A Review of Home Automation System with Speech Recognition and Machine Learning

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Abstract: Many of the technologies currently used in smart homes can be adapted to meet a number of needs. By emerging these technologies in homes can eliminate the need of care and grant independence to those who might struggle with day to day activities or in circumstances of blindness, dumbness or immobility. This paper aims to discuss home automation systems for disables by speech recognition and device control with embedded systems. A concept of machine learning is analyzed which is a method of data analysis that automates analytical model buildings. Machine learning trains computers to perform tasks and provides output without being explicitly programmed. The system uses machine learning methodologies by observing behavior of a person at a particular time, condition, weather and daily routine tasks and then provides output in an effective manner. Ant colony optimization and decision tree algorithm are reviewed for approximate solutions in difficult optimized problems which make system smarter with the terms of accurate decisions and feature selection.

Keywords: Artificial intelligence, speech recognition, machine learning, Ant Colony Optimization, signal processing, decision tree.

I. INTRODUCTION

Artificial Intelligence is the ability of computer or other machine to perform actions that requires intelligence. Among these actions are logical interference and deduction, creativity and the ability to make decision based on their past experience. It may be insufficient or conflicting information but has the ability to understand spoken language. Self driving cars face recognition, web search, industrial robots, missile guidance, tumor detection and many more real time complex problems have already solved with the applications of the artificial intelligence. Natural language is an artificial intelligence specialization that processes the human natural language and prepares computers to give response.

Speech recognition is one of the most complex areas of computer science and partly because of it's interdisciplinary. Speech is naturally dynamic in nature. There are many approaches used in speech recognition namely artificial neural networks (ANN), pattern recognition, language modeling and statistical analysis. In the basic model of speech recognition preprocessing, feature extraction and modeling is performed. The AI field collaborates with engineering, arithmetic, linguistics, psychology, philosophy, neurobiology, and artificial scientific discipline. Self driving cars face recognition, growth recognition and web search, industrial robots missile steering growth detection and lots of additional real time complicated issues have already solved with the applications of the bogus intelligence.

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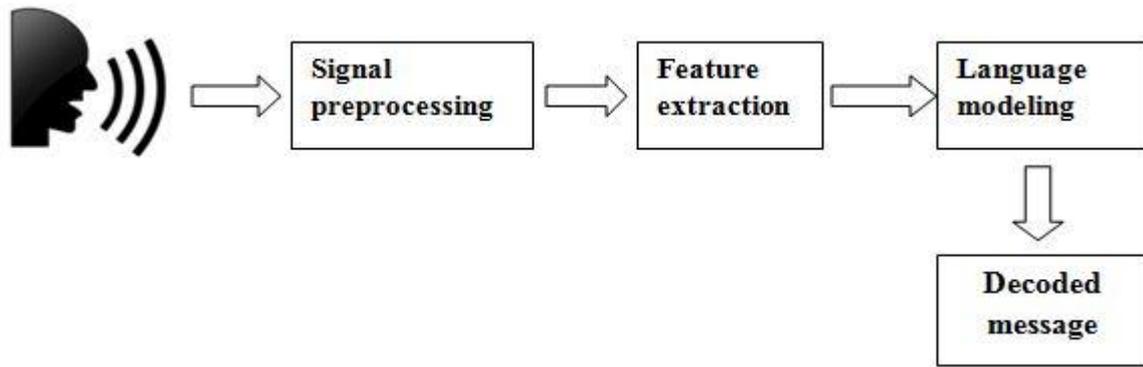*Volume 5, Issue 4, April 2017 pg. 32-35*

Figure 1. Basic working of Speech Recognition

Machine learning is a methodology of information analysis that automates analytical model building. These algorithms that iteratively learn from information, machine learning permits system to search out hidden insights while not being expressly programmed wherever to seem. There are many learning algorithms like supervised, unsupervised, semi supervised learning and transduction learning which are categorized for special purpose tasks. These algorithms help to understand the concept and to use in appropriate manner.

A decision tree is supervised learning algorithm in which internal nodes represents associate attribute, every branch represents outcome of the root problem and every leaf node represents categorized data that computes all attributes. It is one of the most fundamental techniques which are used in classification. Tree is constructed in a top down manner and models are categorized in root- leaf structure to solve any problem.

According to paper [8] Decision tree algorithm has uniqueness for being convert and easily fit for the rules of classification and prediction. This paper has introduced an algorithm to construct a decision tree with less complexity and consider few parameters. In case of designing a smart home, decision tree algorithm works well and provide efficient parameters for classification.

