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Machine Learning Assignment 9

Apply Support Vector Machine Classification Algorithm on a sample case study and data set. Evaluate Results.

Theory:

A Support Vector Machine (SVM) is a supervised machine learning technique used for classification and regression tasks. It excels in scenarios where the goal is to categorize data points into different classes or predict a continuous value.

Here's how an SVM operates:

1. Data Representation:
   - SVM transforms the data into a higher-dimensional feature space. This allows it to find the optimal hyperplane for classifying the data.
   - Think of this as finding the best line (in two dimensions), plane (in three dimensions), or hyperplane (in more than three dimensions) that separates different classes of data points.

2. Margin Maximization:
   - The primary objective of an SVM is to find the hyperplane that maximizes the margin between data points of different classes.
   - The margin is the distance between the hyperplane and the closest data points of each class, known as support vectors.
   - By maximizing the margin, SVM improves its ability to generalize and make accurate predictions on new, unseen data.

3. Support Vectors:
   - Support vectors are the data points closest to the hyperplane, situated at the decision boundary.
   - The location and orientation of the hyperplane are determined by these critical data elements.
   - Support vectors play a crucial role in defining the hyperplane and are essential for the SVM's performance.

4. Kernel Trick:
   - To handle non-linear data, SVM employs a kernel function. This function implicitly maps data

points into a higher-dimensional space without the need to explicitly compute the transformation.
  - The kernel trick enables SVM to create complex, non-linear decision boundaries, allowing it to handle data that cannot be separated linearly.
  - Common kernel functions include the linear kernel (for linear data), polynomial kernel, radial basis function (RBF) kernel, and sigmoid kernel. These kernels help SVM adapt to various data patterns and make accurate classifications or predictions.

In essence, SVM is a versatile machine learning technique that focuses on finding the optimal hyperplane to separate different classes of data points while maximizing the margin between them. It can handle both linear and non-linear data patterns by employing kernel functions. This flexibility makes it a powerful tool for classification and regression tasks in various domains.

Code: https://github.com/Naivedya-Rai/ML-Algo-Implement/blob/main/lab9_svm.ipynb

Dataset Used: Social network ads