



Kalpataru Vidya Samsthe®
Kalpataru Institute of Technology
Tiptur – 572201



Report on Two weeks Faculty Development Program (FDP)

on

***“Machine Learning, Artificial Intelligence in Image Processing
using MATLAB and Xilinx System generator for DSP”***

Organized by the

Department of Electronics and Communication Engineering

From

22-07-2019 to 03-08-2019.



Kalpataru Vidya Samsthe®
Kalpataru Institute of Technology
Tiptur – 572201



Report on Two weeks Faculty Development Program (FDP)
on
“Machine Learning, Artificial Intelligence in Image Processing using
MATLAB and Xilinx System generator for DSP”
Organized by the
Department of Electronics and Communication Engineering
From
22-07-2019 to 03-08-2019.

A two week national level, AICTE funded FDP on ***“Machine Learning, Artificial Intelligence in Image Processing using MATLAB and Xilinx System generator for DSP”*** was organized by the Department of Electronics and Communication Engineering, Kalpataru Institute of Technology from 22-07-2019 to 03-08-2019. For the FDP, around 79 applications were received. Out of which 40 external participants were selected on first come first serve basis plus 06 internal participants. The main objective of the FDP was to provide the knowledge about recent happenings in Artificial intelligence and machine learning in image processing and their applications development using MatLab and Hardware implementation of the designs using Xilinx System generator for DSP targeting FPGA platform. For this FDP, CoreEL Technologies, Bangalore were technical partners. The inaugural ceremony witnessed the presence of two chief guests; **Prof. T Nagbhushan, Principal, JSS, Mysore** and **Dr. Suryakanth Gangashetty, IIIT, Hyderabad**. Along with them,; **Dr. Kiran T S**, In-charge Principal, KIT; **Dr. Rajashekararadhya**, FDP Coordinator; **Prof. G. S. Yogananda**, FDP Convener and Dr. Y P Gowramma, Professor, CSE Department were also present in this auspicious occasion. Prof. G. S. Yogananda, FDP Convener, HOD, Dept. of ECE, formally welcomed the dignitaries and participants. He also provided a brief introduction to the FDP.

Prof. T Nagbhushan, Principal, JSS, Mysore in his motivational speech, explained the recent and future trends in technology. In his continued talk, a good introduction to the concept of AI and Machine learning is provided.

Dr. Suryakanth Gangashetty, IIIT, Hyderabad emphasized the importance of learning new technologies and the importance of such workshops.

On this occasion, Dr. Suryakanth Gangashetty and Prof. T Nagbhushan were honored with felicitation.

The inauguration also witnessed the presence of HODs of all departments, faculty members of KIT and participants from various institutions of the nation.

Prof. T. V. Narendra, Assistant Professor, Dept. of ECE, KIT, Tiptur proposed vote of thanks.

Prof. S. Shambavi, Assistant Professor, Dept. of ECE, KIT, Tiptur, was the Master of Ceremony.



Kalpataru Vidya Samsthe®
Kalpataru Institute of Technology, Tiptur
Department of Electronics & Communication Engineering
AICTE Sponsored Two Week FDP, From 22/07/2019 To 03/08/2019 On
“Machine learning in Image Processing, Artificial Intelligence using Matlab and Xilinx System generator for DSP”
Sessions Table

