

# Implementation of Ant Colony Optimization Algorithm on Lady Finger Expert Advisory System

Prof. M.S. Prasad Babu<sup>1</sup>    B. Jogeswara Rao<sup>2</sup>    B Ravi Kumar<sup>3</sup>

<sup>1</sup> Professor, Dept. of CS & SE, Andhra University, Visakhapatnam (A.P), INDIA.  
[msprasadbabu@yahoo.co.in](mailto:msprasadbabu@yahoo.co.in)

<sup>2</sup> Research Scholar, Dept. of CS & SE, Andhra University, Visakhapatnam (A.P), INDIA  
[bjogesh@gmail.com](mailto:bjogesh@gmail.com)

<sup>3</sup> M.Tech, Dept. of CS & SE, Andhra University, Visakhapatnam (A.P), INDIA  
[ravikumar096@gmail.com](mailto:ravikumar096@gmail.com)

## Abstract

The present paper deals with the development of web based expert systems using machine learning techniques to advice the farmers in villages through online. An expert system is a computer program, with a set of rules encapsulating knowledge about a particular problem domain. In the present paper Ant Colony Optimization algorithm has been taken and this algorithm mainly focuses on finding the diseases affected to the Lady Finger plants. At First, the symptoms provided by the user are processed by a rule based expert system, If the rules required for processing the data by the above are not present in the database, then the system automatically calls the machine learning algorithm technique. As a whole, the system results global solution for recognizing the diseases in Lady Finger plants, and corresponding treatments to the diseases may also be suggested to the users. This expert system is a web based online application for online users with java as front end and MySQL as backend.

**Keywords:** Expert Systems, Machine Learning, Ant Colony Optimization Algorithm, Lady Fingers, JSP & MYSQL.

## 1. Introduction

Expert Systems: An expert system is software that attempts to provide an answer to a problem, or clarify uncertainties where normally one or more human experts would need to be consulted. Expert systems are most common in a specific problem domain, and are traditional application and/or subfield of artificial intelligence. A wide variety of methods can be used to simulate the performance of the expert however common to most of all are 1) The creation of a knowledge base which uses some knowledge representation formalism to capture the Subject Matter Expert's (SME) knowledge and 2) A process of gathering that knowledge from the SME and codifying it according to the formalism, which is called knowledge engineering.

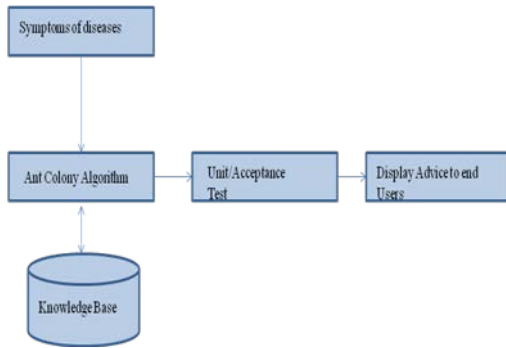
## 2. Machine Learning:

Machine Learning is a mechanism, concerned with writing a computer program that automatically improves with experience. It is a very young scientific discipline whose birth can be placed in the mid-seventies. The First Machine Learning Workshop was taken place in 1980 at Carnie-Mellon University (USA) The goal of machine learning is to program computers to use example data or past experience to solve a given problem. Many successful applications of machine learning exist already, including systems that analyze past sales data to predict customer behavior, recognize faces or spoken speech, optimize robot behavior so that a task can be completed using minimum resources, and extract knowledge from bioinformatics data. Machine learning refers to the changes in systems that perform tasks associated with artificial intelligence (AI). Such tasks involve recognition, diagnosis, planning, robot control, prediction, etc. The changes might be either enhancements to already performing systems or abs initial synthesis of new systems

## 3. Ant Colony Algorithm:

Ant colony Optimization (ACO) metaheuristic is a recent population based approach inspired by the observation of real ants colony and based up on their collective foraging behavior. Ant Colony Optimization (ACO) is a paradigm for designing metaheuristic algorithms for combinatorial optimization problems. A Meta heuristic is a set of algorithmic concepts that can be used to define heuristic methods applicable to a wide set of different problems. Examples of metaheuristics include simulated annealing, tabusearch, iterated local search, evolutionary computation, and ant colony optimization. Meta heuristic algorithms are algorithms which, in order to escape from local optima, drive some basic heuristic: either a

constructive heuristic starting from a null solution and adding elements to build a good complete one, or a local search heuristic starting from a complete solution and iteratively modifying some of its elements in order to achieve a better one. The proposed Architecture is as follows:



### 3.1. Proposed Algorithm:

Ant colony Optimization (ACO) metaheuristic is a recent population based approach inspired by the observation of real ants colony and based up on their collective foraging behavior. Ant Colony Optimization (ACO) is a paradigm for designing metaheuristic algorithms for combinatorial optimization problems.

