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ANALYZING THE DEPARTURE PROFICIENCY FOR HUB AIRPORT DURING THUNDERSTORM USING NAIVE BAYES ALGORITHM

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ABSTRACT

Analyzing the proficiency is more important for flight plan in airport which helps to reduce the flight delays and crash of air plans. Thus, assuring well organized activities of the airport during thunderstorm. Weather and traffic control are the main factors that may result in the delay of flights and air crash. Thunderstorm is the important factor which is affecting the activities of the airport which consists of the properties such as it is difficult to analyze the dynamic evolution of the atmosphere. This paper considered the factor which leads to the problem in the departure proficiency based on the activity data of the previous five years in Beijing Capital International Airport then renowned an analyzed model for the departure proficiency based on Support Vector Machine and Naive Bayer's Algorithm and installed software in control department. This result indicated that the analyzed model can have practical value with more precision so that this proficiency model can reduce the number of flight delays and air crash which matches the operation in Beijing Capital International Airport.

Key words: Proficiency Analysis, Departure Proficiency, Support Vector Machine, Naïve Bayer"s, Thunderstorm.

1. INTRODUCTION

Beijing Capital International Airport is the busiest airport in China, of which the passenger throughput has exceeded 70,000,000 person-times in 2008 while the flight demand and passenger demand is continuously increasing. Unfortunately, the factors such as weather and traffic control often lead to a large-scale flight delays and air crash.

Flight delay is one of the problems to restrict the development of the world activation history and also main source for the airline passenger"s dissatisfaction with the service. At present, countries around the world have taken various measures to reduce the flight delay. In addition, the approach and departure flight scheduling of terminal area also plays an important role in reducing the flight delay, so reasonable scheduling of flights has an influence on ensuring flight safety, improving resource utilization and reducing loss of delay as well as improving airline credibility and soforth. Bowen and Pearcelf [1] proposed a model of aircraft arrival flow in terminal area, to solve the capacity prediction problem, which assumed to conform a Poisson distribution. Gene and Marner [2] extended the capacity concept for the runway to the terminal area and the route, and capacity evaluation in terminal area and the route and they discussed the flow management. Professor Hu and Zhang Zhilong [3] studied about the terminal area capacity, and analyzed the properties affecting the terminal area capacity. Moreover, analyzed the capacity of the terminal area using the network flow theory and they established a terminal area proficiency evaluation model. Ball and Inniss [4-5] proposed an arrival proficiency distribution model of parameters, who converted the bad weather data into the probability distribution of the required arrival proficiency taking San Francisco International Airport as an example. Catherine [6] divided the storm weather into four categories which are storms, moderate storms, good weather, and strong storms, and there are three kinds of proficiency distribution with the corresponding certain probability for each category. However, all the distributions and the probabilities are the empirical value according to the weather forecast which lacks of practical theoretical basis. Fan Xing and Han Songchen [7] calculated the proficiency in terminal area based on Regression Analysis Method.

It can be found that there are significant limitations to calculate the proficiency of the terminal area with mathematical model. Firstly, there are many factors affecting the terminal area proficiency, each of which has obvious characteristic of uncertainty. In addition, the influence of each factor on airspace proficiency in terminal area is also uncertain, which is difficult to express clearly using mathematical model. To avoid the problem discussed above, this paper analyzed the factors affecting the departure proficiency according to the activity data of the past five years in Beijing Capital International Airport, and established a analysis model for the departure proficiency based on Support Vector Machine (SVM) and Naive Bayer"s, thus preferably avoiding the influence of uncertainty. Meanwhile, in this paper we calculated the estimated efficiency reduction and the

amount of flight cancellation through the analysis model refer to the specific flight plan. The test results compared with the actual operation data demonstrated that the analysis model in this paper proposed can offer a more accurate analyzed result. The rest of this paper is organized as follows. Section 2 describes the existing system. Section 3 describes the details of our prediction model for the departure capacity. Section 4 shows the software we developed and presents the relatively accurate prediction results. And our conclusions about this paper with some remarks and future researches are contained in section 5.

2. EXISTING SYSTEM

Analysis of Air Traffic Flow Control through Agent-Based Modeling and Simulation. Agent–based modeling and simulation of complex system provides new methods for system's analysis, control and decision-making. This paper presents a modeling and simulation method of air traffic flow, constructs computer models of Flight Agent and Control Agent, and discusses the performance evaluation parameters of air traffic control system. Furthermore, a computer prototype system has been developed about the simulation of air traffic flow operating in a control sector. According to the results of simulation, this paper analyzes the effectiveness of control decision-making and reveals the emergent phenomena of air traffic operation such as congestion and flight delays. Actually in agent based modeling system, conversation between aircraft and the control center is considered as traffic flow. In This system they are proposing an agent based decision making system which handling huge amount of traffic in space which will generate delay in the communication. Reducing traffic flow is discussed in this proposal. But this system does not consider natural issues on airspace such as rain fall, thunder storm.

