# Air Lines Reservation By Intelligent Traveling Agent System

**[1]Arvind Dewangan, [2]Mukesh Kumar, [3]Dr. D.P.Gupta, [4]Manik Goyal,**
[1]Asstt. Prof-Civil Engg. Deptt. Haryana College of Technology & Management, Kaithal,

[2]Lecturer Civil Engg. Deptt. Haryana College of Technology & Management, Kaithal,

[3]Principal. Haryana College of Technology & Management, Kaithal,

[4]Asstt. Proff. J.C.D.V-Sirsa, Haryana

**Summary**
In this paper Artificial Neural Network are applied to serve as an Intelligent Traveling Agent. The proposed agent is used in the problem domain of' Air Line Travel'. Subsequently this software has been developed which will categorize the incoming emails in three sections. The software first retrieves. Emails sent by clients belonging to different natures. The software has been trained using Neural Network based learning algorithm using both on - line and off - line methods and characterization curve is proposed to obtained after training the designed Neural Network using MA TLAB software. We have also design an interface for this system using VB language. The proposed system differentiates emails into four categories. These are Reservation, Confirmation, Cancellation and Neutral. The scheme has been tested for 100 users with a success rate of 90% in normal case. The on line learning facilitates the Neural Network to recognize new words. The proposed agent is capable to satisfy its importance.

***Key words:***
*Artificial Neural Network(ANN), Back Propagation learning, Intelligent Agents, Clerk.*

## 1. Introduction

Artificial Neural Networks (ANN) [1-4] have been applied for large number of applications including engineering, science & technology, biomedical, financial forecasting etc. [5-7] Due to their properties of inherent massive parallelism capability to solve non linear problems, classifications, regressions and fault tolerance. ANN is being applied to various areas. This paper applied it to design a software agent in terms of an intelligent Travel Agent [8-10].

ANN works very similar to the biological neurons of human brain and its charters tics is also similar to biological neurons. In most of the application of ANN have been applied to predict the events based on their past history. ANN based systems are first trained for a given set of data training set and then tested for unknown pattern. In a manual reservation the operator (Clerk) receives information from all passengers and clients then it forwards to the concerning section for appropriate action. There are always chances that the operator may ignore, forgot, or misunderstand a certain email. The proposed work in the paper develops an intelligent agent based on the principles of ANN. The paper is organized as follows. Section 2 outlines software agents. Section 3 gives a basic and brief understanding of ANN. Section 4 defines the problem. Proposed scheme has been explained in Section 5. Computer simulation of the proposed scheme has been carried out in Section 6 and testing with results has been shown in Section 7. Some conclusions, limitations are mentioned in Section 8.

## 2. Software Agent

Software agents are the agents, which are programmed to react judiciously with preprogrammed intelligence. Software Agents, which learns users' interests and can, act autonomously on their behalf to contribute in solving the problems.

### 2.1 Definitions

"The term agent is used to represent two orthogonal concepts. The first is the agent's ability for autonomous execution. The second is the agent's ability to perform domain oriented reasoning."[11]

"An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through effectors."[12]

"Autonomous agents are computational systems that inhabit some complex dynamic environment, sense and act autonomously in this environment, and by doing so realize a set of goals or tasks for which they are designed."[13]

"Let us define an agent as a persistent software entity dedicated to a specific purpose. 'Persistent' distinguishes agents from subroutines; agents have their own ideas about how to accomplish tasks, their own agendas. 'Special purpose' distinguishes them from entire

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multifunction applications; agents are typically much smaller.[II 14]
"Hardware or (more usually) software-based computer system that carries the following properties:

- Autonomy: agents operate without the direct intervention of humans or others, and have some kind of control over their actions and internal state;
- Social ability: agents interact with other agents (and possibly humans) via some kind of agent-communication language;
- Reactivity: agents perceive their environment, (which may be the physical world, a user via a graphical user interface, a collection of other agents, the INTERNET, or perhaps all of these combined), and respond in a timely fashion to changes that occur in it;
- Pro-activeness: agents do not simply act in response to their environment; they are able to exhibit goal-directed behavior by taking the initiative.[16] "Autonomous agents are systems capable of autonomous, purposeful action in the real world.[II 17]

## 2.2 Agent Classifications

The various definitions discussed above involve a host of properties of an agent. Having settled on a much less restrictive definition of an autonomous agent, these properties may help us further classifies agents in useful ways. The table that follows lists several of the properties mentioned above.

