

# Recent Advances in Computational Intelligence for Signal Processing (RACISP-2020)

## REPORT

Department of Electronics and Communication Engineering organized one week online short term course on “Recent Advances in Computational Intelligence for Signal Processing (RACISP-2020)”. The program was scheduled from 10<sup>th</sup> -15<sup>th</sup> August, 2020. This short term course was coordinated by **Dr. Sunil Datt Sharma** and **Dr. Vikas Baghel**. **Dr. Nafis Uddin Khan** was the convener of the course.

The program was inaugurated by honourable Vice –chancellor (**Prof. Vinod Kumar**) and Dean Research (**Prof. Samir Dev Gupta**). They highlighted the importance of computational techniques in signal processing and motivated the participants. More than 110 faculty members, research scholars from various universities/institutes and industry professionals from different organizations participated in this course.



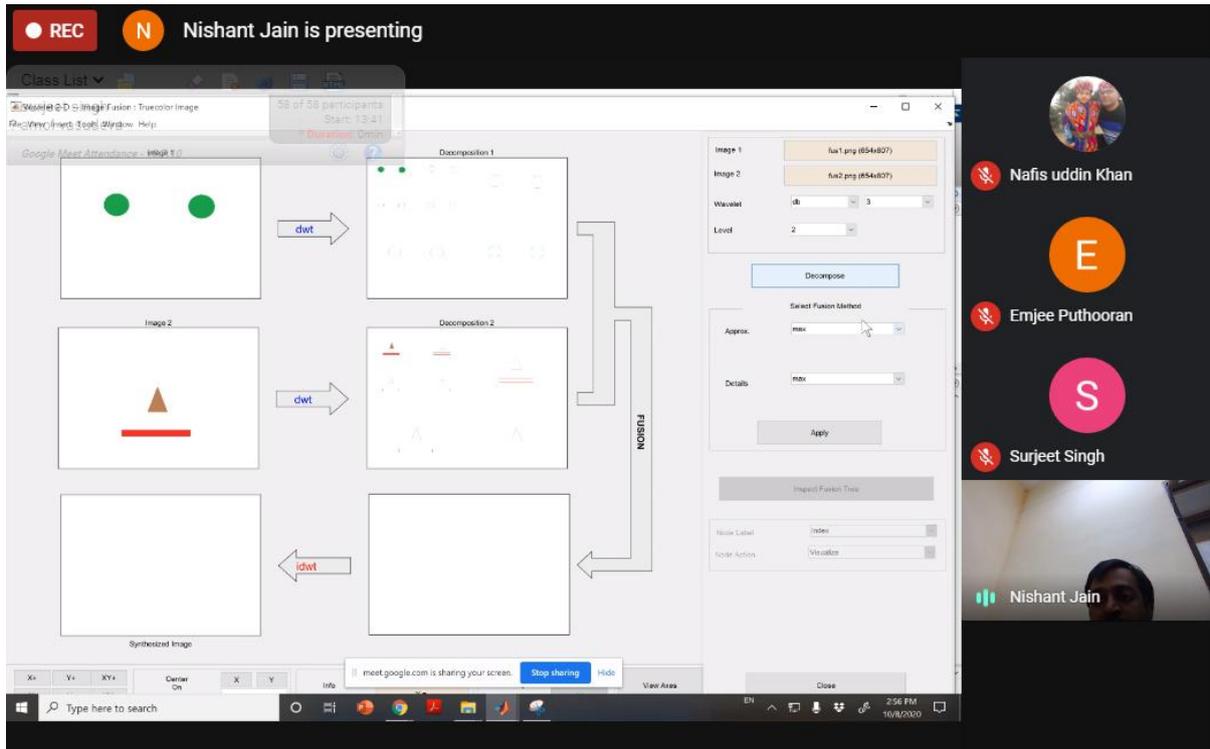


## Expert Sessions:

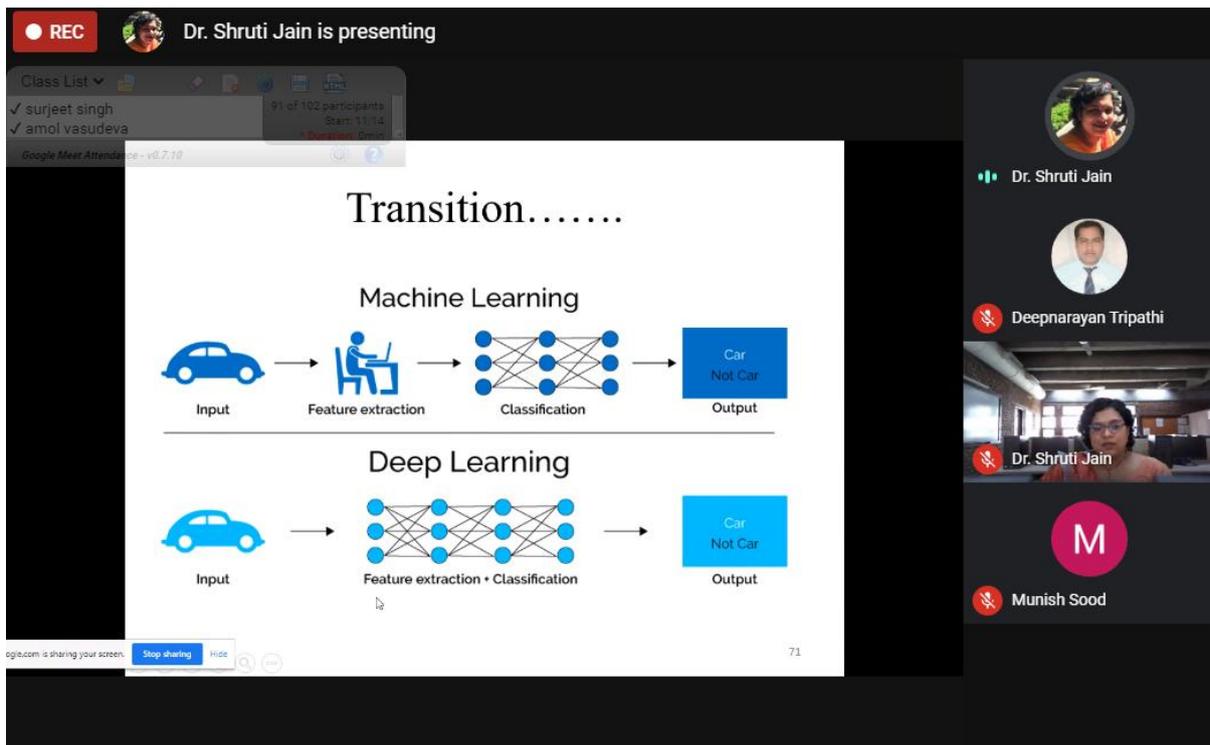
First session was taken by **Dr. Nafis Uddin Khan** and he focussed on Fuzzy inference based edge detection in digital image processing and also highlighted on the open research problems in this area.

A screenshot of a Zoom meeting. The main window shows a presentation slide by Nafis Uddin Khan. The slide title is "contd..." and it contains the text "► Sensitive to high gradient impulse noise". Below this text are three grayscale images of a woman's face wearing a hat. The first image is labeled "Noisy image", the second is labeled "k=4, T=100", and the third is labeled "k=10, T=100". The slide also includes a table of contents with items like "Educational and Experience Details", "Introduction", "Publications so far", "References", "PDE based Image Enhancement and De-noising", "Anisotropic Diffusion", "Critiques of State-of-the-art", "Fuzzy based Diffusion Coefficient Function for Edge and Impulse", "Low Contrast Image Enhancement by Improved Anisotropic Diff", and "Critical Observations". On the right side, there is a vertical list of participants: Emjee Puthooran, Nafis uddin Khan, Jagpreet Sidhu, and sunil datt sharma. Each name is accompanied by a small video thumbnail and a red mute icon.

**Dr. Nishant Jain** discussed about the fusion of biomedical imaging modalities in the second session.



Third Session was conducted by **Dr. Shruti Jain, Associate Professor**, and she highlighted the area of biomedical engineering, time and frequency characterisation of bio signals and bio signal processing. She also motivated the participants to do the research in this area.



Dr. Harsh Sohal discussed the FPGA based digital signal processing and their implementation in fourth session.

**How Fast is Enough for DSP?**

- It depends!
- **Real time requirements:**
  - Example: data capture speed must match sampling rate. Otherwise, data will be lost.
  - Example: in verbal conversation, delay of response can not exceed 50ms end-to-end.
  - Processing must be done by a specific **deadline**.
  - A constraint on **throughput**.
- Different throughput rates for processing different signals
  - Throughput  $\propto$  sampling rate.
  - CD music: 44.1 kHz
  - Speech: 8-22 kHz
  - Video (depends on frame rate, frame size, etc.) range from 100s kHz to MHz.

Participant avatars: Harsh Sohal, M, S, Y, J, V, a, p, D.

