

Lab assignment-1

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B.E Comp-II

DL Lab

Aim:- Implement Boston housing price prediction problem by Linear regression using Deep Neural Network
Use Boston house price prediction Dataset.

Theory :-

Linear Regression

It aims to model the relationship between a dependent variable and one or more independent variables.

In deep learning, Linear regression is used as a basic building block for more complex models and also as a component of more complex model.

In Neural networks, Linear Regression can be used as a way to combine inputs features to generate a single output.

A linear regression neural network takes in a vector of input features multiplies each feature by a weight, adds up the weighted inputs, & then passes the result through the result through linear activation function to obtain predicted value of dependent variable mathematically as,

$$y = w_1x_1 + w_2x_2 + \dots + w_nx_n$$

The goal is to find values of the weights + bias term that minimize the difference between predicted values & actual values of dependent variables.

This is achieved by using a loss function such as MSE.

* Algorithm -

Step 1 :- Import all the python libraries required.

Step 2 : Load the dataset & split it into target and dependent variables

Step 3 :- find the correlation between the Variables

Step 4 :- Split the data into training & test dataset

Step 5 : Initialize the linear sequential model and use custom optimizers and learning rate as well as loss function.

Step 6 : Compare predicted outputs with the actual values using scatterplot

Conclusions - Hence, we've predicted boston housing problem using Linear Regression.

Lab Assignment -2

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B.E Comp-II

DL Lab

Aim : classification using Deep Neural network : Binary classification using Deep Neural Networks : classify movie reviews into "positive" reviews and "negative" reviews, just based on the text context of the reviews.
Use IMDB dataset.

Theory:

Binary classification :

Binary classification is a type of machine learning problem where the task is to classify data into two categories.

In this practical assignment we will use Deep Neural Networks to perform binary classification of movie reviews based on their text context.

Deep neural networks are a type of machine learning model that are capable of learning complex patterns of data.

Algorithm:-

Step 1 : Start

Step 2 : Import IMDB dataset from keras.dataset

Step 3: Load the dictionary mappings from word to integer index and reverse the word index to map integer indexes to their respective words.

Step 4: Decode the review, mappings integer indices to words.

Step 5: Create an all zero matrix of shape (len(sequences)) and sets specific indices of results[i] to 1s.

Step 6: Initialize model Linear-sequential model using 'relu' activation and 'sigmoid' activation function.

Step 7: Fit the model into training & validation functions

Step 8: Calculate the training & validation loss and calculate MAE.

Step 9: Save the prediction into a file using ann_visualizer

Conclusion:- Hence, we've classified the movie 'reviews' into 'positive' & 'negative' reviews just based on the text.

PL Lab assignment 3.

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B.E comp-II

DL Lab

Aim : Use MNIST fashion dataset & create a classifier to classify fashion clothing into categories.

Theory:

Convolutional Neural Network (CNN):

It is a type of neural network commonly used in deep learning for image classification & segmentation tasks. The architecture of CNN is designed to hierarchical of features from input images.

In CNN, the input image is first passed through a series of convolutional layers, each of which applies a set of filters to input image to extract features of different spatial network scales.

Finally, the output of the last pooling layers is passed through one or more fully connected layers which perform classification or regression based on the learned features.

Algorithm:-

Step 1: Start

Step 2: Load the dataset and labels from keras.

Step 3: ~~Start~~ Preprocess the data as the values fall in the range of 0 to 255 and scale it to 0-1 before feeding them to the neural network model.

Step 4: Initialize Sequential model using 'relu' activation function.

Step 5: Use Adam optimizer and Sparse Categorical Crossentropy to calculate the loss function.

Step 6: Use metrics to validate the accuracy of the model.

Step 7: Save the model and use the trained model to make a prediction about a single image:

Conclusion:- Hence, we've successfully classified fashion clothing into various categories using deep learning.

HPC Lab- Assignment-1

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B.E Comp-II

HPC Lab

- Aim:- Design and implement parallel breadth first search and depth first search based on existing algorithm using openMP. Use a tree or an undirected graph for BFS and DFS.
- Theory:-
- BFS :-

It is a graph traversal algorithm that starts traversing the graph from the root node and explores all the neighbouring nodes.

Then, it selects the nearest node & explores all the ^{unexplored} neighbouring nodes.

It is a recursive algorithm to search all the vertices of a tree or graph data structure.

