Department of Mechanical Engineering

ISTE and IIC Approved
One week Faculty Development Program
On

Hands on Machine Learning using Python

Resource Person: Mr. Rohit Kadam
December 21st to December 29th, 2023
Program Proceedings

Day 1:
Inauguration Ceremony
Time: 10.00am to 10.50am

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Department of Mechanical Engineering has arranged **ISTE and IIC Approved One week Faculty Development Program on "Hands on Machine Learning using Python".** We started our FDP with Inauguration Ceremony Mr B. B. Sangame has done the introduction and welcome of guest Dr S. D. Patil, Convener & HOD, Mechanical Engineering Department has given brief information about the FDP Mr. Rohit Kadam Sir addressed the participants regarding how this FDP will help to get experience on use of python for machine learning. Dr S A Khot, Principal SITCOE addressed FDP with the application part of **"Machine Learning in Mechanical Industries"** Mr. Anil A. Bagane, Executive Director SITCOE motivated participants to take advantage of FDP to develop knowledge regarding Python and machine learning. Followed by vote of thanks by Mr. A. S. N. Husainy

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Day 1:
Python Programming Basics
Time and Content:

10.00am-10.30am	**Inauguration Ceremony**
10:40am-01:00pm	**Programming Basics**
01:45 pm-3:15pm	**Programming Basics**
03:20 pm-04:30pm	**Python Programming Language**

1. **Introduction to Python Programming:**
    Mr. Rohit Kadam sir started his session with introduction to Python programming. In

this introductory session he has referred what is a Computer Program, Programming basics and structure of programming language. A computer program is a set of instructions that is executed by a computer to perform a specific task or achieve a particular goal. It is written in a programming language, which serves as a medium for humans to communicate with computers. Computer programs can range from simple scripts to complex applications and are the foundation of all software that runs on digital devices. He also discussed programming basics involve understanding fundamental concepts like variables, data types, control structures (such as loops and conditionals), functions, and algorithms. These elements collectively form the structure of a programming language. A programming language provides a set of rules and syntax that developers use to write code, enabling them to communicate instructions to a computer effectively.

2. Python Programming Basics:

Sir have given information related to Python as a programming language. Python is a high-level, general-purpose programming language known for its readability, simplicity, and versatility. Guido van Rossum created Python in the late 1980s, and since then, it has gained popularity for its ease of learning and use. Python supports both procedural and object-oriented programming paradigms, making it suitable for a wide range of applications.

Sir also discussed some of the python applications used in various domains due to its flexibility and extensive library support. Some common applications include:

- Web Development: Frameworks like Django and Flask.
- Data Science and Machine Learning: Libraries such as NumPy, Pandas, and TensorFlow.
- Artificial Intelligence: Integration with neural networks and natural language processing.
- Automation and Scripting: Writing scripts for repetitive tasks.
- Scientific Computing: Applications in physics, biology, and other scientific fields.

3. Python Programming Language:

At the last session of day 01 sir discussed and conducted hands on session on the Python ecosystem. It is vast and includes a variety of libraries and frameworks that cater to different needs. Some notable components are:

- **NumPy and Pandas**: For numerical and data analysis.
- **Django and Flask**: Web development frameworks.
- **Matplotlib and Seaborn**: Data visualization libraries.
- **Tensor Flow and PyTorch**: For machine learning and deep learning.
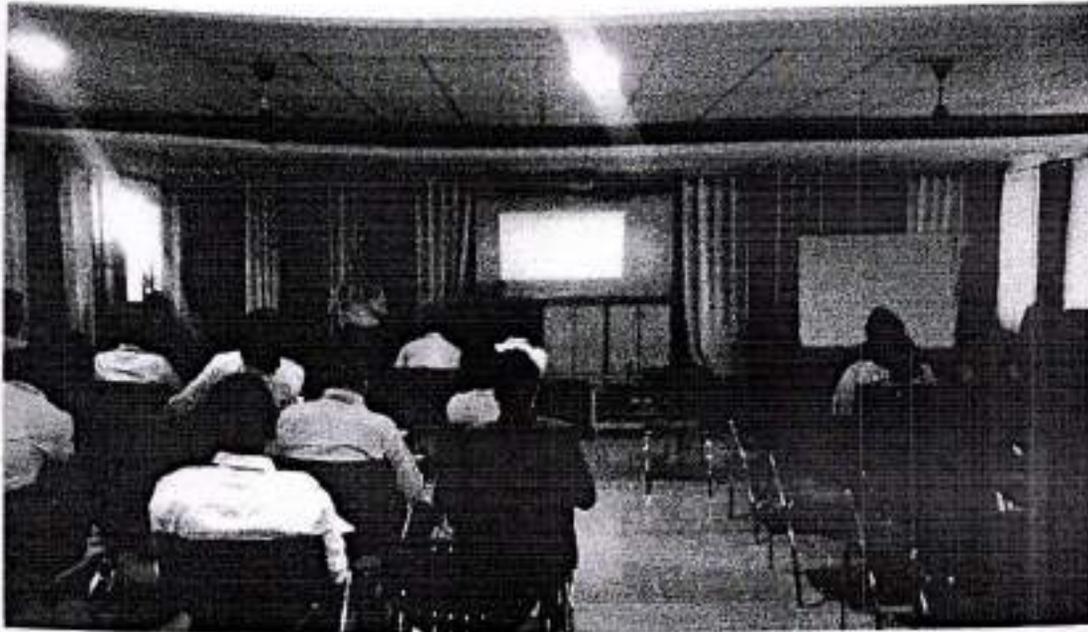
Day 2:
Time: 10:00am-11:30am
      11:45pm to 1:00pm
      02:00pm to 3:15pm
      3.30 pm to 4.30 pm