| Property | Other Names | Meaning |
|---|---|---|
| Reactive | (Sensing and acting) | Responds in a timely fashion to changes in the environment |
| Autonomous | | Exercises control over its own actions |
| Goal-oriented | Pro-active purposeful | Does not simply act in response to the environment |
| Temporally continuous | | Is a continuously running process |
| Communicative | Socially able | Communicates with other agents, perhaps including people |
| Learning | Adaptive | Changes its behavior based on its previous experience |
| Mobile | | Able to transport itself from one machine to another |
| Flexible | | Actions are not scripted |
| Character | | Believable "personality" and emotional state |

Brustoloni's taxonomy of software agents [1991] begins with a three-way classification into regulation agents, planning agents, or adaptive agents. A regulation agent, probably named with regulation of temperature by a thermostat or similar regulation of bodily homeostasis, reacts to each sensory input as it comes in, and always knows what to do. It neither plans nor learns. Planning agents plan, either in the usual AI sense (problem solving agent), or using the case-based paradigm (case-based agents), or using operations research based methods (OR agents), or using various randomizing algorithms (randomizing agent).
Yet another possible classification scheme might involve the environment in which the agent finds itself, for example software agents as opposed to artificial life agents. And, there must be many, many more such possibilities. Which one, or ones, shall we choose?

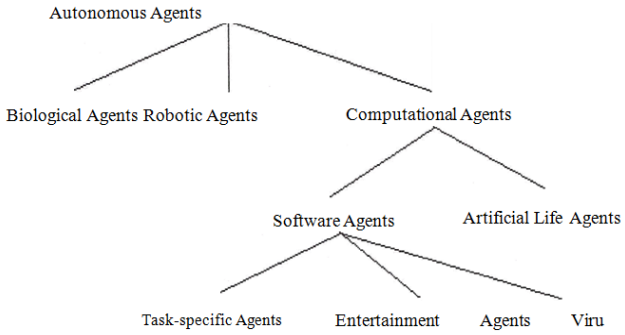

Fig. 1

## 3. Artificial Neural Network ANN

ANN [1..4] are interconnected collections of simple, independent processors. While loosely modeled after the brain, the details of neural network design are not guided by biology. Instead, for over 20 years researchers have been experimenting with different types of nodes, different patterns of interconnection and different algorithms for adjusting connections. Unsupervised neural networks, such as self-organizing feature maps, find relationships between input examples by examining the similarities and differences between the examples. Supervised neural networks, such as back propagation [1-4], are used for pattern recognition or prediction. For supervised neural networks, the input examples must be accompanied by the desired output. Typically a network consist of a Input layer and Output layer then it is called Single layer perceptron (SLP) (Fig 2) .If a network consist of a set of sensory units (Source nodes) that constitutes the 'Input Layer', one or more 'hidden layers' in computation nodes and an 'Output Layer' of computation nodes the input signal propagates through in a forward direction, on a

layer-by-layer basis, These neural networks commonly referred as multilayer preceptron (MLP)(Fig 3).

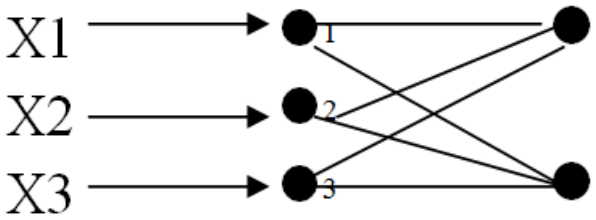


Fig. 2 Single Layer Perceptron (SLP)

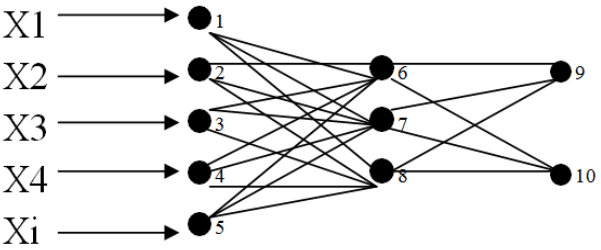


Fig. 3 Multi Layer Perceptron (MLP)

## 4. Problem Definition

The main objective of this paper is to design an agent which can replace a manual travel computer operator. The problem can be divided into following steps

(1) Collection of emails from web server.
(2) Reading the contents of each individual.
(3) Trained a Neural Network to understand the contents read in order to classify into one of the three categories.
(4) Forward the email to the concern section dealing with one of the three categories. Due to varieties in style and language to be used in various countries, it is fare to admit the success cannot be guaranteed 100% .

## 5. Proposed Scheme

Figure 4 shows the adopted to design the agent. Below mentioned algorithm is used to design the agent.