Date	Time	Activity	Session Handled by
22/07/2019 Monday	09.30 - 11.30	Inauguration and Keynote address	Dr. Suryakanth Gangashetty, IIIT, Hyderabad
	11.45 - 01.00	Session 01: Introduction to Artificial Intelligence	
	02.00 - 03.30	Session 02: Introduction to Machine Learning	
	03.45 - 05.00	Session 03: Introduction to Artificial Neural Network	
23/07/2019 Tuesday	09.30 - 11.00	Session 04: Introduction to MATLAB and Its Application to Neural Network, Machine Learning and Deep Learning	ManiSankar, CoreEL Technologies
	11.30 - 01.00	Session 05: Hands on session : Introduction to Matlab Fundamentals	
	02.00 - 03.30	Session 06: Hands on session : Introduction to SIMULINK Fundamentals	
	03.45 - 05.00	Session 07: Hands on session : Introduction to Simscape Fundamentals	
24/07/2019 Wednesday		Session 08: Lecture & Hands on session : Importing and Organizing Data	ManiSankar, CoreEL Technologies
	11.30 - 01.00	Session 09: Lecture & Hands on session : Finding Natural Patterns in Data	
	02.00 - 03.30	Session 10: Lecture & Hands on session : Demo on customer case studies and discussion	
	03.45 - 05.00	Session 11: Lecture & Hands on session : Creating Neural Networks	
25/07/2019 Thursday	09.30 - 11.00	Session 12: Vivado Design Flow, Simulate the design using the XSIM HDL simulator, Synthesis Technique	Vijendra V & Team, CoreEL Technologies
	11.30 - 01.00	Session 13: Implementing the Design	
	02.00 - 03.30	Session 14: Download the bitstream and verify the functionality on ZedBoard	
	03.45 - 05.00	Session 15: Integrated Logic Analyzer (ILA) core (available in IP Catalog) to debug the hardware.	
26/07/2019 Friday	09.30 - 11.00	Session 16: Introduction to Xilinx System Generator	Vijendra V & Team, CoreEL Technologies
	11.30 - 01.00	Session 17: Digital filter design using system Generator	
	02.00 - 03.30	Session 18: Hands on session : Image processing demo	
	03.45 - 05.00	Session 19: Hands on session : Video Processing demo	
27/07/2019 Saturday	09.30 - 11.00	Session 20: Visual Cryptography for Grey Scale and Color Images	Dr. Alwyn Pais, NITK, Surathkal
	11.30 - 01.00	Session 21: Topic not Provided	Dr. Punitha Swamy, IBM, Bangalore
	02.00 - 03.30	Session 22: Topic not Provided	Dr.Y.P.Gowramma, Prof, CS&E, KIT
	03.45 - 05.00	Session 23: Topic not Provided	

29/07/2019 Monday	09.30 - 11.00	Session 24: Lecture & Hands on session : Introduction to Machine Learning	Krishnaraj CoreEL Technologies	
	11.30 - 01.00	Session 25: Lecture & Hands on session : Building Classification Models		
	02.00 - 03.30	Session 26: Lecture & Hands on session : Building Regression Models		
	03.45 - 05.00	Session 27: Lecture & Hands on session : Improving Predictive Models		
30/07/2019 Tuesday	09.30 - 11.00	Session 28: Lecture & Hands on session : Creating Neural Networks	Krishnaraj CoreEL Technologies	
	11.30 - 01.00	Session 29: Lecture & Hands on session : Transfer Learning for Image Classification		
	02.00 - 03.30	Session 30: Lecture & Hands on session : Interpreting Network Behavior		
	03.45 - 05.00	Session 31: Lecture & Hands on session : Improving Network Performance		
31/07/2019 Wednesday	09.30 - 11.00	Session 32: Introduction to Internet of Things(IoT)	Vijendra V & Team, CoreEL Technologies	
	11.30 - 01.00	Session 33: IoT based demo on Edge Artix7 FPGA board and ThingSpeak cloud		
	02.00 - 03.30	Session 34: Bluetooth demo on Edge Artix7 FPGA board		
	03.45 - 05.00	Session 35: Wifi demo on Edge Artix7 FPGA Board		
01/08/2019 Thursday		Session 36: Overview of Artificial Intelligence & Machine Learning	Dr. GeetaKiran, Professor, MCE,	
	11.30 - 05.00	INDUSTRIAL VISIT		
02/08/2019 Friday	09.30 - 11.00	Session 37: Reconfigurable Computing	Mr. PradeepKumar, Mr. Lohith M.S., Dr.Pramodkumar,	Faculty E&CE Dept K.I.T., Tiptur
	11.30 - 01.00	Session 38: Intelligent Automation, Using RPA and IoT	Dr. Santosh Kutnis, Pune	
	02.00 - 03.30	Session 39: Artificial Intelligence & Machine Learning; and How they are changing our life		
	03.45 - 05.00	Session 40: Vivado High Level synthesis (HLS)	Mr. PradeepKumar, Mr. Lohith M.S., Dr.Pramodkumar,	Faculty E&CE Dept K.I.T., Tiptur
03/08/2019 Saturday	09.30 - 11.00	Session 41: Learning based semantic segmentation and labeling of image	Dr. K.V.Suresh, Dept of E&CE, S.I.T., Tumkur Mr. Dayanandaswamy, Lead Engineer, Samsung.	
	11.30 - 01.00	Session 42: Test as per AICTE regulation		
	02.00 – 04.00	Valedictory ceremony		