3. LITERATURE SURVEY

The primary goal of model proposed in this seminar is to predict airline delays caused by inclement of weather conditions using data mining and supervised machine learning algorithm (Random Forest). 2008 US domestic flight data and weather data was extracted for training and prediction. Four different models were developed to for analysis of behavior of different parameters. Departure and Arrival delays were separately determined. OOB score was calculated to determine optimum number of trees. Sampling techniques (SMOTE) were then applied on data to improve the performance of model. Every model‟s performance was compared using precision, recall, F1 score, Accuracy, Confusion matrix, and AUC under ROC

The increase in delays in the National Airspace System (NAS) has been the subject of studies in recent years. The literature on delay analysis and its potential remedies extends back over several decades. Levine (1969) argues that pricing is a better means of allocating scarce airport capacity to meet the demand than other mechanisms being considered at the time, such as slot allocation. The Federal Aviation Administration (FAA) describes the increase in delays and 10 cancellations from 1995 through 1999.

Schaefer and Miller (2001) found that the current system for collecting causal data does not provide the appropriate data for developing strong conclusions for delay causes and recommend changes to the current data collection system.

Allan et al. (2001) examined delays at New York City Airports from September 1998 through August 2000 to determine the major causes of delay that occurred during the first year of an Integrated Terminal Weather System (ITWS) use and delays that occurred with ITWS in operation that were “avoidable” if enhanced weather detection. The methodology used in the study has considered major causes of delays (convective weather inside and well outside the terminal area, and high winds) that have generally been ignored in previous studies of capacity constrained airports such as Newark International Airport (EWR). The research found that the usual paradigm of assessing delays only in terms of Instrument Meteorological Conditions (IMC) and Visual Meteorological Conditions (VMC) and the associated airport capacities is far too simplistic as a tool for determining which air traffic management investments best reduces the “avoidable” delays.

Schaefer and Miller (2001) use the Detailed Policy Assessment Tool (DPAT) to model the propagation of delay throughout a system of airports and sectors. To estimate delays, throughputs, and air traffic congestion in a typical scenario of current operations in the U. S., DPAT models the flow of approximately 50,000 flights per day throughout the airports and airspace of the U. S. National Airspace System (NAS) and can simulate flights to analyze delays at airports around the world. They obtained results for local flight departure and arrival delays due to IMC, propagation for IMC, comparisons to 11 VMC results, and a comparison of propagated delays to entire system.

Rosen (2002) measures the change in flight times resulting from infrastructure-constant changes in passenger demand. Results indicate that delays rise with the ratio of demand to fixed airport infrastructure, decreasing average flight times by close to seven minutes after the sharp decrease in demand in the Fall of 2001. Flight time differences between the airlines in the sample are small, though the larger United had shorter average flight times in the winter quarter than America West, the smaller airline in the data sample.

Janic (2003) presents a model for assessment of the economic consequences of large-scale disruptions of an airline single hub-and-spoke network expressed by the costs of delayed and cancelled complexes of flights. The model uses the scheduled and affected service time of particular complexes to determine their delays caused by disruption. During the last decade, a considerable attention has been given to proactive schedule recovery models as a possible approach to limit flight delays associated with Ground Delay Programs (GDP)

(Abdelghany et al., 2004; Clarke, 1997). In these models, the impact of any reported flight delays, due to GDP or any other reason, is propagated in the network to determine any possible down-line disruptions (Monroe and Chu, 1995).
Wu (2005) explores the inherent delays of airline schedules resulting from limited buffer times and stochastic disruptions in airline operations. It is found that significant gaps exist between the real operating delays, the inherent delays (from simulation) and the zero-delay scenario. Results show that airline schedules must consider the stochasticity in daily operations. Schedules may become robust and reliable, only if buffer times are embedded and designed properly in airline schedules

4. PROPOSED SYSTEM

4.1 Support Vector Machine

Support Vector Machine (SVM) is a classification and regression prediction tool that uses machine learning theory to maximize predictive accuracy while automatically avoiding over-fit to the data. Support Vector machines can be defined as systems which use hypothesis space of a linear functions in a high dimensional feature space, trained with a learning algorithm from optimization theory that implements a learning bias derived from statistical learning theory.

4.2 Naive Bayer's

Naïve Bayer‟s classifier is the classification algorithm based on the Bayer‟s theorem of probability . Given the set of attributes, posterior probability of the event is calculated using the Bayer‟s theorem. Posterior probability that water is potable is given by the following equation,

$$Posterior(potable) = P(potable)P(potable|ph)P(potable|ec) .../evidence,$$

Evidence is the sum of numerators in Posterior(potable) and Posterior(non-potable).

