**Adaptive Feature-Weighted KNN: Enhancing Classification Accuracy through Dynamic Feature Importance**

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**Motivation**:

The standard K-Nearest Neighbors (KNN) algorithm treats all features equally when computing distances between instances, regardless of their relevance to the classification task. However, not all features contribute equally to the classification decision, and some might be more informative or discriminative than others. The motivation behind this project is to create a Feature-Specific KNN algorithm that dynamically adapts the importance of features during the distance calculation to improve classification accuracy and efficiency.

**Method**:

Creating a framework where the algorithm can learn and dynamically adjust feature weights during the distance calculation process.

The approach may involve:

Feature Relevance Estimation: Determine feature relevance using techniques like information gain, mutual information, or feature importance scores from ensemble methods.

Feature Weight Adaptation: Develop a mechanism to assign different weights to features during the distance calculation, where more informative features contribute more to the similarity measure.

Distance Calculation Modification: Modify the KNN algorithm to incorporate feature-specific weights into the distance metric computation.

**Intended Experiments**:

The evaluation of the Feature-Specific KNN algorithm will primarily involve quantitative assessment through various metrics like accuracy, precision, recall, and F1-score. Additionally, visualization techniques and feature importance analysis will aid in understanding how the algorithm assigns importance to different features and how it impacts the classification decisions.

We will compare performance with paper #2 in the references, by using the same variety of datasets and then looking at the different variations and the aforementioned metrics to ultimately determine the ideal solution.

**Conclusion:**

The aim of this project is to create a more adaptive and efficient KNN variant that can better handle varying feature relevance in different classification tasks. The proposed Feature-Specific KNN algorithm has the potential to enhance classification accuracy and efficiency by giving appropriate importance to informative features while reducing the influence of less relevant ones.

References:

[kNN based image classification relying on local feature similarity](https://dl.acm.org/doi/pdf/10.1145/1862344.1862360)

[Comparative performance analysis of K-nearest neighbour (KNN) algorithm and its different variants for disease prediction](https://www.nature.com/articles/s41598-022-10358-x)

Link: <https://drive.google.com/drive/folders/1N-rJt8lxAirwwg0YZCHNHM0aPnNAzEjl?usp=drive_link>