



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
410255: Laboratory Practice V

Teaching Scheme: Practical: 2 Hours/Week	Credit 01	Examination Scheme Term Work: 50 Marks Practical: 50 Marks
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Companion Course: High Performance Computing (410250), Deep Learning(410251)

Course Objectives:

- To understand and implement searching and sorting algorithms.
- To learn the fundamentals of GPU Computing in the CUDA environment.
- To illustrate the concepts of Artificial Intelligence/Machine Learning (AI/ML).
- To understand Hardware acceleration.
- To implement different deep learning models.

Course Outcomes:

- CO1: Analyze and measure** performance of sequential and parallel algorithms.
CO2: Design and Implement solutions for multicore/Distributed/parallel environment.
CO3: Identify and apply the suitable algorithms to solve AI/ML problems.
CO4: Apply the technique of Deep Neural network for implementing Linear regression and classification.
CO5: Apply the technique of Convolution (CNN) for implementing Deep Learning models.
CO6: Design and develop Recurrent Neural Network (RNN) for prediction.

Guidelines for Instructor's Manual

Laboratory Practice V is for practical hands on for core courses High Performance Computing and Data Learning. The instructor's manual is to be developed as a hands-on resource and as ready reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction and Assessment guidelines, topics under consideration-concept, objectives, outcomes, set of typical applications/assignments/ guidelines, references among others.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal may

consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, Algorithm/Database design, test cases, conclusion/analysis). Program codes with sample output of all performed assignments are to be submitted as softcopy.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness reserving weightage for successful mini-project completion and related documentation.

Guidelines for Practical Examination

- Both internal and external examiners should jointly frame suitable problem statements for practical examination based on the term work completed.
- During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement.
- The supplementary and relevant questions may be asked at the time of evaluation to test the student's for advanced learning, understanding of the fundamentals, effective and efficient implementation.
- Encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising boost to the student's academics.

Guidelines for Laboratory Conduction

- List of recommended programming assignments and sample mini-projects is provided for reference.
- Referring these, Course Teacher or Lab Instructor may frame the assignments/mini-project by understanding the prerequisites, technological aspects, utility and recent trends related to the respective courses.
- Preferably there should be multiple sets of assignments/mini-project and distribute among batches of students.
- Real world problems/application based assignments/mini-projects create interest among learners serving as foundation for future research or startup of business projects.
- Mini-project can be completed in group of 2 to 3 students.

- Software Engineering approach with proper documentation is to be strictly followed.
- Use of open source software is to be encouraged.
- Instructor may also set one assignment or mini-project that is suitable to respective course beyond the scope of syllabus.

Operating System recommended :- 64-bit Open source Linux or its derivative

Programming Languages: Object Oriented Languages

C++/JAVA/PYTHON/R

Programming tools recommended: Front End: Java/Perl/PHP/Python/Ruby/.net, Backend :

MongoDB/MYSQL/Oracle, Database Connectivity : ODBC/JDBC

Suggested List of Laboratory Experiments/Assignments

410250 : High Performance Computing

Any 4 Assignments and 1 Mini Project are Mandatory

Group 1

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|----|---|
| 1. | Design and implement Parallel Breadth First Search and Depth First Search based on existing algorithms using OpenMP. Use a Tree or an undirected graph for BFS and DFS . |
| 2. | Write a program to implement Parallel Bubble Sort and Merge sort using OpenMP. Use existing algorithms and measure the performance of sequential and parallel algorithms. |
| 3. | Implement Min, Max, Sum and Average operations using Parallel Reduction. |
| 4. | Write a CUDA Program for : <ol style="list-style-type: none"> 1. Addition of two large vectors 2. Matrix Multiplication using CUDA C |
| 5. | Implement HPC application for AI/ML domain. |

Group 2

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|----|--|
| 6. | Mini Project: Evaluate performance enhancement of parallel Quicksort Algorithm using MPI |
| 7. | Mini Project: Implement Huffman Encoding on GPU |
| 8. | Mini Project: Implement Parallelization of Database Query optimization |
| 9. | Mini Project: Implement Non-Serial Polyadic Dynamic Programming with GPU Parallelization |

