

Hands-on Advanced Deep Machine Learning using Python

ivision Lab of the **Institute of Space Technology (IST)** in collaboration with the **National Electronics Complex of Pakistan (NECOP)** is conducting a hands-on workshop on **Advanced Deep Machine Learning using Python** which will be delivered over 08 sessions in 3 days on **20 -22 December 2021 from 9:30 AM to 04:00 PM PKT**.

Businesses worldwide are using Machine Learning (ML) to solve their greatest challenges. Healthcare professionals use AI to enable more accurate, faster diagnoses. Retail businesses use ML to offer personalized customer shopping experiences. Automakers use it to make personal vehicles, shared mobility, and delivery services safer and more efficient. Deep learning is a powerful AI approach that uses multi-layered artificial neural networks to deliver state-of-the-art accuracy in tasks such as object detection, speech recognition, and language translation. Using deep learning, computers can learn and recognize patterns from data that are considered too complex or subtle for expert-written software.

In this workshop, you'll learn how advanced deep learning works through hands-on exercises. You'll train deep learning models from scratch, learning tools and tricks to achieve highly accurate results. You'll also learn to leverage freely available, state-of-the-art pre-trained models to save time and get your deep learning application up and running quickly. By participating in this workshop, you'll:

- Learn the advanced techniques and tools required to train a deep learning model
- Gain experience with advanced deep learning data types and model architectures
- You'll build, train, and deploy different types of advance deep learning architectures.

The agenda will be as follows:

Day 1

Registration 20-12-2021 (09:30 - 10:00 AM)

- **Session 1** on 20-12-2021: Introduction of Deep Machine Learning (10:00 - 10:30 AM)

- What is DNN vs AI vs ML vs Data Science
- AI applications and success of Deep Learning
- Supervised/Unsupervised/Semi & self-supervised, Reinforcement learning paradigms
- Type of AI systems and Main challenges when designing intelligent systems
- Boosting Industry and Research community with state-of-the-art ML/DL
- Evaluation measures, confusion matrix etc.

- **Session 2** on 20-12-2021: Why and How to use Python (10:30 - 11:00 AM)

- Intro to Python
- Data types, Conditional statements, Loops, Functions
- External packages (numpy, pandas, dataframe etc)
- Lists, Dictionaries.
- Package managers 'pip' and 'conda'
- Project environments, Jupyter notebooks and visual studio code

Running Tea (11:00 - 11:30 AM)



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-Session 3 on 20-12-2021: Journey from Python to Tensorflow(11:30 – 01:00 PM)

- Data representation in tensors, Basic tensor operations
- Loading data from TensorFlow datasets
- Keras API, Designing a model with Keras
- Visualization with Tensorboard

Lunch Break (01:00 – 02:00 PM)

-Session 4 on 20-12-2021: Data Analysis & Preprocessing (02:00 – 03:00 PM)

- Data scraping
- Using the appropriate library for the data representation
- Labeled vs Unlabeled data, Train/validation/test splits, k-fold validation.
- Data visualization to gain insights and Look for correlations
- Data cleaning
- Experimentation with attribute combinations
- Dealing with categorical data
- Feature scaling, Dimensionality reduction techniques
- Custom transformation pipelines



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Day 2

-Session 5 on 21-12-2021: Computer Vision using CovNets (09:00 – 01:00 PM)

- Image classification task
- Acquiring data, Data preprocessing
- Implementing a classifier using Sequential API
- Training and Evaluation, Predictions on test set
- Fine-tuning neural network hyperparameters, The vanishing/exploding gradient problem, Batch normalization
- Tackling with data scarcity with unsupervised pre-training
- Speed up training with fast optimizers, Momentum, AdaGrad and RMSprop
- Techniques to avoid overfitting, Data augmentation, Regularization, Dropout
- Translation invariance, Spatial hierarchies
- Filters, Feature maps, Input padding, Strides, Downsampling with max-pooling
- Project: Building convnet model for image classification & Localization (Object Detection – Yolo v5), Training AI model

RunnnngTea (10:30 – 11:00 AM)

Lunch Break (01:00 – 02:00 PM)

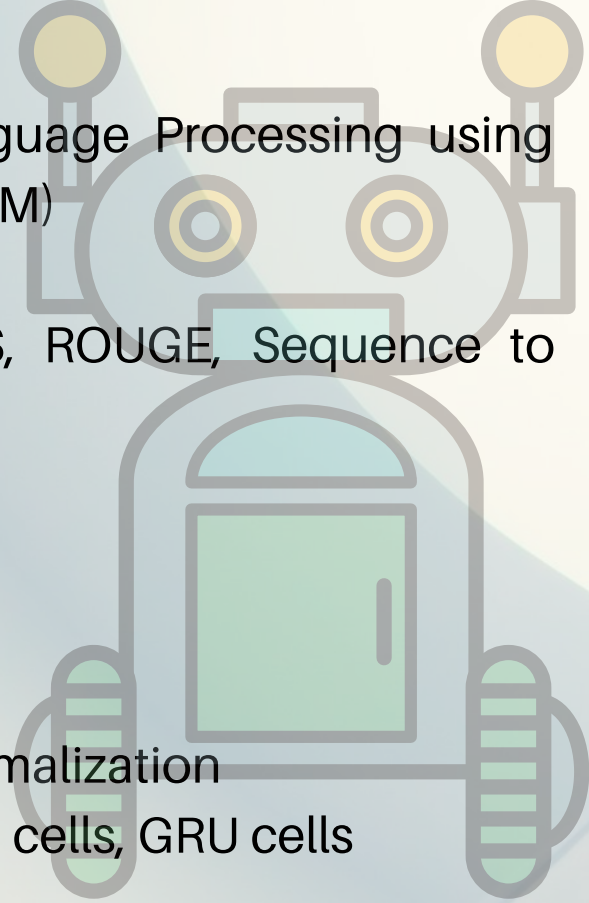
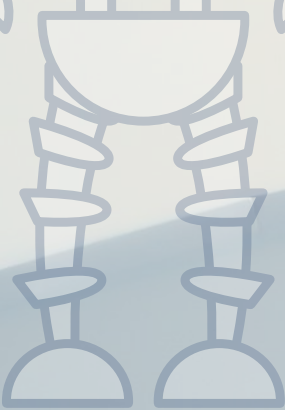