Note:

- High tea break from 11:00 to 11:30 and 03:30 to 03:45.
- Lunch break from 01:00 to 02:00.
- Wearing FDP ID card tag is compulsory inside the KIT

Date: 22-07-2019

Session 1: 11.45am-1.00pm

The first session was handled by Prof. T Nagbhushan, Principal, JSS, Mysore. He provided a brief introduction on Artificial Intelligence. He also explained the importance of research in the field of technical education.



Session 2: 2.00pm-3.30pm

Dr. Suryakanth Gangashetty, IIIT, Hyderabad handled the second session, wherein he gave introduction on Machine Learning, different kinds of Neural networks for Artificial intelligence.



Session 3.45pm-5.00pm

Dr. Suryakanth Gangashetty continued his talk on Neural networks, He discussed on Deep Neural Networks, Recurrent Neural Networks, Speech Recognition using Deep Neural Network and Recurrent Neural Network. We thank Prof. T Nagbhushan and Dr. Suryakanth Gangashetty for briefing on Artificial intelligence and Machine learning.



Date: 23-07-2019

Session 1: 9.30-11.00am

Mr. Manisankar from CoreEL Technologies handled the session. He gave introduction to Matlab, importance of Matlab in different areas of research. He also explained the preprocessing techniques in image processing.



Session 2: 11.30am-1.00pm

Mr. Manisankar continued the session, It was hands on session on fundamentals of Matlab. The participants executed different commands in command window, learnt how to create the matrix and address different elements in a matrix individually and also executed some basic matrix operations.



Session 3: 2.00pm-3.30pm

The session was on introduction to simulink, different toolbox available in simulink library. He gave demo on how to connect the blocks and execute it. He took an example of adding two numbers and displaying the result.



Session 4: 03.45-05.00pm

The session was hands on experience in basics of simulink. The participants learnt how to use the simulink library and executed different examples in simulink. He also explained the fundamentals of Simscape. The participants learnt how to use the Simscape toolbox. He also explained how to add new packages using Add ons in Matlab.



Date: 24-07-2019

Session 1: 9.30am-11.00am

Mr. Manisankar from CoreEL Technologies handled the session. The session was on importing and organising the data, reading and writing different types of files for text, matrix and strings, reading and writing audio, video and image files. The participants executed the reading and writing of different files in Matlab.



Session 2: 11.30am-1.00pm

The session was on finding Natural patterns in data. The participants practically experienced by executing different functions to find natural patterns. Different Pre processing techniques in image processing was explained and also the participants executed the pre processing techniques using Matlab.



Session 3: 2.00pm-3.30pm

The session was hands on experience on pre processing techniques in image processing using Matlab. The participants converted colour images to greyscale and vice versa. Different Morphological operations were explained and practically experienced by participants



Session 3.45pm-5.00pm

The session was hands on experience on Creating Neural Networks, the participants learnt to create different types of network layers in Matlab, assemble layers into a deep network and train the network on data.



Date: 25-07-19

Session 1: 9.30am-11.00am

Mr. Vijendra V from CoreEL Technologies handled the session. He briefed on 7-Series architecture of an FPGA, importance of FPGA, advantages of FPGA when compared with the Processors. He gave introduction on ARTIX, KINTEX, VIRTEX, ZYNQ family of FPGAs and the characteristics of these FPGAs, he also discussed on use of the boards in different areas.