(a) Collect all the emails from mailbox. It is assumed that one mail one purpose.
(b) Check each email one by one.
(c) If agent found a new word then it will direct to user to specify the category.
(d) Agent is trained by pre available patterns. if it get any email then it will categorize it according to its training.

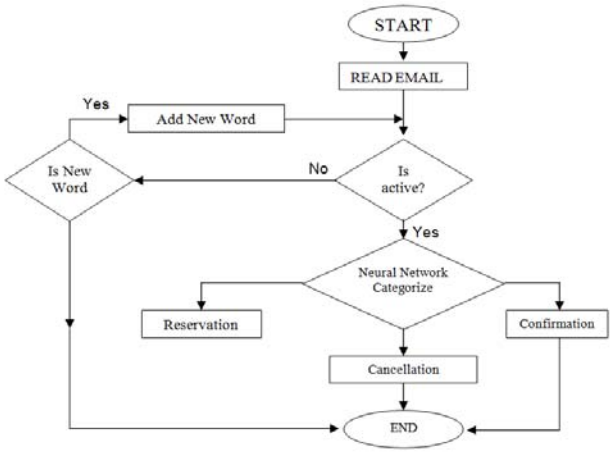


Fig.4 Data Flow diagram of Intelligent Agent System

## 6. Simulation of proposed scheme

The proposed scheme is stimulated through computer. Emails were received and read using Visual Basic. Every email is composed of sentences separated by period and words are separated by space. Here normal convention has been used. There are three categories of active words. These are Reservation. Confirmation and Cancellation. Thus there will be four databases in all. Three for active category and the last for 'Neutral category'. Each word of the sentence is marked as a active or inactive by their occurrence in database .If any word is active then the whole sentence will be treated as active sentence. One active sentence in email will make it active email. An email with no active sentences is treated as neutral and consequently any email having no active sentence will be categorized as a neutral category. Every word of a database has given a numeric constant value for a clear distinction among the weight values of the words in database. Words in one database are given values with a good margin with those in the other databases. This will have two advantage:; first there will be space for marking new word in the same database, second training become easier due to discrete wide range of numbers. The databases with their weights and words are shown

Table 1. Different options for maintaining Dictionary

| **REERVATION** | | **CONFIRMATION** | |
|---|---|---|---|
| 1 | RESERVE | 30 | CONFIRM |
| 2 | BOOK | 31 | CHECK |
| 3 | GET | 32 | AVAILABILTY |
| 4 | TAKE | 33 | FINAL |
| 5 | RESERVATION | 34 | STATUS |
| 6 | ARRANGE | | |
| **CANCELLATION** | | **NEUTRAL** | |

| | | |
|---|---|---|
| 50 | CANCEL | I |
| 51 | UNABLE | .AM |
| 52 | POSTPONE | PLZ |
| 53 | DROP | WANT |
| 54 | WITHDRAW | A |
| 55 | BACK | SEAT |
| 56 | CANCELLATION | NEED |
| 57 | RETURN | THE |
| | | ME |
| | | TRIP |
| | | TO |
| | | LONDON |

The input to a neural network is a pattern consisting of the weight values of the words in an active sentence. The size of input layers has been fixed to 10 because a normal sentence does not have more than ten words. The output of the neural network is the category, which this active sentence refers.
(MLP) there are three neurons in hidden layer. If an active sentence has less then ten words then extra nodes of neural network are given value of the inactive words that is -1,

(i) 100 Reservation
(ii) 010 Confirmation
(iii) 001 Cancellation

If a new word is encountered and this word is not found in any of the four databases then the Agent will direct this word to the user for classification, which will be added to one of the four databases.

Simple Mail Reader

| Remote Host | User Name | Password | Check Mailbox | Category |
|---|---|---|---|---|
| Mail.softhome.net | Travel Agent | ******** | | |

Message

| From | Subject | SendDate | Size | ID |
|---|---|---|---|---|
| CLIENT_1@ Hotmail.Com | Regarding Reservation | 12 DEC 2005 | 1K | 125456 |
| CLIENT_2@ Yahoo.Com | Regarding Reservation | 12 DEC 2005 | 1K | 521452 |
| CLIENT_3@ MSN.Com | Please Cancel | 12 DEC 2005 | 1K | 256325 |
| Please reserve me a ticket for GOA on Monday | | | | |
| Reservation | Cancellation | Confirmation | Garbage Box | |

Fig.5 An Interface design by VB application For Reservation

| **New York** |
|---|
| **RESERVATION** |
| **CONFIRMATION** |
| **CANCELLATION** |
| **GARBAGE** |

It is the third interface, which will appear when a new word will found. As it, shows four options for user to categorize the world.