Content:
1) NumPy Pandas
2) Python for Machine Learning
3) Hands on Python

In day 2 sir conducted sessions on basics of NumPy, Pandas, conditions statements, loops and set operations. The session commenced with an in-depth exploration of NumPy and Pandas, essential libraries in Python for numerical computing and data manipulation, respectively. Participants delved into the creation and manipulation of arrays using NumPy, gaining proficiency in fundamental operations and array-based computations. Subsequently, the focus shifted towards Pandas, where attendees learned to employ Series and Data Frames for data organization, cleaning, and analysis. The second segment delved into the application of Python for Machine Learning, elucidating the role of libraries like Scikit-Learn in implementing various algorithms. Participants were exposed to the workflow of model building, training, and evaluation using Python's ML ecosystem. The culmination of the day two session involved hands-on Python exercises, providing attendees with practical experience in implementing machine learning concepts and reinforcing their understanding of NumPy, Pandas, and the broader Python ecosystem for data science and machine learning.

As this session was completely hands on session it was arranged in Computer lab and participants got the hands on experience of Python programming operations. Most of the participants were new to this Python programming, they faced some challenges regarding the

same, but sir solved all their doubts. All the participants got hands on experience on this.

Day 3:

Time: 10:00am-11:30am
11:45pm to 1:00pm
02:00pm to 3:15pm
3.30 pm to 4.30 pm

Content:
1) Introduction to Data collection techniques and Pre-processing
2) Visualizations using Seaborn and Matplot Lib.
3) Introduction to Scikit-Learn
4) Hands on Programming Exercises on Above Concepts.

Day three has started with introduction to data collection techniques, data Pre-processing and visualization using Seaborn and Matplot Lib. The session commenced with a comprehensive overview of data collection techniques and pre-processing, emphasizing the importance of obtaining clean and relevant data for effective analysis. Participants learned various methods such as web scraping, API usage, and dataset exploration to collect and preprocess data.

The second segment focused on enhancing data interpretation through visualizations using Seaborn and Matplotlib. Attendees gained insights into creating compelling and informative visual representations, leveraging these libraries for diverse plots and charts. Following this, the session introduced Scikit-Learn, a powerful machine learning library in Python. The exploration covered fundamental concepts, key functionalities, and its role in implementing various machine learning algorithms.

The session culminated with hands-on programming exercises, allowing participants

to apply the acquired knowledge in practical scenarios. This interactive component provided valuable experience in data manipulation, visualization, and machine learning implementation, fostering a well-rounded understanding of the discussed concepts.

Day 4:

Time: 10:00am-11:30am
11:45pm to 1:00pm
02:00pm to 3:15pm
3.30 pm to 4.30 pm

Content:

1) Machine Learning Work Flow
2) Supervised Learning with Examples
3) Unsupervised Learning
4) Concepts of Virtual Environments.

The training session provided a solid foundation in machine learning, guiding participants through the intricacies of the machine learning workflow. It clarified the distinctions and common misconceptions between machine learning, deep learning, and artificial intelligence, offering a comprehensive understanding of each concept. Emphasis was placed on a problem-solving approach, equipping participants with strategies to tackle real-world challenges. The session delved into supervised learning, elucidating key algorithms with illustrative examples that showcased their practical applications. Participants also gained insights into unsupervised learning techniques, exploring clustering and dimensionality reduction. The workshop further introduced Anaconda Navigator, a powerful tool for managing Python environments and packages, while discussing the significance of virtual environments in isolating project dependencies and ensuring reproducibility. This

holistic approach provided attendees with a well-rounded comprehension of machine learning concepts, practical applications, and the necessary tools for effective implementation in diverse scenarios.

