## K-Nearest Neigbor Based Image Classifier
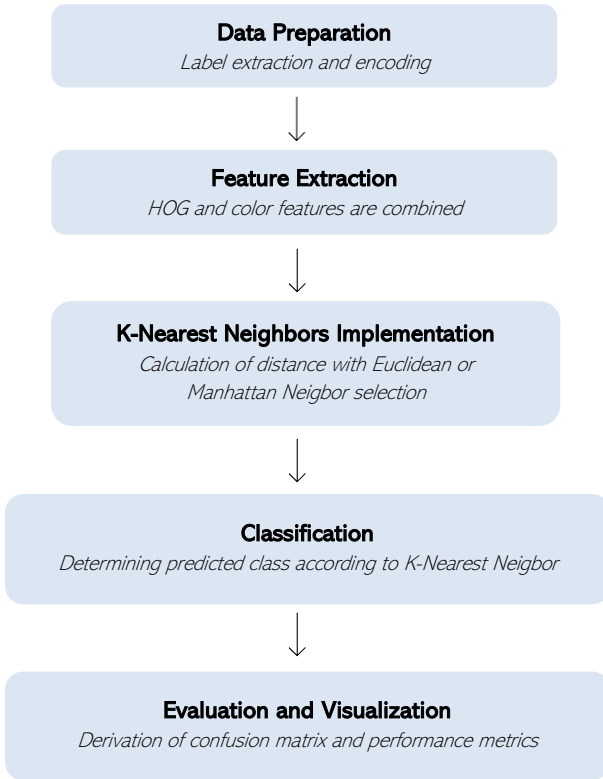
The overall goal of this system is to demonstrate how image processing, feature extraction, and K-Nearest Neighbors can be used together to classify images based on their visual content. It's a form of machine learning applied to image classification that figures how to handle real-world data, process it into a usable form, apply ML algorithm, and evaluate its performance. Implementation was done with **Python3** and **Sklearn**, **NumPy**, **Matplotlib** etc. libraries were used.

**Data Preparation**
*Label extraction and encoding*

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**Feature Extraction**
*HOG and color features are combined*

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**K-Nearest Neighbors Implementation**
*Calculation of distance with Euclidean or Manhattan Neigbor selection*

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**Classification**
*Determining predicted class according to K-Nearest Neigbor*

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**Evaluation and Visualization**
*Derivation of confusion matrix and performance metrics*



Confusion Matrix

| True Label \ Predicted Label | Ball | Bowl | Fork | Laptop | Mug | Orange | Plate | Salat | Tin Can | Tomato |
|---|---|---|---|---|---|---|---|---|---|---|
| Ball | 5 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 1 |
| Bowl | 2 | 4 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 |
| Fork | 1 | 0 | 7 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Laptop | 0 | 1 | 0 | 3 | 0 | 1 | 1 | 0 | 0 | 4 |
| Mug | 3 | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 1 |
| Orange | 1 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 1 |
| Plate | 0 | 0 | 0 | 0 | 0 | 3 | 7 | 0 | 0 | 0 |
| Salat | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 7 | 0 | 0 |
| Tin Can | 1 | 0 | 1 | 1 | 0 | 2 | 1 | 1 | 2 | 1 |
| Tomato | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 1 | 0 | 2 |

*In this implementation, features are insufficient to determine whether the object is a tomato, a ball or orange. New features should be added to ensure that objects can be distinguished efficiently.*