

Report

Expert Lecture

(Session: - 2022-23)

Topic of Talk: Hardware-aware Neural Architecture Search (HW-NAS)

Keynote speaker - Prof. (Dr.) Arun K. Somani, Associate Dean for Research, College of Engineering, Iowa State University, Ames, USA.

Date: - 04/02/2022

Keynote Session Time: 09:00 am - 09:30 am

Link of the Session: - <https://meet.google.com/vsg-jngt-kbh>

No. of Participant:-103

Summary of the keynote session:-

- Prof Somani, has talked about the Hardware-aware Neural Architecture Search.
- He has talked about convolutions operations, manually designed neural networks and designing of neural networks.
- He has talked about pruning & its methods, quantization.
- He has talked about hardwares can be used for deep learning.
- He has emphasized on the neural architecture search – Reinforcement based, evolutionary, DARTS.

Screen Shot of the Session:-

The top screenshot shows a Google Meet session with a presentation slide titled "Hardware-aware Neural Architecture Search (HW-NAS)". The slide content includes:

- Diagram illustrating the transition from Manual Architecture Search to Automatic Architecture Search.
- Text: "Arun Somani, Department of Electrical and Computer Engineering, Iowa State University".
- Text: "The presentation is based on the Ph.D. work of Krishna Teja Chitty-Venkata".

The bottom screenshot shows a Google Meet session with a presentation slide titled "Neural Network Design is Difficult". The slide content includes:

- Diagram illustrating the complexity of neural network design, showing various operations like Convolution, Pooling, and SE modules.
- Text: "4x Convolution and 2x Pooling Operations for above network".

Both screenshots show the Google Meet interface with participants and a "People" list on the right.

Inbox (3,154) - anjali.pandey@si... (5) WhatsApp Meet - vsg-jngt-kbh

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Arun Somani is presenting

Pruning

Pruning Methods:

- Magnitude of DNN Weights
- L-1 Norm
- L-2 Norm

Weight/Irregular Pruning Node/Symmetric Pruning

Pruning Methodology

```
graph TD
    A[Pretrained Neural Network model] --> B[Remove Unimportant Parameters]
    B --> C[Retrain the unpruned weights]
    C --> D{Significant Accuracy Loss?}
    D -- no --> B
    D -- yes --> E[Pruned Model]
```

3:56 PM | vsg-jngt-kbh

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Illustration of NAS

Performance estimation: example

- Search space is a set of candidate neural network architectures.
- Search strategy defines how to explore the search space.
- Performance estimation strategy defines how to estimate/predict the performance of a given neural network architecture in the design space.

```
graph LR
    A[Search Space] --> B[Search Strategy]
    B --> C[architecture AEA]
    C --> D[Performance Estimation Strategy]
    D --> E[Train the model on the target dataset to get accuracy]
```

Neural Architecture Search: A Survey [Ehkan et al., JMLR 2019]

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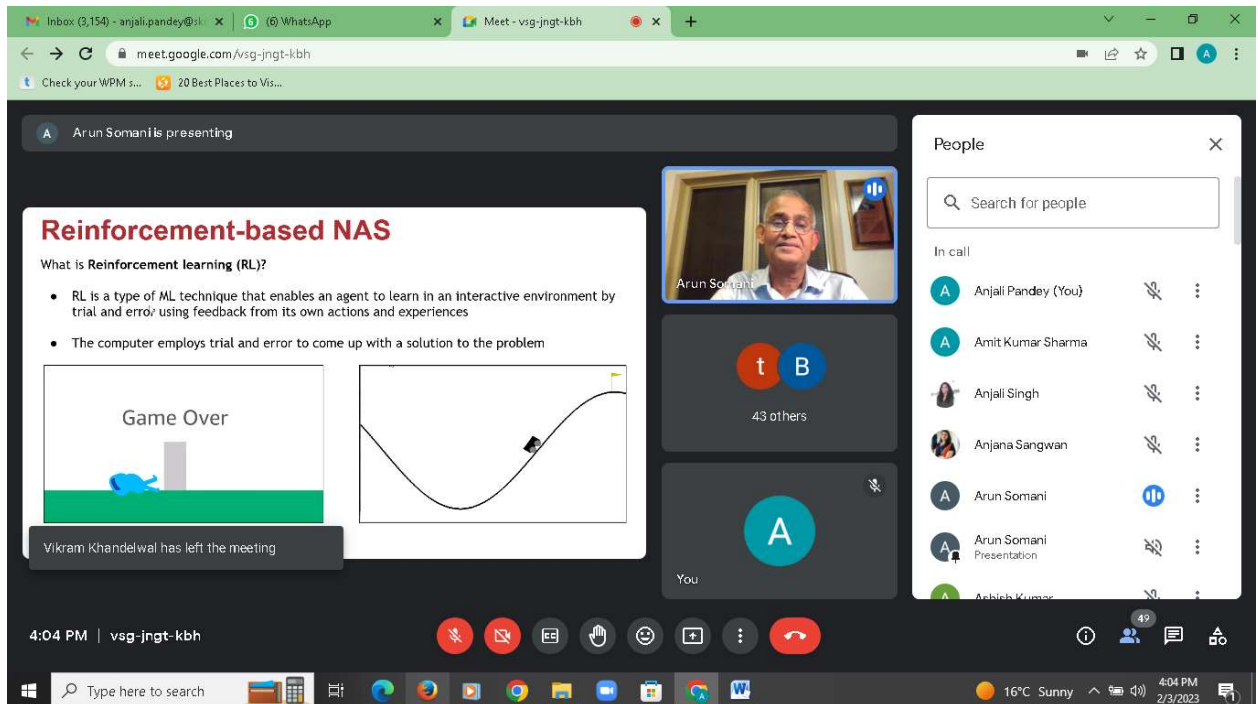
Hardware-aware Neural Architecture Search

- HW-NAS automates the design process to find models with trade-off between accuracy and performance
- Metrics include latency, FLOPs, power consumption, energy, and memory usage, etc.

```
graph LR
    A[Hardware Platform  
• MCU • ASIC  
• CPU • FPGA  
• GPU • ReRAM] --> B[Search Space (SS)  
• Primitives  
• Fixed Search Space  
• HW-aware Search Space]
    B --> C[SS Construction  
• Micro/Cell-based  
• Macro/Layer-wise]
    C --> D[Multi-Objective Search Strategy  
• Reinforcement Learning  
• Evolutionary Algorithms  
• Gradient/Differentiable]
    D --> E[Hardware Metrics  
• Latency, Energy, FLOPs  
• Lookup Table (LUT)  
• Prediction-based]
```

4:01 PM | vsg-jngt-kbh

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GROUP PHOTOGRAPH

