The Medical Diagnostic Support System Using Extended Neural Network and Multiagent

Daisuke Yamaguchi[1], Fumiyo Katayama[1], Muneo Takahashi[1], Masataka Arai[2], Kenneth James Mackin[3]
[1]Toin University of Yokohama, [2]Hitachi Advanced Systems Corporation, [3]Tokyo University of Information Sciences
[1]1614, Kurogane-cho, Aoba-ku, Yokohama, 225-8502, JAPAN,
[2]3-3-21, Isogo, Isogo-Ku, Yokohama, 224-0817, JAPAN, [3]1200-2, Yatou-cho, Wakaba-ku, Chiba, 265-8501 JAPAN
email:yamaguti@intlab.toin.ac.jp

Abstract—**Multiagent technologies enable us to explore their sociological and psychological foundations. A medical diagnostic support system is built using this. Moreover, We think that the data inputted can acquire higher diagnostic accuracy by sorting out using a determination table. In this paper, the recurrence diagnostic system of cancer is built and the output error of Multiagents learning method into the usual Neural Network and a Rough Neural Network and Genetic Programming be compared. The data of the prostatic cancer offered by the medical institution and a renal cancer was used for verification of a system.**

Keywords—Multiagent System, Neural Networks, Medical Diagnostic Support System

I. INTRODUCTIONS

In this paper, the recurrence diagnostic system of cancer is built and the output error of Multiagents learning method into the usual Neural Network, Rough Neural Network and Genetic Programming be compared. Generally, medical data is complicated, and when building a diagnostic system using such data including some errors, the calculation with expression is difficult in many cases. Then, the diagnostic systems configuration from a data pattern is effective using the Neural Network who is excellent in pattern recognition to such a problem.

Furthermore, in order to treat effectively the error included in data, a Rough Neural Network is formed using the extended type Rough Neuron defined from Rough Aggregate Theory. Moreover, change of the diagnostic accuracy by using Genetic Programming to changing the number and combination of the data inputted is seen. Back Propagation generally used in a Neural Network is used for study of a network.

The data of the prostates cancer offered by the medical institution and a renal cancer was used for verification of a system.

II. METHOD

Artificial Intelligence (AI) has made great strides in computational problem solving using explicitly represented knowledge extracted from the task. If we continue to use explicitly represented knowledge exclusively for computational problem solving, we may never computationally accomplish a level of problem solving performance equal to humans. From this idea, the paper describes the development of a multiagent system that can be used to support the assessment of design performance in the cellular automata model. Agents represent objects or people with their own behavior, and take the structure of cellular automata lattice.

Intelligent agents and multiagent systems are one of the most important emerging technologies in computer science today [1]. The advent of multiagent systems has brought together many disciplines in an effort to build distributed, intelligent, and robust applications. They have given us a new way to look at distributed systems and provided a path to more robust intelligent applications.

Multiagent systems deal with coordinating intelligent behavior among a collection of autonomous agents. Emphasis is placed on how the agents coordinate their knowledge, goals, skills, and plans jointly to take action or to solve problems. Constructing the multiagent systems is difficult [2]. They have all the problems of traditional distributed and concurrent systems plus the additional difficulties that arise from flexibility requirements and sophisticated interactions.

We study evolution as it occurs in our model. Learning in an observable and non-stationary environment is still one of the challenging problems in the area of multiagent systems. Our algorithm of learning for our model requires learning from interactions in an environment in order to achieve certain goals. At each time step, the agent observes its environment and selects the next actions based on that observation. In the next time step, the agent obtains the new observation that may reflect the effects of its previous action and a payoff value indicating the quality of the selected action.

The Rough Neural Network [3] hidden layer considered in this subsection is 2 states where states are denoted {0, 1}. The learning or evolution of the rule that the agent may use is achieved by using technique similar to genetic programming [4].

III. RESULTS

We study combined as it occurs in genetic Techniques into agent learner. We used as a tool for searching wide and complex solution space in intelligent agent learns data. Intelligent agent using complex techniques of related research. It combined on genetic programming same function of genetics algorithm using rough neural network input data. These techniques supported by graphical data in tree structure that retrieval of optimal end point. Because, This techniques consider with using Intelligent Agent Learner expanded of diagnostic support.

Multiagent is state in a filed. These fields include other Learner kept in Intelligent Agent. Other Learner support anything AI techniques and genetic techniques of input data. Intelligent Agent has made combined these techniques into the Machine Learning.