- DFS:-

It is a recursive algorithm to search all the vertices of a tree data structure or a graph.

The DFS algorithm starts with the initial node of Graph G and goes deeper until we find the goal node or the node with no children.

Because of the recursive nature, stack is used to implement DFS.

- Steps for searching :

In parallel BFS:

Step 1: start with the root node, mark it visited.

Step 2: As the root node has no node in same level, go to the next level.

Step 3: visit all the adjacent node & mark them visited.

Step 4: Go to the next node level 8)
visit all the unvisited nodes.

Step 5: Continue this process until all the nodes are visited or ~~found in~~
~~the required element is found~~.

- In parallel DFS:

Step 1: consider a node (root node) that is not visited previously and mark it visited.

Step 2: visit the first adjacent successor node and mark it.

Step 3: follow the successor node and see if it doesn't have any more successor node.

Conclusion:-

Hence, we successfully studied 8)
Implemented parallel first search 8)
Parallel Depth first search.

HPC lab- assignment -2

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B.E Comp-II

HPC Lab.

- Aim:- Write a program to implement parallel bubble sort & merge sort using OpenMP.
Use existing algorithm & measure the performance of sequential & parallel algorithm.
- Theory:-
- Parallel bubble sort:-

It is implemented as a pipeline.

let localsize=n
no process we divide the array in no. process parts and each process executes the bubble sort on its part including comparing, the last element with the first are belonging to the next thread.

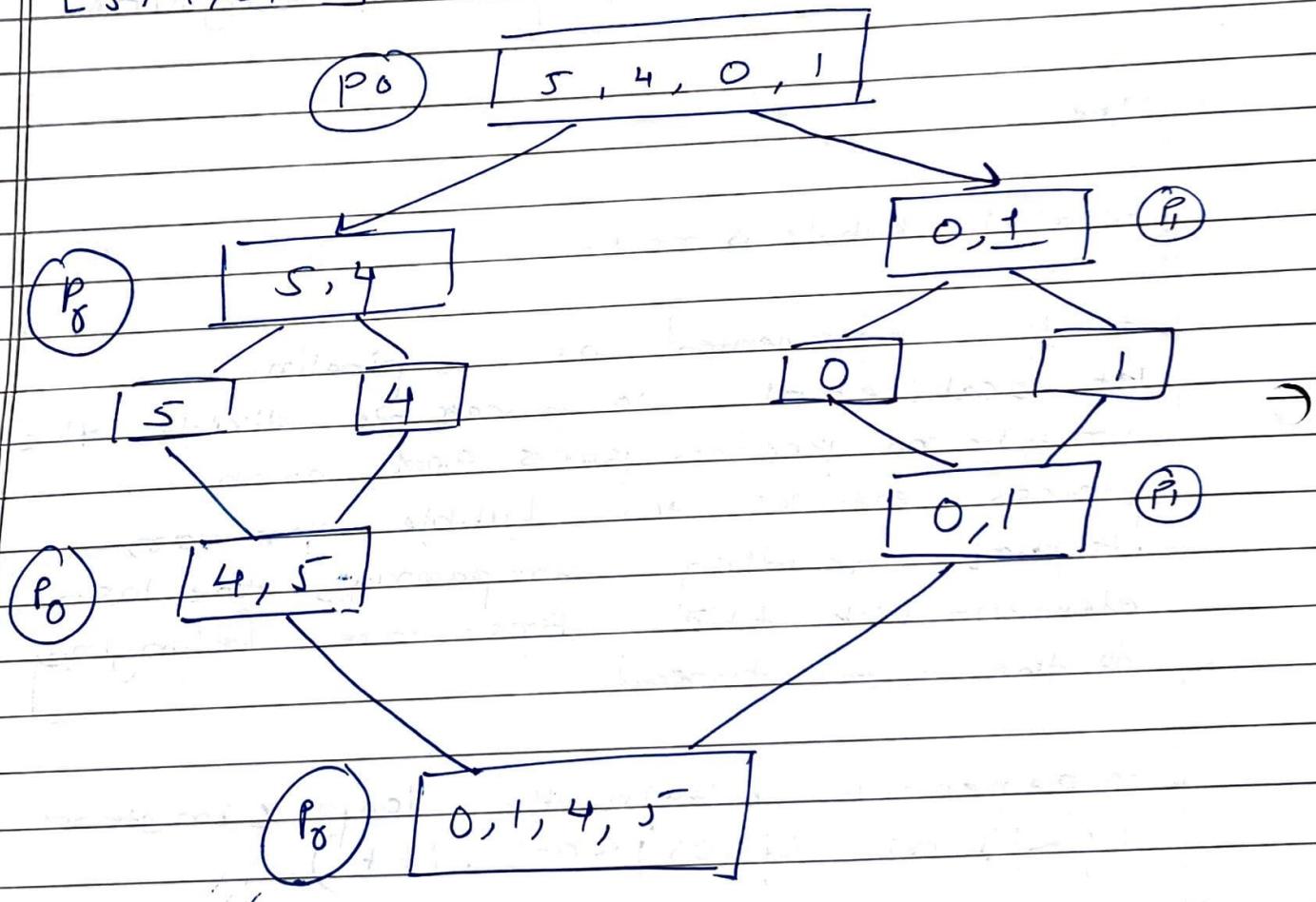
Implement it within the loops (instead of $c_j < i$ for $c_j=0; j < n-1; i++$)