Given the Standard deviation σ, and mean μ, of the parameter p, calculation of P(potable | p) can be done as,

$$p(potable \mid p) = \frac{1}{\sqrt{2\pi\sigma^{\wedge}2}} ^{\wedge} (\frac{-(val-\mu)^{\wedge}2}{2\sigma^{\wedge}2})$$

4.3 Algorithm

Step1: user registration
Step2: user login
Step3: admin login
Step4:
if((username.equals(“username”) &&(password equals(“password”))
{
Step5: upload(filename);
Step6: identify=class label(threshold);
Step7: select=(SVM/naive bias)
{
Train_data();
}
}
Else{
Alert(„wrong password‟);
}
Step8: predict current value();
Step9: test_data(`DEWP,TEMP,PRES,Iws,Is,Ir`)
Step10: predict_output();
Step11: choose(take on/take off)

4.4 Architecture of Proposed system

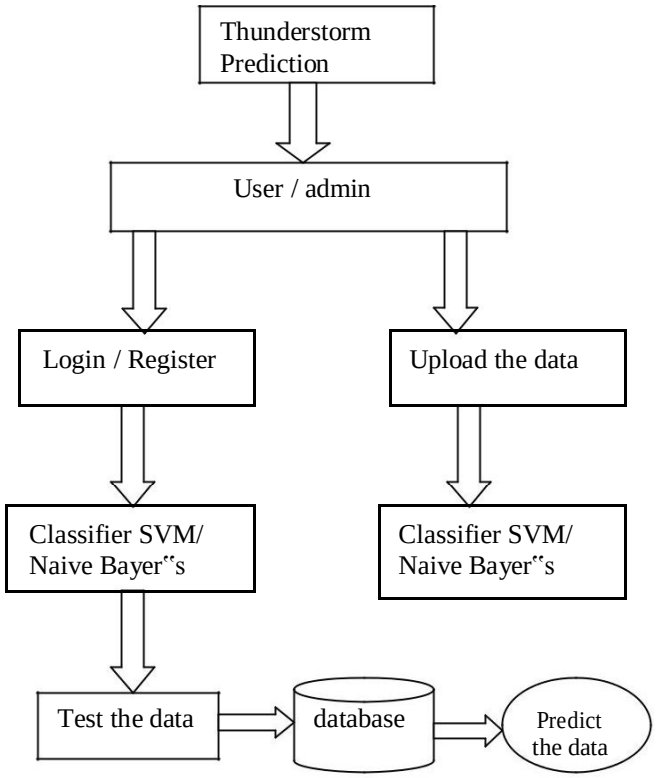

Fig1. Architecture of proposed system

Table 1: Test Datasets

DEWP	TEMP	PRES	Iws	Is	Ir
-21	-11	1021	1.79	0	0
-21	-12	1020	4.92	0	0
-21	-11	1019	6.71	0	0
-21	-14	1019	9.84	0	0
-20	-12	1018	12.97	0	0
-19	-10	1017	16.1	0	0
-19	-9	1017	19.23	0	0
-19	-9	1017	21.02	0	0
-19	-9	1017	24.15	0	0
-20	-8	1017	27.28	0	0
-19	-7	1017	31.3	0	0
-18	-5	1017	34.43	0	0
-19	-5	1015	37.56	0	0
-18	-3	1015	40.69	0	0

DEWP: Dew Point (â„ƒ)
TEMP: Temperature (â„ƒ)
PRES: Pressure (hPa)
Iws: Cumulated wind speed (m/s)
Is: Cumulated hours of snow
Ir: Cumulated hours of rain

4.5 Libsvm

The establishment of the prediction model in this paper adopts the Libsvm software package, which is designed and developed by Professor Lin at National Taiwan University. Libsvm is a fast, effective and easy-to-use software package for pattern recognition and regression of SVM, which provides not only executable files but also the source code, thus making it convenient to modify and improve. The package rarely adjusts parameters involved in SVM, which provides a lot of default parameters as well as the function of cross validation that can solve many problems.

4.6 Software implementation and the prediction results

In this paper, the software was developed in the windows 10 operating system. The database adopted Oracle and the server program was developed with Java, while the web pages were developed with JSP. The read of samples and the model training are developed with Java. In addition, the samples we adopted are the operation data and weather information at Beijing Capital International Airport from 2010 to 2014.

CONCLUSION

In this paper sensitivity experiments conducted with SVM and naïve bias algorithm to test the data to analysis the thunder storm using Beijing capital international airport whether report. Using this real time dataset find the thunderstorm happen or not based on that predication we can fix the fight take off or on. Before predicting first training the network using real time data and identify the label (threshold).to test data over the training data predict the output. In existing system they use only one algorithm to predict in our work we are using multiple algorithms to predict and increase efficiency rate and accuracy.

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