Report

(1) Name of Lecturer: Genaro Juarez Martinez

(2) Title of Lecturer: Assistant Professor

(3) Affiliation: National Polytechnic Institute of Mexico

(4) Short Biography:

Genaro Juarez Martinez got his bachelor's degree from National Autonomous University of Mexico in 1998. He then got Master's degree, and PhD degree from National Polytechnic Institute of Mexico in 2000, and in 2006 respectively. From October 2006 to July 2009 he was a Fellow Researcher at University of West of England, UK. From September 2009 to August 2012 he was an assistant professor at National Autonomous University of Mexico. From September 2012 he has been working at National Polytechnic Institute of Mexico. His research interests include complex cellular automata, in particular, elementary cellular automata of rule 110 and 54, and cellular automata with diffusion rules.

(5) Subject and Schedule of the Lectures:

Five lectures on "Cellular Automata as Complex Systems" were given as a part of the course "Advanced Artificial Intelligence."

Oct. 15, 2012, 14:35-16:05: Introduction to cellular automata theory
Oct. 16, 2012, 12:50-14:20: Diagrams in one-dimensional cellular automata: cycle diagrams
Oct. 18, 2012, 14:35-16:05: Diagrams in one-dimensional cellular automata: de Bruijn and subset diagrams
Oct. 19, 2012, 14:35-16:05: Minimum universal computing cellular automata: ECA Rule 110
Oct. 19, 2012, 16:20-17:50: Cellular automata with memory

1. Introduction to cellular automata theory

This lecture display a general introduction about cellular automata theory, exploring mainly the state of art of this theory, historical antecedents, main results, applications, journals, repositories, and other sources. The motivation was given a general introduction of this theory to students, in this advance field of computer science.

2. Diagrams in one-dimensional cellular automata: cycle diagrams

In this lecture, I introduce the concept of cycle diagrams (named fields of attraction as well) to explore dynamics particularly in one-dimensional cellular automata across of tress and attractors. In this lecture, we had an active participation of students constructing one example in the classroom for evolutions in one-dimensional cellular automata, and one cycle diagram they self. Finally, in this class we leave two exercises for home and the exploration of the free DDLab software to construct most complicated cycle diagrams.

3. Diagrams in one-dimensional cellular automata: de Bruijn and subset diagrams

In this lecture, we had studied and practiced two kinds of particular finite machines. The first one is the de Bruijn diagram which introduces the concept of regular expressions in one-dimensional cellular automata. These diagrams are able to establish a formal language from each evolution rule. The second diagram is a general non-deterministic machine able to recognize what kind of strings can be accepted by each automaton. In this lecture, we had an active participation of students constructing one example in the classroom with de Bruijn and subset diagrams. In this class, we leave three exercises for home.

4. Minimum universal computing cellular automata: ECA Rule 110

In this lecture, we had discussed the smallest universal computing cellular automaton (Turing universal). It is one of the most relevant results in the last years in cellular automata theory. This lecture was specialized for the result itself and the number of techniques used to explain such construction. However, in this time with all previous lectures the students had already acquired several abilities to understand

several concepts used in this lecture. It was a nice proof for testing the utility of the previous lectures for most advanced topics.

5. Cellular automata with memory

In this lecture, we discussed the concept of memory in cellular automata. Memory is another function that is used in cellular automata, and helps us to understand how we can recognize hidden information in each class. This way, memory has been showed a useful application to open new domains of complex systems in cellular automata, and not just in this theory but on any discrete or continuous dynamical system. The goal of this lecture was to display to students some recent results about cellular automata with memory, and its utility and applications in other scientific or practical fields.

Slides of all these lectures are available from the internet at: http://fcs.iec.hiroshima-u.ac.jp/lectures/

(6) Comments:

Students gradually show more interest day by day. That was really nice and its participation was very good. A good number of students follow the lectures with interest. It was very evident from their answers on exercise problems they gave on the blackboard.