VIGNAN'S NIRULA
INSTITUTE OF TECHNOLOGY & SCIENCE FOR WOMEN
(Approved by AICTE, New Delhi & Affiliated to JNTU Kakinada)
Vignan Avenue, Peda Palakaluru, Guntur - 522009
Department of Information Technology

Innovative Practices

Faculty Name : M.Mallikarjuna Rao, Mrs.G.Rohini Phaneendra Kumari
Course Name : Machine Learning
Class : II B. Tech II Semester
Academic Year : 2023-2024
Title of the Topic : Analysis of ensemble learning methods
Activity Name : Collaborative Learning

Objective:
The objective of analyzing ensemble learning methods in machine learning is to assess the performance of different techniques like bagging, boosting, and stacking. The goal is to understand their impact on model accuracy, robustness, and generalization across diverse datasets, ultimately identifying optimal methods for various predictive tasks.

Steps to Implement Collaborative Learning:

Assign Problems:

1. **Divide the participants into groups**: Each group will analyze a different ensemble learning technique (e.g., bagging, boosting, stacking).
2. **Provide each group with a specific problem**: The groups will explore the theory and practical applications of their assigned ensemble method, comparing it with others in various contexts.

Problems for Students on Ensemble Learning Methods:

Bagging (Bootstrap Aggregating):

1. **Problem**: You are tasked with improving the accuracy of a decision tree model. Using bagging, generate multiple bootstrapped datasets and train a decision tree on each, then combine their results.
2. **Task**: Explain how bagging helps reduce variance and improves model performance.
3. **Question**: What happens when bagging is applied to an overfitting model? Does it help?

Boosting:

1. **Problem**: You are using boosting (e.g., AdaBoost or Gradient Boosting) to enhance a weak classifier (like a decision tree) for a binary classification task.
2. **Task**: Describe how boosting sequentially adjusts weights on misclassified instances and how this improves predictive performance.

3. **Question**: How does boosting handle overfitting, and what is the trade-off between bias and variance?

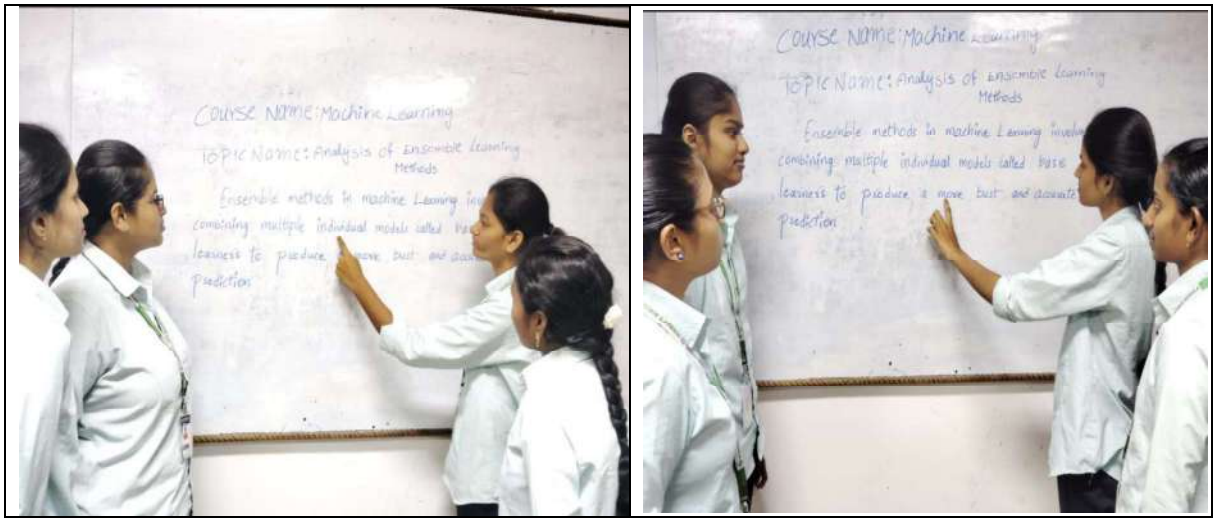
Stacking:

1. **Problem**: Given three different base models (e.g., decision tree, SVM, and logistic regression), use stacking to combine them into a meta-model for a classification problem.
2. **Task**: Explain how stacking differs from bagging and boosting in terms of combining predictions and model diversity.
3. **Question**: What are the advantages and challenges of using stacking compared to bagging and boosting?

Comparison of Ensemble Methods:

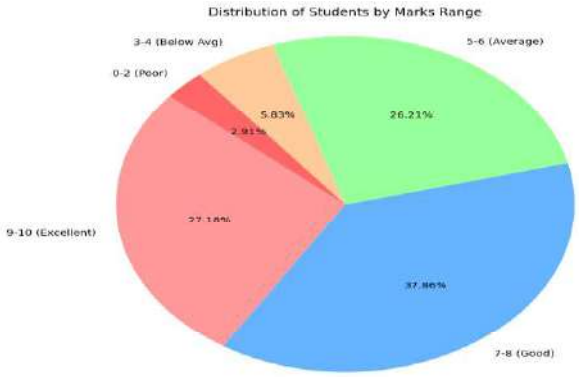
1. **Problem**: You are tasked with comparing the performance of bagging, boosting, and stacking on a common dataset (e.g., Iris or Titanic).
2. **Task**: Evaluate each method's performance based on accuracy, precision, recall, and F1-score. Visualize their performance using ROC curves or confusion matrices.
3. **Question**: In which scenarios does one method outperform the others, and why?

Screenshots of the Practice



Assessment Summary

Marks Range	Number of Students	Percentage
9-10 (Excellent)	28	27. 18%
7-8 (Good)	39	37. 86%
5-6 (Average)	27	26. 21%
3-4 (Below Avg)	6	5. 83%
0-2 (Poor)	3	2. 91%
Total	**103**	**100%**



Conclusion:

Ensemble learning methods enhance predictive performance by combining multiple models to reduce bias, variance, and improve generalization. Techniques like bagging, boosting, and stacking leverage the strengths of individual models to create a more robust and accurate system.

Signature of the Faculty **Head of the Department**