### 3.2. Implementation Procedure of Proposed ACO Algorithm:

- Step.1. Set parameters initialize pheromone trails. Pheromone values are associated with Disease.
- Step.2. while termination conditions not met do.
- Step.3. Construct Ant Solutions,
- Calculate the pheromone value for each disease by the symptom related to that disease.
- Step.4. Apply Local Search (optional).
- Step.5. Update Pheromones.
- Step.6. end while.

### 4. Database Generation:

In this section, the setup for production rules in the knowledge base is presented. Generally, the rules are of the form,

Rule 1:  $S_1=1, S_2= 0, S_3= 0, S_4= 0, S_5=0, S_6= 1, S_7= 0, S_8=1, S_9= 0, S_{10}= 0, S_{11}= 0, S_{12}= 0$

Resultant disease may be D1

Rule 2:  $S_1= 1, S_2=1, S_3= 0, S_4= 0, S_5= 0, S_6= 0, S_7=1, S_8= 0, S_9= 0, S_{10}= 0, S_{11}=0, S_{12}= 1$

Resultant disease may be D2

Rule 3:  $S_1= 0, S_2= 1, S_3= 0, S_4= 0, S_5= 1, S_6= 1, S_7= 0, S_8= 0, S_9= 0, S_{10}=1, S_{11}=0, S_{12}= 0$

Resultant disease may be D3.

## 5. Results:

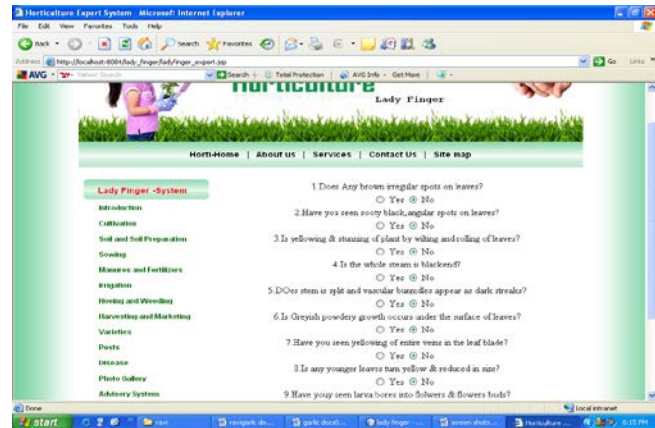


Fig.1: Selection of Symptoms

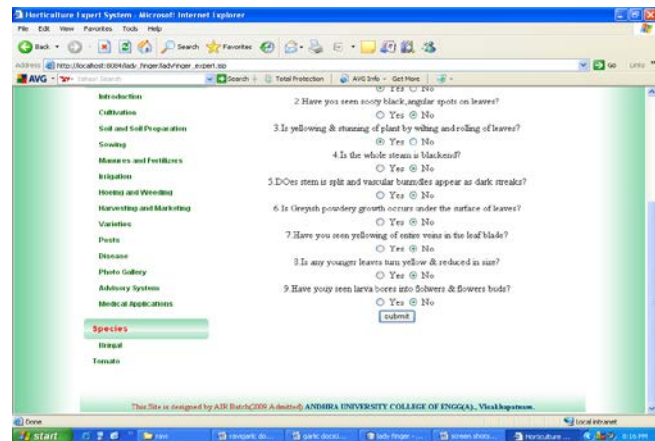


Fig.2: Selection of Symptoms



Fig: 3.-displaying advice to the end user

## 6 . Conclusions:

Its main emphasis is to have a well designed interface for giving Lady finger plant related advices and suggestions in the area to farmers by providing facilities like online interaction between expert system and the user without the need of expert all times. In the present developed expert system, the user can get a detailed data about the Lady finger and the diseases affecting to lady finger plants and cure to those diseases can also be seen by the user. The implementation of the proposed system also gradually reduces the processing time of rules and gives the solution to the problem in a more pheromone level. The algorithm used in the system can be treated as quite effective, in most cases it finds a solution which represents a good approximation to the optimal one and fast enough for the number of iterations. By the thorough interaction with the users and beneficiaries the functionality of the System can be extended further to many more areas in and around the world.