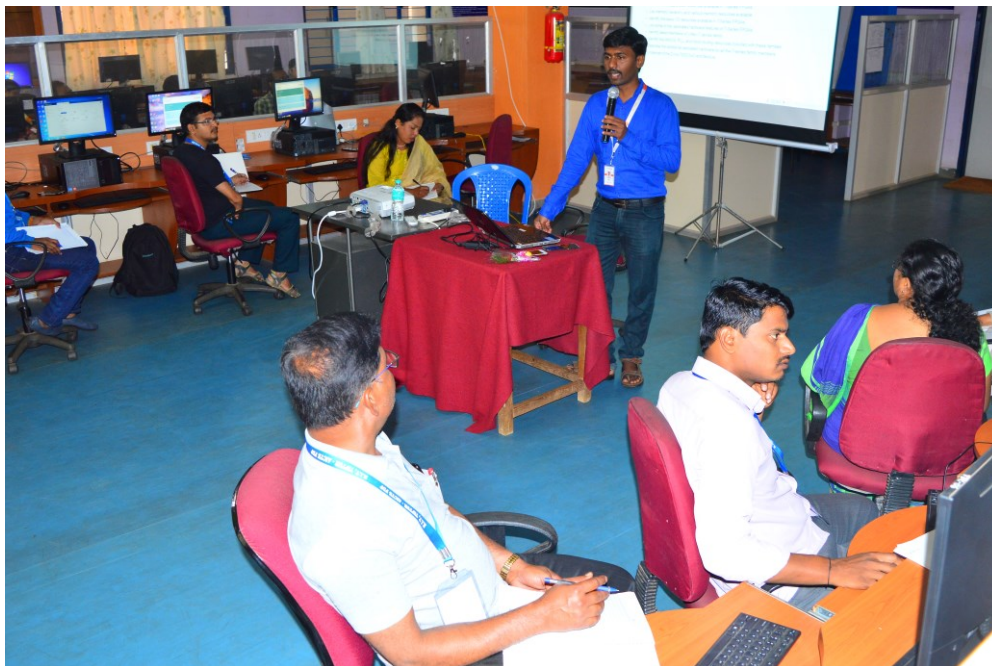
Session 2: 11.30am-1.00pm

The session was on Xilinx. The participants practically experienced Xilinx and learnt how to design, simulate, synthesize and implement bitstream in ARTIX7 FPGA in XILINX Vivado. The participants learnt how to convert verilog code to gate level netlist.



Session 3: 2.00pm-3.30pm

This session was hands on experience in VIVADO, He gave demo on how to create netlist using vivado and implement it in FPGA. The participants designed a counter and synthesised it using VIVADO.



Session 4: 3.45pm-5.00pm

The participants implemented their design in FPGA, they also designed an adder/sub using VIO blocks, add/sub block and clock block and implemented in FPGA using VIVADO. The VIO block was replaced with ILA and implemented in FPGA. The session was interactive and participants enjoyed learning.



Date: 26-07-19

Session 1: 9.30am-11.00am

Mr. Vijendra V from CoreEL Technologies handled the session. The session was on System Generator. He gave demo on sysgen and also designed a simple application using SIMULINK and converted it into a Verilog code. The participants practically used the System Generator and converted the simulink module to a verilog code.



Session 2: 11.30am-1.00pm

The session was on Cosimulation using System Generator. In system generator, Vivado was invoked and an Image Processing application was designed, and block level implementation was made using Xilinx toolbox



Session 3: 2.00pm-3.30pm

The block level implemented image processing application in the previous session was implemented in FPGA using System Generator.



Session 4:3.45pm-5.00pm

The session was on designing a filter using FDATAOOL. The filter was designed in simulink using Xilinx blocks, participants learnt how to connect the blocks and design a filter. Using Vivado, bit file was generated and implemented in FPGA. The session was interactive. We thank Mr. Vijendra V for sharing his knowledge on Vivado and System Generator.



Date: 27-07-19

Session 1: 9.30am-11.00am

Dr. Alwyn Roshan Pais handled the session. He discussed on processing in under water images, problems in this area. He also discussed on Super resolution images, advantages of it and where these images can be used. We thank Dr. Alwyn Roshan Pais for the informative session.



Session 2: 11.30am-1.00pm

Dr. Puneetha P from IBM handled the session. She gave an overview on Artificial intelligence, Machine learning and deep learning and research going on in this area. She also discussed on Cognitive Computing. We thank Dr. Puneetha P for the session.



Session 3: 2.00pm-3.30pm

Dr. Y P Gowramma from Kalpataru Institute of Technology handled the session. She explained how artificial intelligence is used in different areas and the advantages of artificial intelligence.



