A Bayesian classifier is used in this Python program to diagnose breast cancer. It evaluates the classifier's performance using k-fold cross-validation and a test dataset. The following explains the program.

* The program begins by importing the required libraries, which include numpy, pandas, and scikit-learn (train test split, RandomizedSearchCV, cross\_val \_score, GaussianNB, and confusion matrix). It also uses load breast cancer to load the breast cancer dataset from Scikit-learn ().
* The program then splits the data into training and testing sets with test size of 0.2 and random\_state of 42 using train\_test\_split(). It creates a GaussianNB() classifier and defines the hyperparameter search space as a dictionary with var\_smoothing as the key and an array of values for it to search over. It then performs a random search over the hyperparameter space using RandomizedSearchCV(), which finds the optimal hyperparameters for the classifier.
* The program also uses random search to tune the classifier's hyperparameters and presents the test dataset's accuracy, sensitivity, and specificity. Using fit, the software trains the classifier with the optimum hyperparameters on the training set (). It uses cross\_val \_score() to evaluate the classifier's performance on the training set using k-fold cross-validation and reports the mean accuracy and standard deviation.
* The program then analyzes the classifier's performance on the test set by calculating the accuracy with predict() and accuracy score(). It also calculates sensitivity and specificity with the confusion matrix (). Lastly, the program displays the classifier's accuracy, sensitivity, and specificity on the test dataset.  Overall, this program demonstrates how to use a Bayesian classifier to identify breast cancer and how to evaluate the classifier's effectiveness using cross-validation and a test dataset. It also shows how to utilize random search to discover the best classifier hyperparameters.
* The accuracy of the test-set is 0.9649(0.9649\*100) i.e., 96.49%
* Sensitivity is 1.0
* Specificity is 0.9069

GitHub link: <https://github.com/Sandeep-5597/breast-cancer-detection-using-Machine-learning-GaussianNB->