## 7. References:

1. M. Dorigo and L. M. Gambardella “Ant colony system: a cooperative learning approach to the traveling salesman problem”, IEEE Transactions on Evolutionary Computation 1, Vol.1, 1997, pp.53-66.
2. M. Dorigo, V. Maniezzo and A. Colomi, “The ant system: optimization by a colony of cooperating agents”, IEEE Transactions on Systems, Man and Cybernetics Part B, Vol.26, 1996, pp.29-42.
3. L M Gambardella and M .Dorigo, “Solving symmetric and asymmetric TSPs by ant colonies”, Proceedings of the IEEE International Conference on Evolutionary Computation (ICEC'96), Nagoya Japan, 1996, pp.622-627
4. V. Maniezzo, A. Colomi. “The ant system applied to the quadratic assignment problem.” IEEE Transactions on

Knowledge and Data Engineering, Vol.11, No.5, pp.769-778, 1999

5. A. Colomi, M. Dorigo, V. Maniezzo. “Distributed optimization by ant colonies.” Proceeding of First European Conference on Artificial Life, Paris, France, pp.134-142, 1992.
6. B. Bilchev, I.C. Parmee. “The ant colony metaphor for searching continuous design spaces.” Proceedings of the AISB workshop on evolutionary computation, Berlin: Springer, pp.25–39, 1999.
7. J. Dréo, P. Siarry. “A new ant colony algorithm using the heterarchical concept aimed at optimization of multimimima continuous functions.” Ant algorithms Proceedings of ANTS 2002-Third international workshop, Berlin: Springer, pp.216–219, 2002.
8. J.L. Ding, Z.Q. Chen, Z.Z. Yuan. “On the combination of genetic algorithm and ant algorithm.” Journal of Computer Research and Development, Vol.40, No.9, pp.1351-1356, 2003.
9. L.J. Sun, R.C. Wang. “Solving QoS multicast routing problem based on the combination of ant colony algorithm and genetic algorithm.” Acta Electronica Sinica, Vol.34, No.8, pp.1391-1395, 2006

### First Author



Prof. M.S. Prasad Babu was born on 12-08-1956 in Prakasam district of Andhra Pradesh, India. He obtained his B. Sc, M.Sc and M. Phil and Ph.D. degrees from Andhra University in 1976, 1978, 1981 and 1986 respectively. During his 34 years of experience in teaching and research, he attended about 28 National and International Conferences/ Seminars in India and contributed about 81 papers either in journals or in National and International conferences/ seminars. Prof. M.S. Prasad Babu has guided 112 student dissertations of B.E., B. Tech. M.Tech. & Ph.Ds. Prof Babu presently working as senior Professor in the Department of Computer Science & Systems Engineering of Andhra University College of Engineering, Andhra University, Visakhapatnam.

### Second Author



B. Jogeswara Rao was born in Srikakulam, Andhra Pradesh, India in 1984. He received M.Sc in Computer Science from Andhra University, India in 2007, M.Tech in Computer Science & Technology with Specialization Artificial Intelligence and Robotics from Andhra University, Visakhapatnam, India in 2010. From 2010 to 2014 he worked as Assistant Professor in VITAM engineering college, India and Since April 2014.

He was working as PhD research scholar under guidance of Prof. M.S. Prasad Babu, Department of Computer Science and Systems Engineering, Andhra University, Visakhapatnam, India. He published two research papers in international journals, presented one research paper at national conferences in India.

**Third Author**



B.Ravi Kumar was born on 02-07-1985 in Krishna district of Andhra Pradesh in India. He received B.Tech in Computer Science from Andhra University, India in 2006, M.Tech in Computer Science & Technology with Specialization Artificial Intelligence and Robotics from Andhra University, Visakhapatnam, India in 2010 .