Session 4:3.45-5.00pm

Dr. Y P Gowramma continued the session , she discussed on supervised learning and unsupervised learning. We thank Dr. Y P Gowramma for her interactive session.



Date: 29-07-19

Session 1: 9.30am-11.00am

Krishna Raj from CoreEL Technologies handled the session. This session was on Machine Learning using Matlab. Participants practically downloaded the IRIS images database and read data using READTABLE from the excel sheet, classified the images using KNN and recognized an image input using PREDICT.



Session 2: 11.30am-1.00pm

Krishna Raj continued the session, He discussed on different kinds of recognition algorithms along with KNN, Support Vector Machine. He discussed the working of KNN, the statistical analysis of KNN.



Session 3: 2.00pm-3.30pm

The session was continued by Krishna Raj, He gave an overview on different decision making techniques, he discussed Bayes algorithm and also explained the mathematical model of this algorithm. He also discussed on Cross Validation.



Session 4:3.45pm-5.00pm

The session was on Cross Model in Matlab, He discussed different functions like Kfoldpredict, Kfoldloss, Kfoldmargin and also discussed how to create models using Cross Model. The participants practically experienced modelling using Cross Model



Date: 30-07-19

Session 1: 9.30am-11.00am

Krishna Raj from CoreEL Technologies handled the session. The session was hands on experience in Deep Neural Networks, how to create different types of network layers in MATLAB and assemble layers into a deep network and train the network on data. Perform convolutions on an image using matrices.



Session 2: 11.30am-1.00pm

The session was on Transfer learning for Image Classification, he discussed how to train a network from scratch. Participants added Alexnet library from Add-Ons, he gave an overview on Convolution layer and Relu layer.



Session 3: 2.00pm-3.30pm

The session was on Interpreting Network behaviour. He discussed on modify training options to configure network training, monitor performance during network training, prevent overfitting using validation data during training.



Session 4:3.45-5.00pm

The session was on Improving Network Performance. The participants learnt how to adjust the default training options to improve the performance of a network, perform image augmentation to prevent overfitting. We thank Krishna Raj for his sessions, it was informative and participants enjoyed learning.



Date: 31-07-19

Session 1: 9.30am-11.00am

Mr. Vijendra V from CoreEL Technologies handled the session. The session was on implementing the netlist in zynq FPGA, participants implemented the netlist in Zynq FPGA using System Generator. He also gave an overview of using the peripherals in FPGA. An introduction on IOT was also started.



Session 2: 11.30am-1.00pm

Introduction on IOT was continued, he gave demo on implementing IOT applications in Edge Artix 7 FPGA board and ThingSpeak cloud, demo on interfacing Bluetooth with Artix7 FPGA board was also given, participant practically experienced implementing IOT using FPGA.



Session 3: 2.00pm-3.30pm

Mr. Vijendra V continued the session, he gave demo on interfacing Wifi with Artix7 FPGA board. He also gave demo on generating a bit file of an image and implementing it on FPGA, SDK was launched and the image in FPGA was displayed on screen.



Session 4:3.45-5.00pm

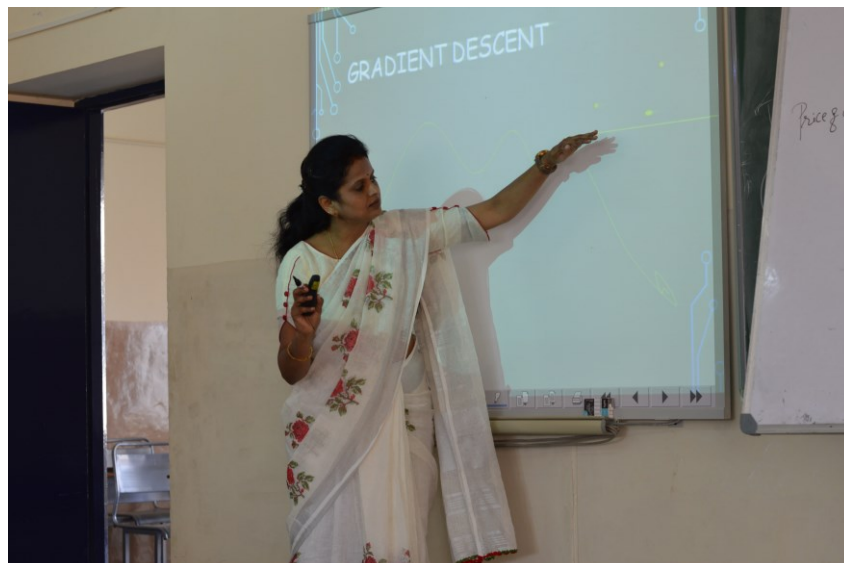
The session was hands on experience on generating a bit file and implementing it on FPGA for image processing applications. We thank Mr. Vijendra V for sharing his knowledge on Zynq FPGA boards.