Fifth session & Sixth session were taken by Dr. Sunil Datt Sharma with Mr. Pardeep Garg and they discussed about the importance genomics signal processing in coming era and also discussed the open research research directions in this area.

**sunil datt sharma is presenting**

Class List: pushpendra kumar saimi, sunil datt sharma

Gene: Exon 1, Exon 2, Exon 3, Exon 4, Exon 5

RNA: 1, 2, 3, 4, 5

Alternative splicing

RNA: 1, 2, 3, 4, 5

Translation

Protein A, Protein B, Protein C

Participant avatars: Kumutha D., sunil datt sharma, Jagpreet Sidhu, Prince Subhashish Dwivedi

Session seven was taken by **Dr. Vikas Baghel** and he discussed the fundamentals and evolutionary methods for multi-objective optimization. He also conducted hand-on-session on the same topic in eighth session.

## Definitions

**Domination :**  
One solution is said to dominate another if it is **better in all objectives**.

**Non-Domination [Pareto points] :**  
A solution is said to be non-dominated if it is **better than other solutions in at least one objective**.

- ✓ A dominates B (better in both  $f_1$  and  $f_2$ )
- ✓ A dominates C (same in  $f_2$  but better in  $f_1$ )
- ✓ A does not dominate D (non-dominated points)
- ✓ A and D are in the **"Pareto optimal front"**
- ✓ These non-dominated solutions are called Pareto optimal solutions.
- ✓ This non-dominated (trade-off) curve is said to be **Pareto front**.
- ✓ The concept of optimizing one performance on the cost of other is termed as **Pareto Optimality**.

Jaypee University of Information Technology, Waknaghat

Vikas Baghel

**Dr. Emjee Puthooran** conducted talk and hands on session machine learning using python in ninth and tenth session respectively.

REC

E Emjee Puthooran is presenting

Class List

localhost:8888/notebooks/Desktop/machine-learning-master/notebooks/03.02-Understanding-the-k-NN-Algorithm-Copy1.ipynb

jupyter 03.02-Understanding-the-k-NN-Algorithm-Copy1 Last Checkpoint: an hour ago (autosaved)

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the map, and the second integer as the point's y coordinate. Similarly, let's pick a label for the data point.

```
In [10]: single_label = np.random.randint(0, 2)
single_label
Out[10]: 1
```

Turns out that this data point would have class 0.

Let's wrap this process in a function that takes as input the number of data points to generate (that is, `num_samples`) and the number of features every data point has (that is, `num_features`).

```
In [ ]: def generate_data(num_samples, num_features=2):
    """Randomly generates a number of data points"""
    data_size = (num_samples, num_features)
    train_data = np.random.randint(0, 100, size=data_size)
    labels_size = (num_samples, 1)
    labels = np.random.randint(0, 2, size=labels_size)
    return train_data.astype(np.float32), labels
```

Let's put the function to test and generate an arbitrary number of data points, let's say eleven, whose coordinates are chosen randomly.

```
In [ ]: train_data, labels = generate_data(11)
train_data
```

As we can see from the preceding output, inspect the first data point with its coord...

