The IEEE CIS Summer School on Advanced Topics in Computational Intelligence – Theory and Applications: A Report

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1. The Summer School: An Overview

The IEEE Summer School on "Advanced Topics in Computational Intelligence – Theory and Applications" was jointly organized by the IEEE Computational Intelligence Society and PES University in association with the PES Centre for Intelligent Systems and scheduled at Bangalore between August 08, 2016 and August 12, 2016. There were a total of 45 participants from the industry including research and development organisations, and students and faculty members.

2. Objective

The objective of the IEEE Summer School was to provide a platform for research scholars and students to experience recent developments in computational intelligence methods and its applications in diverse areas. The topics of interest in the summer school included deep learning, meta-cognitive neural networks, spiking neural networks, differential evolution, and

reinforcement learning. The ultimate goal was to provide an opportunity for young researchers to interact with eminent experts in computational intelligence and exchange ideas. This provided a mechanism for them to pursue their own research with full confidence and produce outstanding contributions.

3. **Organizing Committee**

General Chair: Koshy George, PES University
Programme Chair: Suresh Sundaram, Nanyang Technological University, Singapore
Members:
T.S. Chandar, PES University
Anuradha M., PES University
B. Niranjana Krupa, PES University
Ravikant G. Biradar, PES University
S.S. Rekha, PES University
Y.J. Pavithra, PES University
Karpagavalli S., PES University

4. **Resource Persons**

   a. V. Babu, Indian Institute of Science, Bangalore
   b. S. Das, Indian Statistical Institute Calcutta
   c. K. George, PES University
   d. K. Mahesh, PES University
   e. S. K. Meher, Indian Statistical Institute Bangalore
   f. Y.-S. Ong, Nanyang Technological University, Singapore
   g. T. Poston, Forus Health, Bangalore
   h. J. Sarangapani, Missouri University of Science & Technology, USA
   i. D. Sitaraman, PES University
   j. G. Srinivas, PES Institute of Technology South Campus, Bangalore
   k. P. N. Suganthan, Nanyang Technological University, Singapore
   l. N. Sundararajan, Nanyang Technological University, Singapore
   m. S. Sundarrajan, InMobi, Bangalore
   n. S. Sundaram, Nanyang Technological University, Singapore
   o. S. Vasudev, Forus Health, Bangalore
   p. Q. Zhang, City University, Hong Kong

5. **Programme Schedule**

   Annexure A

6. **List of Participants**

   Annexure B

7. Session Details

The Summer School was inaugurated on Monday, August 08th, by Professor D. Jawahar, Pro-Chancellor of PES University and CEO, PES Group of Institutions. The Chief Guest was Prof. P.N. Suganthan, NTU, Singapore. The inaugural session was followed by the latter's talk on "Computational Intelligence Algorithms for Time Series." He discussed several algorithms including deep learning for time series touching upon short-term memory recurrent networks and convolutional networks. The second session was on "Biomedical Imaging" by Shyam Vasudev, President and CTO, Forus Health. He presented methods to diagnose eye-related problems based on images of the eye, and the equipments developed by the company related to this. An introduction to artificial neural networks was provided by K. George followed by the applications of sequential learning algorithms for time series prediction, pattern recognition and adaptive control of nonlinear systems. He also discussed how meta-cognition and multiple models can improve performance.

The first session on the second day of the Summer School began with a talk on "Multiresolution Classification Systems: Tiramisu of the ML World" by Gowri Srinivas, PES Institute of Technology South Campus. She spoke about the different stages of generic pattern recognition systems with bioimaging as an application. This was followed by a lecture on "Finding Structure in Complexity" by Tim Poston, Chief Scientist, Forus Health, Bangalore. He spoke about intelligence that include machine vision, pattern recognition, decision making, reasoning and natural language processing. The third session was on "Recent Developments in Meta-cognitive Neural Network Systems" by N. Sundararajan, NTU, Singapore. He reviewed human learning from the viewpoint of cognitive psychology, discussed self regulatory learning algorithms, benchmark evaluation and comparisons, and applications to medical informatics. The day concluded with a talk on "Deep Learning for computer vision" by R. Venkatesh Babu, Indian Institute of Science, Bangalore. Beginning with early vision and machine learning algorithms, he moved on to biologically inspired algorithms and convolutional networks for computer vision.