Day 5:

Time: 10:00am-11:30am
11:45pm to 1:00pm
02:00pm to 3:15pm
3.30 pm to 4.30 pm

Content:

1) Machine Learning Models - Regression Models
2) Decision Tree
3) SVM and Bayesian Learning
4) Hands on Basic Examples Programming exercise on the Machine Learning Applications.

The training session on machine learning models was a comprehensive exploration of various techniques, beginning with regression models for predicting numerical outcomes and addressing task problems. Participants were introduced to classification models, with a detailed focus on decision trees, providing a clear understanding of their structure and application. The session delved into instance-based learning, illustrating its principles through practical examples. Theoretical discussions on Support Vector Machines (SVM) and Bayesian learning enriched participants' understanding of these complex algorithms. Ensemble learning, a powerful technique combining multiple models for improved accuracy, was thoroughly covered. The session also delved into unsupervised learning methods,

covering clustering and dimensionality reduction. The practical application of these concepts was reinforced through basic programming exercises, enabling participants to implement machine learning models in Python and gaining hands-on experience in solving real-world problems. The session successfully provided a robust overview of machine learning models, ensuring participants were equipped with both theoretical knowledge and practical skills.

Day 6:

Time: 10:00am-11:30am
11:45pm to 1:00pm
02:00pm to 3:15pm
3.30 pm to 4.30 pm

Content:

1. Task on Development and Machine Learning application hands on with the concepts learning.

The hands-on session on development and machine learning applications was a pivotal component of the FDP program, providing participants with a practical platform to apply the concepts they had learned. The session commenced with a task-oriented approach, where participants engaged in the development of real-world applications integrating machine learning. This involved translating theoretical knowledge into practical skills, fostering a deeper understanding of the intricacies of model implementation, feature engineering, and overall project development. The participants were guided through the entire development lifecycle, from data preprocessing and model training to evaluation and deployment strategies.

To reinforce the practical application of machine learning concepts, the session featured two case examples. One case example on development of machine learning model for detection of type of plant from inputs petal length and petal width data. And second one on detection of operation from various 3D printer input parameters.

These real-world scenarios allowed participants to tackle authentic problems, emphasizing the importance of selecting appropriate algorithms, fine-tuning model parameters, and interpreting results. The case studies not only served as exercises in critical thinking and problem-solving but also provided valuable insights into the challenges and considerations inherent in deploying machine learning solutions. Overall, this hands-on segment enriched the learning experience, empowering participants with the skills and confidence to approach real-world problems in the field of development and machine learning.

Day 7:

Time: 10:00am-11:30am
11:45pm to 1:00pm
02:00pm to 3:15pm
3.30 pm to 4.30 pm

Content:

1) Introduction to Deep Learning and Artificial Computational Intelligence
2) Hands on Computer Vision Project
3) Hardware's used in machine learning's
4) Conclusion with valedictory function

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The training session commenced with a comprehensive introduction to Deep Learning and Artificial Computational Intelligence, elucidating the fundamental concepts underpinning these advanced fields. Participants gained insights into the broader landscape of artificial intelligence, exploring the intricacies of machine learning and deep learning techniques. A significant portion of the session was dedicated to computer vision, a key application area within AI, providing participants with a profound understanding of how machines interpret and process visual information. The discussion extended to Open-CV, a powerful computer vision library, where participants delved into its functions, focusing on topics such as edge detection and color detection. Practical hands-on exercises allowed participants to apply Open-CV functions in a real-world context, enhancing their skills in image processing and computer vision. The roadmap for further study provided participants with guidance on advancing their skills in deep learning, AI, and computer vision.

Machine learning applications often require specialized hardware to handle the computational demands associated with training and deploying complex models. Graphics Processing Units (GPUs) have become a cornerstone in machine learning hardware due to their parallel processing capabilities, significantly accelerating training times for neural networks. Tensor Processing Units (TPUs), designed by Google, focus specifically on deep learning tasks and excel at processing tensor operations, making them particularly efficient

for machine learning workloads. Additionally, Field-Programmable Gate Arrays (FPGAs) offer customizable hardware that can be tailored to specific machine learning tasks, providing flexibility and energy efficiency. The choice of hardware depends on factors such as the scale of the machine learning task, the nature of the algorithms involved, and considerations related to power efficiency and cost. As the field continues to evolve, advancements in hardware technologies play a crucial role in pushing the boundaries of what machine learning systems can achieve.