Date: 01-08-19

Session 1: 9.30am-11.00am

Dr. GeetaKiran, Professor from MCE handled the session. The session was on Machine learning. She gave an overview on different approaches of Machine learning like Linear Regression, Hierarchical Regression, Clustering and Gradient Decent. She also explained on Supervised Machine learning and Unsupervised Machine learning.



Session 2: 11.30am-1.00pm

Industrial Trip

An industrial trip to Master Control Facility (MCF) situated at Salagame road, Hassan, Karnataka was planned and we had requested for permission on 01/08/2019, but due to rescheduling of Chandrayaan-2 launch, permission was granted on 07/08/2019. As the session time table was planned before, we were unable to visit MCF. The arrangements were made to visit “*Namratha Oil Refineries Private Limited*” and “*Coir Industry*”, which are two local industries.



Date: 02-08-19

Session 1: 9.30am-11.00am

In house resource person Mr. Pradeep Kumar S K, Assistant Professor handled the session, he discussed the importance of Reconfigurable computing for Machine learning algorithms and briefed on present innovations and necessity and advantages of training DNN in FPGA.

Dr. Pramod Kumar S, Associate Professor from JNNCE, Shimmoga continued the first session, he briefed on the design flow and advantages of High level synthesis using Vivado.



Session 2: 11.30am-1.00pm

Dr. Santosh Kutnis from Pune handled the session. The session was on Intelligent Automation using RPA and IOT. He briefed on Internet of Things and Robotic Process Automation and how they can be integrated.



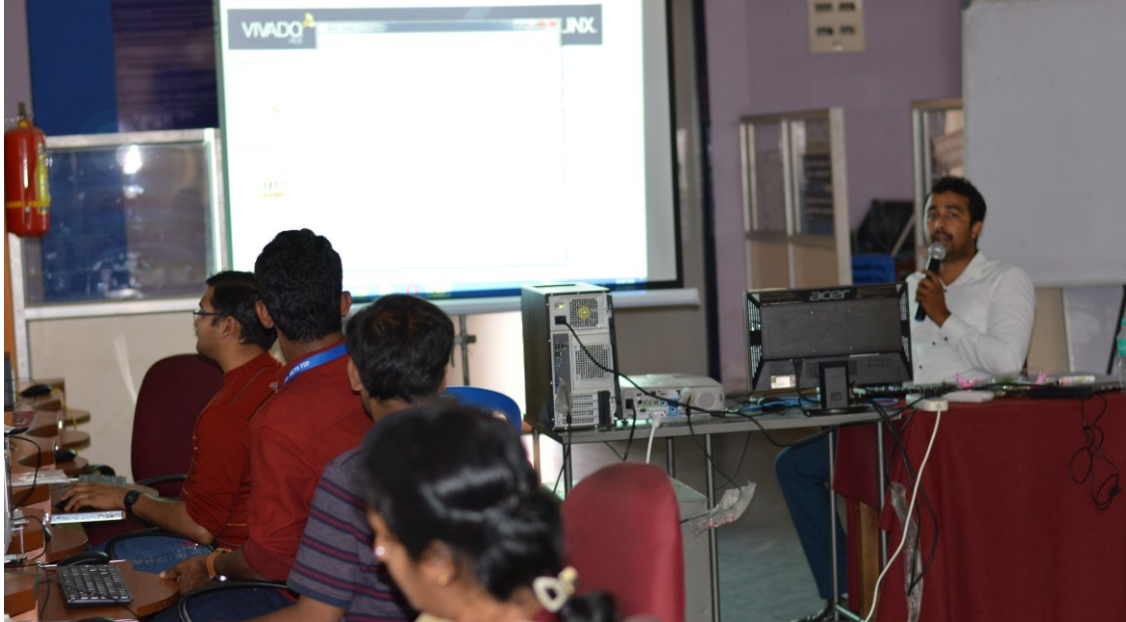
Session 3: 2.00pm-3.30pm

Dr. Santosh Kutnis continued the session, he explained how Artificial Intelligence and Machine learning field is growing and where they are already implemented and how they are changing our life.