The third day began with "Granular Neural Networks: Theory and Applications" a lecture delivered by Saroj K Meher, Indian Statistical Institute, Bangalore. He spoke about the advantages of networks that first worked on coarse information and then making it finer. In his talk on "Differential Evolution for Continuous Parameter Evolutionary Optimization," Dr. Swagatam Das, Indian Statistical Institute, Kolkata, spoke on how evolutionary algorithms can be applied to solve real parameter optimization problems. He showed different types of evolution algorithms with examples. This was followed by a lecture on "Evolutionary Computations" by Qingfu Zhang, City University of Hong Kong. In his talk he explained about

optimization and evolutionary computation, orthogonal genetic algorithm, MOEA based on decomposition and MOEA based on regularity. The last session for the day was on "Big Data Analytics" by Srikanth Sundarrajan, Chief Architect, InMobi. He discussed on what constitutes big data, and the architectures for big data from an industrial perspective, and considered some applications such as recommendations systems, targeting and fraud detections.

The first lecture on the fourth day was by Yew-Soon Ong, NTU, Singapore on "Evolutionary Multitasking: A New Paradigm in Evolutionary Computation." He discussed this paradigm and presented applications where this was deemed necessary to improve the performance. Different machine learning methods were presented by Jagannathan Sarangapani, Missouri University of Science and Technology in his talk on "Neural Networks, Reinforcement Learning and Applications," with an emphasis on reinforcement learning with application to robotics. The third session was on "Intelligent Algorithms for the web" by Dr. Kavi Mahesh, PES University. The last session was on "Introduction To Deep Learning Networks" by Dinkar Sitaram, PES University, where he spoke on convolutional neural networks and deep learning.

The final day of the Summer School had only one talk on "Recent Works in Spiking Neural Networks" by Sundaram Suresh, NTU, Singapore. In his talk he explained the basics of neural networks leading to spiking neural networks including architecture, challenges, encoding techniques and learning algorithms. The day concluded with a valedictory function wherein participation certificates were presented on the participants.

There were a total of 10 sessions of duration 2 hours, 5 sessions of duration 1.5 hours and 1 session of duration 1 hour. No hands-on sessions were included.

8. Feedback

The participants provided positive feedback regarding the Summer School. They appreciated the informative range of topics dealt with during the school and the very good set of speakers. The Summer School was well organised with one of them even commenting that it was the best program ever attended. Several of them requested for more of such programmes. Of those who responded, 72% gave "excellent" for course contents and 28% gave "good"; 60% gave "excellent" for the organisation and 28% gave "good"; and, 56% gave "excellent" for the overall experience and 40% gave "good". Many participants indicated that the topics would help them in the future. Several students were motivated to take up their final year undergraduate projects or master's thesis related to computational intelligence. Some of the participants expected more case studies and hands-on experience. Amongst those who

gave the feedback, 43% said it was "very likely" and 50% said it was "likely" that they would use computational intelligence tools in the future. Further, 28% said it was "very likely" and 43% said it was "likely" that they would join the IEEE Computational Intelligence Society.

9. Financial Summary

Sl. No.	Activity	Amount (INR)
1.	Transportation for Resource Persons (Flight/Train/Taxi) and Visa fees (wherever applicable)	3,06,895.00
2.	Boarding and Lodging for Resource Persons	65,910.90
3.	Honorarium for Resource Persons	64,000.00
4.	Mementos for Resource Persons	13,926.00
5.	Food charges for Summer School Participants	40,000.00
6.	Kits for Summer School Participants	41,295.00
7.	Printing charges	8,670.00
8.	Miscellaneous expenses	1,696.00
Total in INR		**5,42,392.90**
Total (rounded) in INR		**5,44,393.00**
Total (rounded) in USD @ INR 68.00 per 1 USD		**8006.00**

10. Registration Fees

The registration fees charged were as follows:

INR 2000 (Student, IEEE CIS Member)
INR 2500 (Student, non-IEEE CIS Member)
INR 4000 (Academic, IEEE CIS Member)
INR 5000 (Academic, non-IEEE CIS Member)
INR 7000 (Professional, IEEE CIS Member)
INR 8500 (Professional, non-IEEE CIS Member)

There were only two IEEE CIS Members who registered for the Summer School. The remaining 43 participants were non-IEEE CIS members.

11. Photographs

Annexure C

Annexure A

Programme

<u>Monday – August 8, 2016</u>

8:30-9:30 am	Coffee and Registration
9:30	Inaugural Function
10:30	Coffee Break
11:00	P N Suganthan (Nanyang Technological University, Singapore)
	Computational Intelligence Algorithms for Time Series
1:00-2:00pm	Lunch Break
2:00	Shyam Vasudev Rao (Forus Health)
	Biomedical Imaging
4:00-4:30	Coffee Break
4:30	Koshy George (PES University)
	Online Sequential Learning: Theory and Applications
6:00	Discussions over Coffee