The training concluded by emphasizing the integral role these technologies play in the rapidly evolving landscape of artificial intelligence, encouraging participants to continue exploring and applying their knowledge in innovative ways.

Valedictory Function:

Following the preceding sessions, we moved to the valedictory function in the esteemed presence of Honorable Mr. Anil A. Bagane, Executive Director of SITCOE, Dr. S. A. Khot, Principal of SITCOE, and Dr. S. D Patil, Head of the Mechanical Department and Convenor of the FDP. Dr. S. D. Patil provided an introduction to the guest, emphasizing advancements in technology expected in the coming years and effective teaching-learning practices. He offered insights into the ongoing activities at Sharad Institute of Technology College of Engineering. Mr. Anil A. Bagane, Executive Director of SITCOE, highlighted the evolving role of engineers in education, emphasizing the importance of faculty staying updated to meet industry needs. He appreciated Mr. Rohit Kadam for conducting the FDP and encouraged participants to engage in such workshops for self-development. During the valedictory function, participants shared valuable feedback on their seven-day FDP experience, and Mr. A. S. N. Husainy conveyed the vote of thanks.

OUTCOME:

The Hands-On Machine Learning using Python FDP culminated with participants gaining a profound understanding of machine learning concepts and practical skills in Python. Participants developed a strong foundation in implementing machine learning models, understanding the nuances of data preprocessing, and exploring the intricacies of various algorithms. The program fostered a collaborative learning environment, allowing faculty members to engage in hands-on exercises and real-world projects. By the end of the program, participants were equipped with the knowledge and confidence to integrate machine learning into their teaching curriculum, apply machine learning to projects, and preparing the next generation of learners for the evolving landscape of technology.
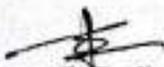
Dr. Suyog S. Patil
FDP Coordinator
Mechanical Engineering Department

Dr. Sagar D. Patil
Convener, and Head
Mechanical Engineering Department

Sharad Institute of Technology College of Engineering

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Department of Mechanical Engineering

One week Faculty Development Program on "Hands on Machine Learning using Python" approved by "Indian Society for Technical Education (ISTE) and Institution's Innovation Council (IIC)"

List of Participants

Sr. No.	Name of Participant	Name of Institute/Employer	ISTE Membership Number	Amount to be paid to ISTE for Certificate (Including GST)
1	Dr. S. D. Patil	SITCOE, Yadrav	LM 94955	Rs.118/-
2	Dr. V. V. Patil	SITCOE, Yadrav	LM 108877	Rs.118/-
3	Dr.A.M. Takale	SITCOE, Yadrav	LM 94946	Rs.118/-
4	Dr. P. M. Bhagwat	SITCOE, Yadrav	LM136333	Rs.118/-
5	Dr. M.M. Khade	SITCOE, Yadrav	LM 66268	Rs.118/-
6	Dr. S. S. Patil	SITCOE, Yadrav	LM 136302	Rs.118/-
7	Mr. S.M.Ghanvat	SITCOE, Yadrav	LM 108879	Rs.118/-
8	Mr.A.S. N.Husainy	SITCOE, Yadrav	LM136304	Rs.118/-
9	Mr. U. S. Patil	SITCOE, Yadrav	LM 108881	Rs.118/-
10	Mr. S.V.Kumbhar	SITCOE, Yadrav	LM 108883	Rs.118/-
11	Mr.B. B.Sangame	SITCOE, Yadrav	LM 94953	Rs.118/-
12	Mr. S P.Udgave	SITCOE, Yadrav	LM 94950	Rs.118/-
13	Mr.S.B. Kamble	SITCOE, Yadrav	LM136320	Rs.118/-
14	Ms.V.S.Patil	SITCOE, Yadrav	LM 136570	Rs.118/-
15	Mr.P. J. Patil	SITCOE, Yadrav	LM 104627	Rs.118/-
16	Mr.A.A.Desai	SITCOE, Yadrav	LM 94931	Rs.118/-
17	Ms. S. S. Halunde	SITCOE, Yadrav	LM 136217	Rs.118/-

Dr. S. S. Patil
FDP CO-ORDINATOR

Dr. S. D. Patil
CONVENER, FDP