Emjee Puthooran

Y

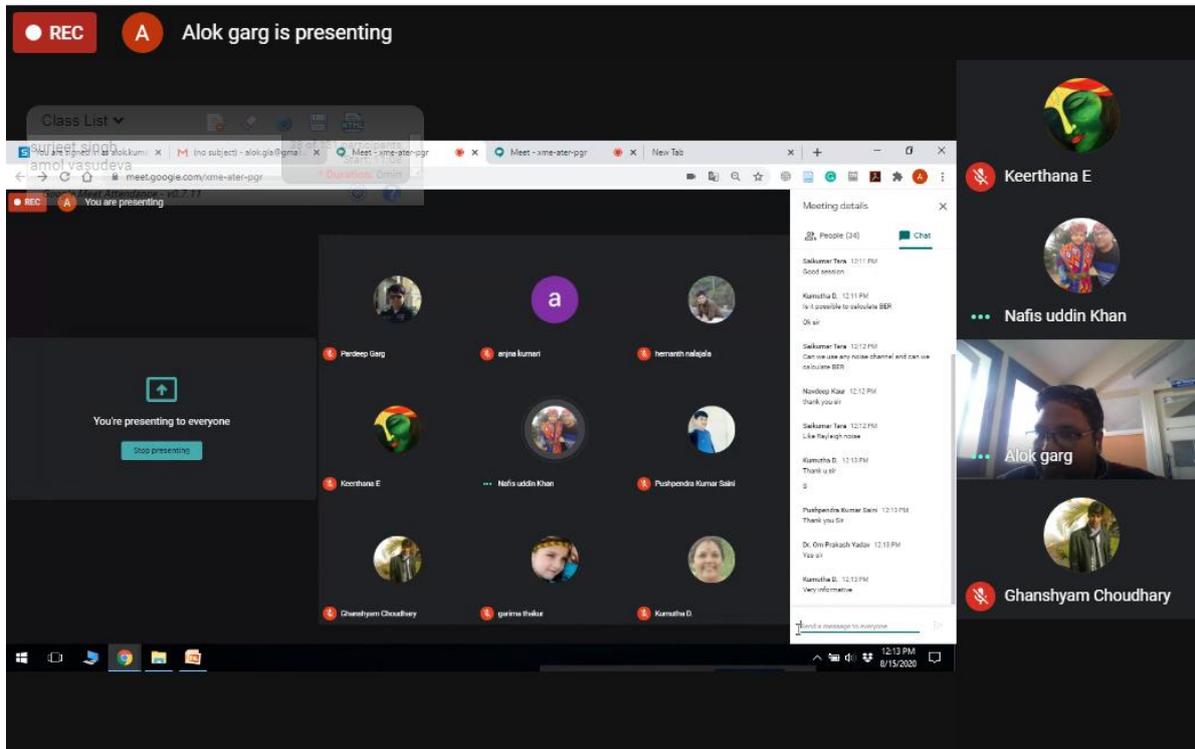
Yugal Kumar

J

Jagpreet Sidhu

Deepnarayan Tripathi

Eleventh session was taken by **Dr. Alok Kumar** on role of threshold in spectrum sensing and he also highlighted on open research directions in this area.



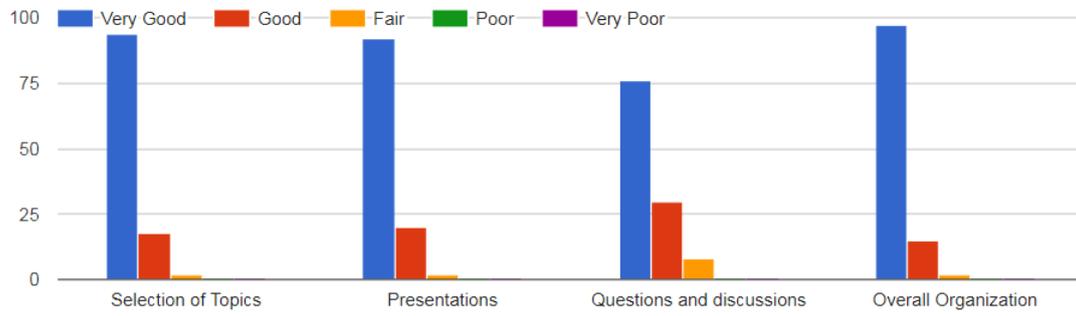
In the last session of the course, queries of the participants were answered by all speakers and suggestions from the participants were taken.

The short term course was concluded with valedictory function. The highlights of the course were given by **Dr. Vikas Baghel**. The valedictory speech was given by **Dr. Nafis U. Khan**. The vote of thanks was given by **Dr. Sunil Datt Sharma**. He highlighted the immense contribution of the Organizing Committee members and experts. He presented a special thanks to **Prof. Vinod Kumar**, Vice–chancellor, **Prof. Samir Dev Gupta**, Dean Research and **Dr. Rajiv Kumar**, Program chair & HoD ECE. He also showed his gratitude towards all speakers for their wonderful talks. He also thanked all the participants who made this event a grand success by participating wholeheartedly.

### **Feedback by Participants:**

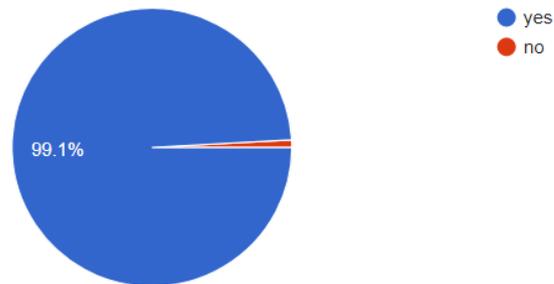
Most participants felt that the correct direction and knowledge for conducting scientific research was obtained in the short term course.

What is your rating of the following aspects of STC?



Did the STC meet your learning and research objectives?

114 responses



What is your overall evaluation of the short term course?

114 responses