<u>Tuesday – August 9, 2016</u>

8:15-8:30 am	Coffee
8:30	Gowri Srinivas (PES Institute of Technology Bangalore South Campus)
	Multiresolution Classification Systems: Tiramisu of the ML World
10:30	Coffee Break
11:00	Tim Poston (Forus Health)
	Finding Structure in Complexity
1:00-2:00pm	Lunch Break
2:00	N Sundararajan (Nanyang Technological University, Singapore)
	Recent Developments in Meta-cognitive Neural Network Systems
4:00-4:30	Coffee Break
4:30	Venkatesh Babu (Indian Institute of Science)
	Challenges and Advances in Machine Vision
6:00	Discussions over Coffee

<u>Wednesday – August 10, 2016</u>

8:15-8:30 am	Coffee
8:30	Saroj K Meher (Indian Statistical Institute, Bangalore)
	Granular Neural Networks: Theory and Applications
10:30	Coffee Break
11:00	Swagatam Das (Indian Statistical Institute, Calcutta)
	Differential Evolution for Continuous Parameter Evolutionary Optimization
1:00-2:00pm	Lunch Break
2:00	Qingfu Zhang (City University, Hong Kong)
	Evolutionary Computation

4:00-4:30	Coffee Break
4:30	Srikanth Sundarrajan (InMobi)
	Big Data Analytics
6:00	Discussions over Coffee

<u>Thursday – August 11, 2016</u>

8:15-8:30 am	Coffee
8:30	Yew-Soon Ong (Nanyang Technological University, Singapore)
	Evolutionary Multitasking: A New Paradigm in Evolutionary Computation
10:30	Coffee Break
11:00	Sarangapani Jagannathan (Missouri University of Science & Technology, USA)
	Neural Networks, Reinforcement Learning and Applications
1:00-2:00pm	Lunch Break
2:00	Kavi Mahesh (PES University)
	Intelligent Algorithms for the Web
3:30	Coffee Break
4:00	Dinkar Sitaraman (PES University)
	Neural Networks and Deep Learning
5:00	Discussions over Coffee

<u>Friday – August 12, 2016</u>

8:15-8:30 am	Coffee
8:30	Suresh Sundaram (Nanyang Technological University, Singapore)
	Spiking Neural Networks
10:00	Valedictory Function
11:00	Discussions over Coffee

Annexure B

List of Participants

No.	Name	Affiliation
1	A. Achpal	PES University
2	P.M. Amita	PES Centre for Intelligent Systems
3	S. Ansari	PES University
4	N. Asrani	PES University
5	S. S. Bharadwaj	Continental Automotive Components, Bangalore
6	G. Biradar	PDA College of Engineering, Gulbarga
7	R. G. Biradar	PES University
8	K. Boraiah	PES University
9	A. Chatterjee	PES Centre for Intelligent Systems
10	N. Chauhan	Target, Bangalore
11	N. Choudhary	Target, Bangalore
12	K. George	PES University
13	A. Giridharan	Indian Institute of Science, Bangalore
14	V. Jithesh	Electronics and Radar Development Establishment (LRDE), DRDO, Bangalore
15	M. Karki	M.S. Ramaiah Institute of Technology, Bangalore
16	S. Karpagavalli	PES University
17	A. Kori	PES University
18	A. Krishnamurthy	PES University
19	V. Kulkarni	Electronics and Radar Development Establishment (LRDE), DRDO, Bangalore
20	A. Kumar	Centre for Airborne Systems (CABS), DRDO, Bangalore
21	C. Kumar	Mercedes-Benz, Bangalore
22	V. Kumar	Jain University, Bangalore
23	H. Madhumita	PES University
24	H. Mallika	M.S. Ramaiah Institute of Technology, Bangalore
25	S. Mehta	PES University
26	S. Murthy	University College of Engineering, Bangalore
27	P. Mutalik	PES Centre for Intelligent Systems
28	P. Nagaraju	Intel, Bangalore
29	S. Panda	PES University
30	A. M. Parvez	PES University
31	M.S. M. Prasad	PES University

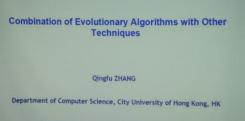| 32	M. G. Purvidatta	PES University
33	A. Radhakrishnan	PES University
34	K. Radhakrishnan	PES University
35	A. Ramesh	PES University
36	O. K. Rana	Electronics and Radar Development Establishment (LRDE), DRDO, Bangalore
37	N. Rashmi	PES Centre for Intelligent Systems
38	A. Ravi	Mercedes-Benz, Bangalore
39	J. B. Singh	Electronics and Radar Development Establishment (LRDE), DRDO, Bangalore
40	S. Soman	Centre for Airborne Systems (CABS), DRDO, Bangalore
41	N. Somesh	PES University
42	B. M. Srikanth	PES University
43	B. N. Sumukha	Nokia Networks, Bangalore
44	A. Tashniwal	PES University
45	S. J. Vijayanth	PES University

Annexure C

Photographs