Session 4:3.45-5.00pm

In house resource person Mr. Lohith M S, Assistant Professor handled the session, it was hands on session on High level synthesis using Vivado HLS, an example project Matrix multiplication was written in C language then created an IP, which can be used in SysGen or Vivado IP based design.



Date: 03-08-19

Session 1: 9.30am-11.00am

Mr. Dayanandaswamy from Samsung handled the session, the session was on Learning based semantic segmentation and labelling of image, he briefed on different algorithms in it and their advantages. We thank Dayanandaswamy for his session.



Session 2: 11.30am-1.00pm

We conducted test for the participants based on the topics covered till date.

Session 3 : 2.00pm-4.00pm

Valedictory Function

“A day spent in learning is a day never wasted”

A two week national level, AICTE funded workshop on **“Machine Learning, Artificial Intelligence in Image Processing using MATLAB and Xilinx System generator for DSP”** organized by the Department of Electronics and Communication Engineering, from 22-07-2019 to 03-08-2019 has took its ending ceremony. The function was presided by chief guest, **Mr. Dayanandaswamy** from Samsung India, Bangalore. **Dr. S V Rajashekararadhya**, FDP Coordinator, **Prof. G. S. Yogananda**, FDP Convener, **Dr. Y. P. Gowramma**, Professor, **Prof. G D Gurumurthy**, Associate Professor, **Dr. Jayaramu H S**, Professor and **Dr. Nandeeshaiiah**, Principal, Kalpataru Institute of Technology, Tiptur were also present in the auspicious occasion on stage.

Prof. G. S. Yogananda, FDP Convener, HOD and Associate Professor, Department of Electronics and Communication Engineering, welcomed chief guests and guests of honor.

Mr. Dayanandaswamy congratulated the organizers for the successful conduction of two weeks FDP and encouraged to take upon research work on recent trends. In his inspirational talk, shared his own experiences during research, difficulties involved & the final fruitful result out of the research which are being carried out in industries.

Dr. Nandeeshaiiah, Principal, Kalpataru Institute of Technology, Tiptur, appreciated about the FDP organization and its successful conduction. Also encouraged to conduct similar events in future.

On-stage feedback from the participants was invited. Prof. Sachin Eknath Hajare, Electronics & Telecommunication Engineering, STB College of Engg, Tuljapur, Maharashtra; Prof. Alina Dash, Assistant Professor, Department of Computer Science and Engineering, VSSUT, Burla, Sambalpur, Odisha, Dr. Renjith V Ravi, Assistant Professor, Department of Electronics & Communication Engineering, MEA Engg College, Perinthalmanna, Kerela and Prof. G. Murthi Mahadeva Naik, Associate Professor, Department of Electronics and Communication Engineering, Malnad College of Engineering, Hassan appreciated the team work in conducting the FDP.

Chief guests, Mr. Dayanandaswamy, Dr. S V Rajashekararadhya and Dr. Nandeeshaiiah distributed certificates to the participants. The master of ceremony was done by Prof. S.

Shambhavi, Assistant Professor, Department of Electronics and Communication Engineering, Kalpataru Institute of Technology, Tiptur.

Chief guests and Guests of honor



Mr. Dayanandaswamy addressing the gathering



Dr. S V Rajashekararadhya addressing the gathering



Dr. Nandeeshaiiah addressing the gathering



Certificate being issued to one of the participant



Feedback by one of the participants



Feedback by one of the participants



Feedback by one of the participants



We thank AICTE for providing fund to conduct this FDP. We are very much grateful to the Management and Principal of Kalpataru Institute of Technology for their uninterrupted encouragement throughout the process. Also, we thank everyone who was involved directly or indirectly in making two weeks FDP a grand success.

Our special thanks to all the resource persons and participants whose involvement took this FDP to a great level of success.

We thank one and all.