- Parallel merge sort:-

In parallel merge sort we use parallelism to process the sub-problem. max parallelization achieved with one processor per node - (at layer/height)

- example:-

$[5, 4, 0, 1]$



Algorithm for parallel bubble sort:

Step 1:- for $i=0$ to $n-2$

Step 2:- if i is even then

Step 3:- for $j=0$ to $(n/2)-1$ in parallel

Step 4:- if $A[2j] > A[2j+1]$ then

Step 5:- exchange $A[2j] \leftrightarrow A[2j+1]$

Step 6:- else

Step 7:- for $j=0$ to $(n/2)2$ do in parallel

Step 8:- if $A[2j+1] > A[2j+2]$ then

Step 9:- exchange $A[2j+1] \leftrightarrow A[2j+2]$

Step 10:- Next i

Conclusion:- Hence, we successfully studied & implemented parallel bubble sort & parallel merge sort using OpenMP.

HPC lab assignment - 3

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B.E Comp - II

HPC - Lab.

- Aim: Implement Min, Max, Sum & average operations using parallel Reduction.

Theory:-

- Operation Minimum (min) :-

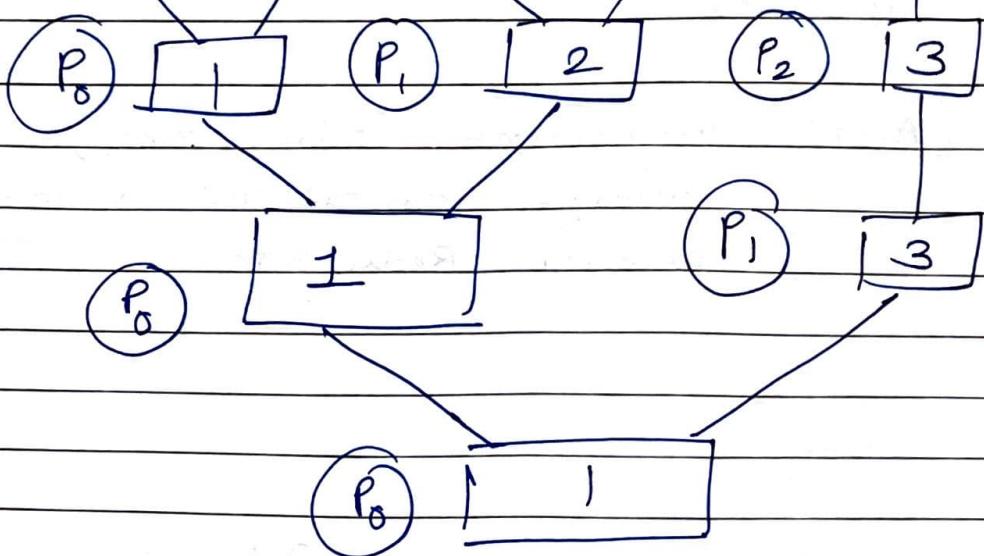
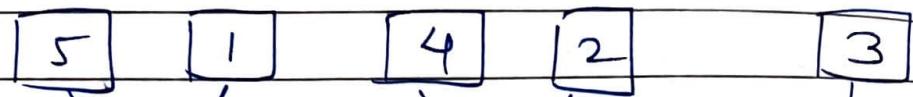
The minimum value is the smallest value in the array.