Ant colony is a concept of self organizing principle which allows highly coordinated behavior and finds a solution with togetherness. Several different aspects of the behavior of ant colonies have inspired different kinds of ant algorithms. Foraging, division of labor, brood sorting and cooperative transport are such examples. Ant colony optimization (ACO) is one of the most successful examples of ant colony algorithms inspired by foraging behavior of ants. A special hormone produced by ants is pheromone which is essential thing for communication between ants. By sensing pheromone trails foragers can follow the path from food source to their nest. This trail-following behavior whereby an ant is influenced by a chemical trail left by other ants is the inspiring concept of ACO.

II. LITERATURE SURVEY

The major processes of speech recognition include feature extraction, acoustic modeling, pronunciation modeling and decoder. The end user gets through the application by means of an applicable input device such as a microphone. Sound waves travel in form of analog signal thus the recognizer first accepts them as analog signal and converts them into digital signal. The conclusion part of paper [2] shows that Computers would quickly arrive with preinstalled automatic speech recognition systems. Equipments and devices with this technology would make the lives of the blind, the deaf, and other physically challenged people by providing them access to computers without the click of buttons.

The smart interface has been developed in first research [3] to help people with disabilities at workplace. It has used assistive technologies to implement Real time location system (RTLS) that works with RFID tags and communicates through

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Wi-Fi network in the building. In this paper an algorithm is used named the event and noting algorithm which monitors the events periodically (every 4 hours) set up by disabled people as well as their location to determine how to intervene them and their caretakers.

According to [4] ACO is the heuristic algorithm for solving hard combinatorial problems. The pheromone can be considered as a numerical data for giving probabilistic solutions. ACO components are vast enough to provide a large number of solutions but have heuristics to select some promising output. This paper has concluded some final steps to apply ACO metaheuristic.

- o Initialization

- o construstAntsolutions

- o ApplyLocalSearch

- o GlobalUpdatePheromones

By the simulated results analysis this proposed algorithm has given optimal solution with higher performance but to update the pheromone continuously well communication, intensification and diversification is needed for some parameters. In the comparison of genetic algorithms, evolutionary programming, simulated annealing and ACS, the self evolving ACO gives optimum solution with balancing other factors in the context of TSP.

A different algorithm called efficient ant colony optimization (EACO) algorithm has introduced in paper [5] which improves the conventional ACO algorithm for combinatorial, continuous and mixed variable optimization problems by introducing the sampling technique.

In combinatorial ACO algorithm, the transition probability that help to choose the next solution component and for continuous and mixed-variable optimization problems, the probability of choosing ant guide and the distribution of the random numbers generated for the acceptance probability of a solution component affects the performance of the ACO algorithm. EACO algorithm is developed based on efficient sampling technique that keeps the diversity and the multidimensional uniformity property of samples.

In the network to solve routing problem a different concept of ACO is used in paper [9] known as multiple ant colonies optimization (MACO). This algorithm introduces multiple ant colonies to simulate the competition for load balancing within network resources allocation. One new direction of ACO researches that focus on enhancing the performance of ACO and reducing the effect of the search stagnation is the use of Multiple Ant Colonies Optimization (MACO) where several ant colonies work together to collectively solves an optimization problem.

Using adaptive adjustment strategy and balance factor an algorithm has developed in paper [10] named IMVPACO Algorithm (improved ACO) to solve travelling salesman problem (TSP). At the end of experiment, according to results IMVPACO algorithm proved better than conventional ACO in terms of finding optimal solution and lesser iterations.

Table 1. Variations of Ant Colony Optimization Algorithms

Name of Algorithms	Technique Used	Solves Problem
Efficient Ant Colony Optimization(EACO)	Sampling technique	Combinatorial and Continuous Optimization
Improved Ant Colony Optimization(IMVPACO)	Adaptive Adjustment Strategy	Travelling Salesman Problem
Memory Based Immigrants (MI-ACO)	Combines immigrants and memory	NP Hard Problems and DTSP
Multiple Ant Colony Optimization(MACO)	Load balancing technique	Routing Problems

Self Evolving Optimization	Balance between intensification and diversification	Travelling Salesman Problem

III. CONCLUSION

Artificial intelligence has a special impactin home automaton with the new emerging technologies and learning methods. For physically challenged people automating a home by speech recognition with embedding hardware of home with the system can be beneficial. Ant Colony Optimization shows flexibility with different techniques and solves many problems. With this Decision tree algorithm is useful in a same aspect in smart home automation. So the key concept is to combine ant colony optimization and decision tree machine learning will create a system with high accuracy of decision making as well as learning itself. This kind of system can help the disables to do their tasks efficiently.

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