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-**Session 6** on 21-12-2021: Natural Language Processing using Recurrent Neural Network (02:00 – 04:00 PM)

- Recurrent neuron, Memory cell, POS, ROUGE, Sequence to sequence & sequence to a vector
- Training RNNs
- Project: Forecasting a time series
- Baseline metrics
- Deep RNN, Handling long sequences
- Unstable gradients problem, Layer normalization
- Dealing with short term memory, LSTM cells, GRU cells
- Using stateful RNN
- Bidirectional RNNs, Beam search
- Attention mechanism, Transformer network
- Project: Neural machine translation with transformers



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Day 3

-Session 7 on 22-12-2021: Generative Learning Models (09:00 – 01:00 PM)

- Autoencoders, Visualizing reconstructions, Unsupervised pre-training using autoencoders
- Convolutional autoencoders, Denoising autoencoders, Variational autoencoders
- Project: Generating fashion MNIST like images with variational autoencoders
- Generative adversarial networks, Challenges in training GANs, Deep convolutional GANs
- Project: Generating artificial faces with DCGANs
- Conditional GANs, Progressive GANs, StyleGAN

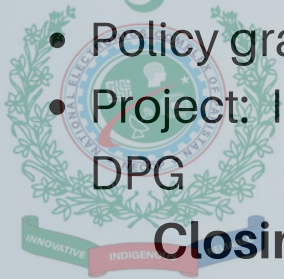
Running Tea (10:30 – 11:00 PM)

Lunch Break (01:00 – 02:00 PM)

-Session 8 on 22-12-2021: Reinforcement Learning (02:00 – 03:30 PM)

- Reward optimization, Policy search
- Brute force approach, Genetic algorithm approach
- Creating an environment for the agent, Simulating environments with Open AI Gym and PyBullet
- Project: CartPole environment and inverse pendulum problem
- Hard coding simple policy for CartPole, Neural network policies, Credit assignment problem
- Value based method, Q learning and DQN
- Policy gradient, DDPG, A2C, A3C
- Project: IoT for smart switch (home automation) using DQN and DPG

Closing & Certificate Distribution (03:30 – 04:00 PM)



Workshop Prerequisites:

Basic understanding of Artificial Intelligence & Machine Learning is assumed.

Workshop Hands-On Sessions:

Every Participant will be given access to a **GPU-accelerated** server on the cloud to do the hands-on exercises.

Completion Certificate:

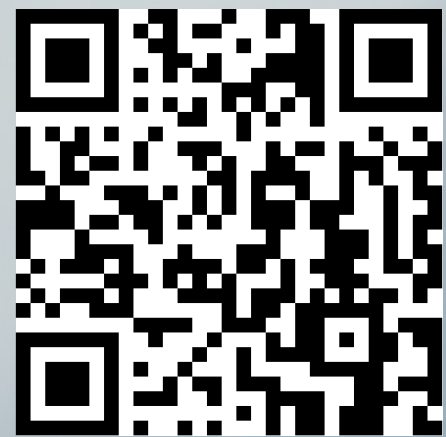
Upon successful completion, participants will receive a certificate and one PEC-approved CPD point to recognize their subject matter competency and support professional career growth.

Resource Person(s):

Dr. Sajid Baloch
Prof. Dr. Khurram Khurshid
Dr. Usman Qayyum
Engr. Muhammad Asad
Danyal Mateen

Contact/Email:

For any queries related to the workshop, please feel free to ask at:
muhammadasad429@gmail.com



Registration

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Resource Person(s):



Dr Sajid Baloch (SI & TI) has 25 Years' experience working in public and international organizations as a Consultant on AI, Chip Design, Machine Learning based Intelligence ICs. He was among few top researchers in UK, who were selected to work with NASA. Currently he is serving in a Public sector organization and holds a position of Directorate General at National Center of Electronics.



Dr Khurram is the founder and director of iVision Lab. He is working as Professor and heading the Electrical Engineering & Computer Science department at IST, Islamabad. He obtained his PhD in Computer Vision from Paris Descartes University, France. He is also one of the founding members of Pakistan Pattern Recognition Society affiliated with IAPR.



Dr. Usman is an experienced researcher, a skilled Artificial Intelligence and Machine vision professional, with a proven track record in the research industry with 17+ years of experience. He did Postdoc on Self Driving Cars. He has a solid experience in AI, Deep Learning. Currently he is working in the National Center of Electronics as Director AI and adjunct faculty member at Institute of Space Technology.



Asad is a lecturer & Researcher in iVision lab at the Institute of Space Technology and an IBM certified Data Scientist. He has a Master's degree in Computer Systems Engineering from GIK Institute. His experience lies in Deep Learning, Data Science & Feature Engineering for the last 5 years.



Daniyal Mateen graduated in 2020 with a bachelors degree in Computer Science and currently in pursuit of MS from National University (FAST). He has been working in National Center for Electronics for the past 08 months. His main areas of interest are AI, deep learning and computer vision.

