristics of the aviation product; the other is the self dynamic evaluation of adjusting the business model parameters with analysis marketing performance of recommendation efficiency. Therefore, the recommendation model has the ability of intelligent adaptation to periodic changes in the aviation market.

![Figure 5. Architecture of intelligent recommendation model.](image)

Unlike other e-commerce platforms, which are generally associated with products and customers, the airline industry's products and passengers have unique characteristics. The Intelligent recommendation system in this paper modeling with the characteristics of the aviation industry, the analysis of passenger information and product attribute in the system is no longer confined to the category of the data itself, but modeling with data of ticket reservation time, flight time, check-in habit, ticket channels under the help of big data which study the key technology and business trend.

**Summary**

The application of e-commerce platform based on the data of some airlines, can solve precision of the marketing process, and greatly improve the marketing efficiency. In addition, the study plays a positive role in the progress of civil aviation electronic commerce and passenger service improvement.
However, the research and application still need to constantly optimize themselves: one is the limitation of the aviation data, caused by the passenger behavior and the sidedness of social analysis, so it is needed to gradually improve the passenger data view on visitors' cognition in combination with other industries; the other is that precise of all modules are influenced by airline policy, capacity and business strategy deeper than other e-commerce industries.

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References