We create The Medical Diagnostic Support System based on Graphical User Interface Agent. Maintainable this system separated from interface data connected to other Agent Learner. This Agent learner using Neural Network, Rough Neural Network, Neural Network combined Genetic Programming and Rough Neural Network combined Genetic Programming.

Figure 1 shows Diagnostic System for Biopsy. This software used to medical doctor suggested cure judgment from inspection data of patients.

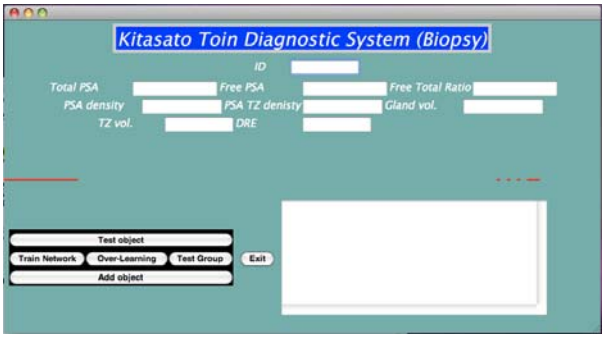

Figure 1. Diagnostic System for Biopsy

Agent Learner used to Neural Networks parameter: Input Layer Neuron of 12, Hidden Layer of 2, and Neural Network in Neuron of 30. Other Learner used to Two Rough Neuron combinative Input Layer Neuron of 12, Hidden Layer of 2, and Neural Network in Neuron of 30.

The data of the prostatic cancer offered by the medical institution and a renal cancer included to this renal cancer 20 % (Difficult Problems). Rough Neuron sends to input data: Chief Complaint, Grade, pT2, pN2, NHS2, PS, Score, pV2, INF2, PDT2, The diameter of a tumor. But Age and Men or Female using default neuron of input data. Training Data check Republication of 5 years after of output data. Intelligent Agent using cases of Learner in training Data 112 and Test Data: 50.

Intelligent Agent includes other learning method using genetic techniques. But, This Intelligent Agent considers revising Learner good parameter of out put data. So, Intelligent agent duplicated on these good parameters Learner into this output data. Duplicated Intelligent Agent cross learner supported by genetic techniques.

In this case, Intelligent Agent Learner used Neural Network and Rough Neural Network. Because, Genetic tourniquets consider combined in a Learner method only. Combined point join to this neural network wait link. New Intelligent Agent has make in this hybrid learner. Hybrid Learner is Neural Network or Rough Neural Network and genetic tourniquets. Genetic Techniques consider with many method support of algorithm into this data. This case used to parameter based on network wait and neuron input data and learning wait after output data. So, This control wait of neuron support Genetic Programming using tree stricture model based on graphical techniques.

Table 1 shows the Agent between learners in other learning method. This Learner has made be able to smaller than network size and output error count.

TABLE I. THE PRECISION COMPARISON IN VARIOUS NETWORKS

Agent Learner	Output Error	Error Countes
NN	0.14	7/50
NN + GP	0.12	6/50
RNN	0.12	6/50
RNN + GP	0.10	5/50

IV. CONCLUSIVE DISCUSSION

We applied best choice of genetic programming complex system buildings. We were able to searching wide and complex solution space. We create agent learner in compact network system. The proposed system applied agent learning to successfully realize diagnosis support for the difficult prediction of cancer recurrence, which doctors cannot easily predict from medical data. However, before the proposed system is applied to actual medical diagnosis for real patients, the learning accuracy of the system must be improved further.

For future works, we will consider methods quick running of genetic programming in learning techniques and noise input data. We try to delete noisy filter on input data. We consider to that delete noisy filter on input data.

Future versions of this model will aim to show how the system in communication response in a more natural, unscripted scenario, involving multiple parts in addition to other forms of process and contingency.

REFERENCES

[1] Weiss, G., Multiagent Systems, A Modern Approach to Distributed Artificial Intelligence, the MIT Press, 1999

[2] Abul, O., Polat, F., and Alhajj, R., Multiagent Reinforcement Learning Using Function Approximation, IEEE Transaction on systems, man, and cybernetics-part c: application and reviews, Vol. 30, No. 4, pp. 485-497 , 2000

[3] Pawan Lingers: Rough Neural Network, Department of Computer Science, Algoma University College Sault Ste. Marie, Ontario, Canada, P6A 2G4, 1998

[4] Koza, J.R., Genetic Programming III Darwinian Invention and Problem Solving, San Francisco, CA, 1999