410251 : Deep Learning

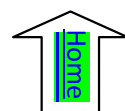
Any 3 Assignments and 1 Mini Project are Mandatory

Group 1

1.	Linear regression by using Deep Neural network: Implement Boston housing price prediction problem by Linear regression using Deep Neural network. Use Boston House price prediction dataset.
2.	Classification using Deep neural network (Any One from the following) <ol style="list-style-type: none"> 1. Multiclass classification using Deep Neural Networks: Example: Use the OCR letter recognition dataset https://archive.ics.uci.edu/ml/datasets/letter+recognition 2. Binary classification using Deep Neural Networks Example: Classify movie reviews into "positive" reviews and "negative" reviews, just based on the text content of the reviews. Use IMDB dataset
3.	Convolutional neural network (CNN) (Any One from the following) <ul style="list-style-type: none"> • Use any dataset of plant disease and design a plant disease detection system using CNN. • Use MNIST Fashion Dataset and create a classifier to classify fashion clothing into categories.
4.	Recurrent neural network (RNN) Use the Google stock prices dataset and design a time series analysis and prediction system using RNN.
Group 2	
5.	Mini Project: Human Face Recognition
6.	Mini Project: Gender and Age Detection: predict if a person is a male or female and also their age
7.	Mini Project: Colorizing Old B&W Images: color old black and white images to colorful images

@The CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	1	1	-	2	1	-	-	-	-	-
CO2	1	2	1	-	-	1	-	-	-	-	-	1
CO3	-	1	1	1	1	1	-	-	-	-	-	-
CO4	3	3	3	-	3	-	-	-	-	-	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-
CO6	3	3	3	3	3	-	-	-	-	-	-	-
CO7	3	3	3	3	3		-	-	-	-	-	-



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
410256: Laboratory Practice VI

Teaching Scheme:
Practical: 2 Hours/Week

Credit
01

Examination Scheme :
Term Work: 50 Marks

Companion Course: Elective V (410252), Elective VI(410253)

Course Objectives:

- To understand the fundamental concepts and techniques of natural language processing (NLP)
- To understand Digital Image Processing Concepts
- To learn the fundamentals of software defined networks
- Explore the knowledge of adaptive filtering and Multi-rate DSP
- To be familiar with the various application areas of soft computing.
- To introduce the concepts and components of Business Intelligence (BI)
- To study Quantum Algorithms and apply these to develop hybrid solutions

Course Outcomes:

On completion of this course, the students will be able to

CO1: Apply basic principles of elective subjects to problem solving and modeling.

CO2: Use tools and techniques in the area of software development to build mini projects

CO3: Design and develop applications on subjects of their choice.

CO4: Generate and manage deployment, administration & security.

Guidelines for Instructor's Manual

List of recommended programming assignments and sample mini-projects is provided for reference. Referring to these, Course Teacher or Lab Instructor may frame the assignments/mini-project by understanding the prerequisites, technological aspects, utility and recent trends related to the respective courses. Preferably there should be multiple sets of assignments/mini-project and distributed among batches of students. Real world problems/application based assignments/mini-projects create interest among learners serving as foundation for future research or startup of business projects. Mini-project can be completed in group of 2 to 3 students. Software Engineering approach with proper documentation is to be strictly followed. Use of open source software is to be encouraged. Instructor may also set one assignment or mini-project that is suitable to the respective course beyond the scope of syllabus.

Operating System recommended: - 64-bit Open source Linux or its derivative **Programming**

Languages: C++/JAVA/PYTHON/R

Programming tools recommended: Front End: Java/Perl/PHP/Python/Ruby/.net, **Backend:**

MongoDB/MYSQL/Oracle, Database Connectivity: ODBC/JDBC, **Additional Tools:** Octave, Matlab, WEKA, powerBI

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by students in the form of a journal. Journal may consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory- Concept in brief, Algorithm/Database design, test cases, conclusion/analysis). Program codes with sample output of all performed assignments are to be submitted as softcopy.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of digital storage media/DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab Home Faculty of Engineering Savitribai Phule Pune University

Syllabus for Fourth Year of Computer Engineering assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness reserving weightage for successful mini-project completion and related documentation.