## 7. Testing and Results

The proposed agent program used 500 emails for training and 50 emails for used for testing. Some Tasting results shown below. From this table it is clear that the agent design using proposed scheme is capable to recognize 94 % of the emails correctly with an error rate of 6 %

Table 2 Sample data obtained after applying Back Propagation Algorithm through MATLAB

| SN | Email (Active Word only) | Desired Category | Neural Proposed | | | Error |
|---|---|---|---|---|---|---|
| 1 | PLEASE RESERVE A SEAT | Reservation | 1.00 | 0.856 | 0.523 | No |
| 2 | PLEASE GET A SEAT FOR ME. | Reservation | 0.99 | 0.822 | 0.500 | No |
| 3 | PLEASE GET A TICKET FOR ME. | Reservation | 0.992 | 0.556 | 0.723 | No |
| 4 | PLEASE TAKE A TICKET. | Reservation | 0.975 | 0.856 | 0.443 | No |
| 5 | PLEASE TAKE A SEAT FOR MUMBAI. | Reservation | 0.905 | 0.656 | 0.263 | No |
| 6 | I WANT TO RESERVE A SEAT. | Reservation | 0.903 | 0.576 | 0.583 | No |
| 7 | I WANT TO BOOK A SEAT. | Reservation | 0.992 | 0.899 | 0.565 | No |
| 8 | I NEED A RESERVATION. | Reservation | 0.900 | 0.89 | 0.523 | No |
| 9 | PLEASE CONFIRM MY RESERVATION. | Confirmation | 0.75 | 0.99 | 0.23 | No |
| 10 | PLEASE CONFIRM MY BOOKING. | Confirmation | 0.57 | 0.992 | 0.35 | No |
| 11 | PLEASE CHECK THE AVAILABILTY OF SEAT | Confirmation | 0.55 | 0.963 | 0.60 | No |
| 12 | PLEASE CONFIRM THE TICKET. | Confirmation | 0.78 | 0.912 | 0.35 | No |
| 13 | PLEASE CONFIRM A SEAT. | Confirmation | 0.75 | 0.915 | 0.23 | No |
| 14 | WHAT IS THE AVAILABILITY AGAINST THE RESERVATION? | Confirmation | 0.66 | 0.81 | 0.44 | No |
| 15 | WHAT IS THE STATUS OF MY TICKET? | Confirmation | 0.36 | 0.906 | 0.56 | No |

| | | | | | | |
|---|---|---|---|---|---|---|
| 16 | PLEASE CANCEL THE RESERVE SEAT. | Cancellation | 0.45 | 0.56 | 0.77 | No |
| 17 | PLEASE CANCEL THE BOOKING. | Cancellation | 0.40 | 0.33 | 0.89 | No |
| 18 | PLEASE POSTPONE THE Reservation. | Cancellation | 0.65 | 0.20 | 0.89 | No |
| 19 | PLEASE CANCEL THE TICKET. | Cancellation | 0.66 | 0.52 | 0.929 | No |
| 20 | PLEASE BACK THE TICKET. | Cancellation | 0.78 | 0.565 | 0.95 | No |
| 21 | I AM UNABLE TO GO. | Cancellation | 0.40 | 0.56 | 0.855 | No |
| 22 | PLZ DROP MY BOOKING. | Cancellation | 0.11 | 0.25 | 0.945 | No |
| 23 | I NEED TO CANCEL THE SEAT. | Cancellation | 0.22 | 0.52 | 0.991 | No |
| 24 | PLEASE RETURN MY TICKET. | Cancellation | 0.20 | 0.63 | 0.902 | No |
| 25 | PLEASE BOOK A TO MUMBAI. | Reservation | 0.99 | 0.265 | 0.635 | No |
| 26 | PLEASE BOOK A RETURN TICKET. | Reservation | -9.00 | 0.456 | 0.523 | Yes |

## 8. Conclusions

ANN which has been extensively used in different areas have been applied to design an intelligent agent. This paper proposed application of neural network to design an intelligent travel agent. This agent is supposed to receive emails from clients spread out over the country and direct to concerning section of travel centre. The sentences of email are categorized as an active or inactive on the basis of words in it. The active sentence is used as an input to neural network where as the inactive sentences are stored in neutral category. The ANN is trained to predict the category of active sentence. In this scheme there are also provision to include a new unknown word into of the database by the user directive. For training of ANN SLP and MLP have been used and the performance of the each is satisfactory. The training has been carried out on a large number of emails to include as many sample patterns as possible. Tasting has also been done with fair results. It is to admit here that the variation in style and language may affect the results minutely or majority. This limitation opens the scope for researchers

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