In implementation of the operation the minimum value is initialized to the first element in array, then compared to each subsequent element in loop. If smaller element is found then the minimum value is updated accordingly.

e.g. Input: 10 20 30 40 50
Output: 10 20 30 40 50

[5, 1, 4, 2, 3]

min = 5



• Operation Sum of Values (Sum)

The sum of values is the total of the values in the array.

In implementation of this operation, the num is initialized to zero and then by using parallel threads, we do the summation of the two array elements in one thread.

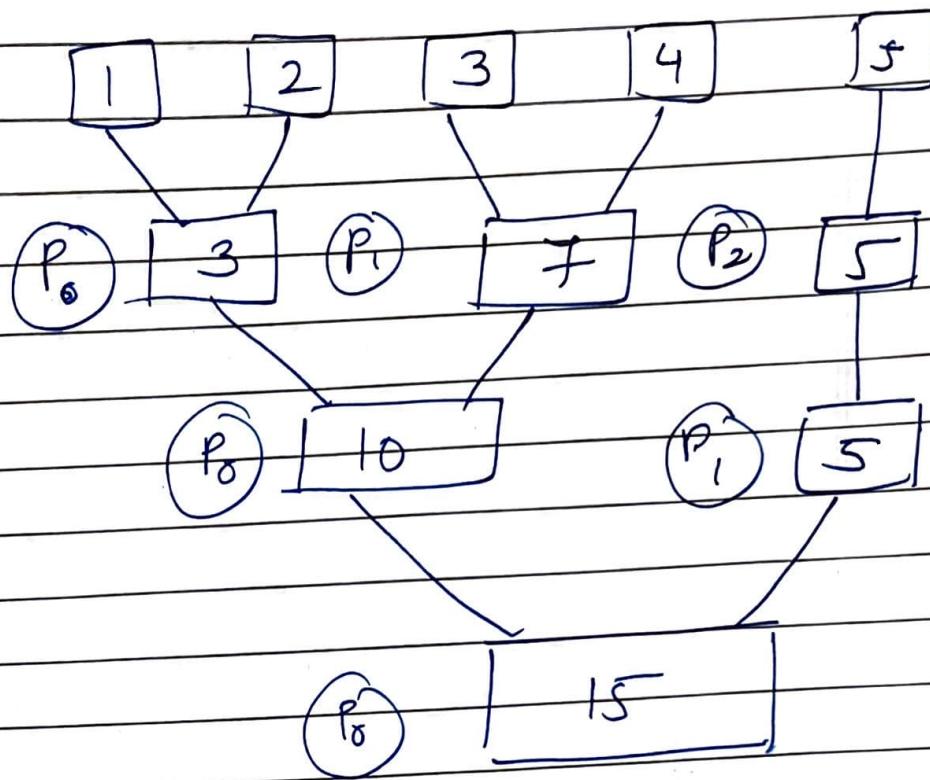
After than the summation values of all threads are added into pairs.

eg. $[1, 2, 3, 4, 5]$

Sum $[P_0 = 0]$

Sum

$[P_0 = 3, P_1 = 7,$
 $P_2 = 5]$



Conclusion:-

Hence, we successfully studied 8) implemented min, max 8) average operations using parallel reduction.

HPC lab- assignment 4

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B.E Comp - 2

HPC - lab.

Aim:- HPC application for AI/ML domain

Theory :-

Here,

Tokenization :-

It is the process of breaking down a text into smaller components called token.

Tokens can be words, phrases, sentences or any meaningful unit of text

Tokenization is a crucial step in many NLP applications such as text classification, namely entity recognition & machine translation.

There are many libraries available for tokenization.

Here are many some ways

while openMP can be a powerful tool for parallelizing tokenization.

AI can be used in HPC to augment the analysis of datasets & produce faster results at the same accuracy level.

- How HPC can help build better AI applications:-
- Massive parallel computing speeds up calculations significantly, allowing the processing of large datasets in less time.
- More storage & memory makes it easy to process large volumes of data, thereby increasing the accuracy of AI models.
- GPUs can be used to process AI algorithms more effectively.
- HPC as a service can be accessed on the cloud; hence, upfront costs can be reduced.

Conclusion:- Hence, we've developed HPC application for AI/ML domain.