Guidelines for Practical Examination

It is recommended to conduct examination based on Mini-Project(s) Demonstration and related skill learned. Team of 2 to 3 students may work on mini-project. During the assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation and software engineering approach followed. The supplementary and relevant questions may be asked at the time of evaluation to test the student's for advanced learning, understanding, effective and efficient implementation and demonstration skills. Encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So adhering to these principles will consummate our team efforts to the promising start of the student's academics.

Guidelines for Laboratory Conduction

The instructor's manual is to be developed as a hands-on resource and as ready reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), University syllabus, conduction and Assessment guidelines, topics under consideration- concept, objectives, outcomes, set of typical applications/assignments/ guidelines, references among others.

Recommended / Sample set of assignments and mini projects for reference for four courses offered for Elective III and for four courses offered for Elective IV. Respective Student has to complete laboratory work for elective III and IV that he/she has opted.

410252(A): Natural Language Processing

Any 5 Assignments and 1 Mini Project are mandatory

Group 1	
1.	Perform tokenization (Whitespace, Punctuation-based, Treebank, Tweet, MWE) using NLTK library. Use porter stemmer and snowball stemmer for stemming. Use any technique for lemmatization. Input / Dataset –use any sample sentence
2	Perform bag-of-words approach (count occurrence, normalized count occurrence), TF-IDF on data. Create embeddings using Word2Vec. Dataset to be used: https://www.kaggle.com/datasets/CooperUnion/cardataset
3	Perform text cleaning, perform lemmatization (any method), remove stop words (any method), label encoding. Create representations using TF-IDF. Save outputs. Dataset: https://github.com/PICT-NLP/BE-NLP-Elective/blob/main/3-Preprocessing/News_dataset.pickle
4	Create a transformer from scratch using the Pytorch library
5	Morphology is the study of the way words are built up from smaller meaning bearing units. Study and understand the concepts of morphology by the use of add delete table
Group 2	
6	Mini Project (Fine tune transformers on your preferred task) Finetune a pretrained transformer for any of the following tasks on any relevant dataset of your choice: <ul style="list-style-type: none"> • Neural Machine Translation • Classification • Summarization
7	Mini Project - POS Taggers For Indian Languages
8	Mini Project -Feature Extraction using seven moment variants
9	Mini Project -Feature Extraction using Zernike Moments
Virtual Lab: https://nlp-iiith.vlabs.ac.in/	
410252(B) Image Processing	
Any 5 Assignments and 1 Mini Project are mandatory	
Group 1	
Programming language: Python/C/C++ using OpenCV	

Mini Project: Handwritten digits recognition
Mini Project: Bank loan approval decision-making system
Mini Project: Stock market prediction
Mini Project: Unemployment prediction
Mini Project: Spoken words recognition, for example, "on"/"off"; "yes"/"no"; "stop"/ "go."
Mini Project: Loan approval

410253(C) : Business Intelligence

Any 5 Assignments and 1 Mini Project are mandatory

Group 1

1	Import the legacy data from different sources such as (Excel , Sql Server, Oracle etc.) and load in the target system. (You can download sample database such as Adventure works, Northwind, foodmart etc.)
2	Perform the Extraction Transformation and Loading (ETL) process to construct the database in the Sql server.
3	Create the cube with suitable dimension and fact tables based on ROLAP, MOLAP and HOLAP model.
4	Import the data warehouse data in Microsoft Excel and create the Pivot table and Pivot Chart
5	Perform the data classification using classification algorithm. Or Perform the data clustering using clustering algorithm.

Group 2

6	Mini Project: Each group of 4 Students (max) assigned one case study for this; A BI report must be prepared outlining the following steps: a) Problem definition, identifying which data mining task is needed. b) Identify and use a standard data mining dataset available for the problem.
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410253(D):Quantum Computing

Any 4 Assignments and 1 Mini Project are mandatory

Group 1

1	Analyze simple states of superposition and the effect of doing the measurement in different basis states .
2	Build simple quantum circuits with single and two-qubit gates
3	Install Setup for running quantum programs on IBM machines.