1. CalorieCam

Paper: CalorieCam: Calorie Estimation for Food Images Using a Reference Object

Models and Methods:

- Image Segmentation: Uses edge detection, k-means clustering, and GrabCut for segmenting food and reference objects.

- Reference Object: Needs a pre-registered reference object like a credit card to estimate the size of food items.

- Food Size Estimation: Converts pixel measurements of food items relative to the reference object's known size to calculate the actual food size.

- Food Calorie Estimation: Computes calories from the estimated real size of the food items using specific equations.

2. AR DeepCalorieCam V2

Paper: AR DeepCalorieCam V2: Real Food Size and Calorie Estimation Using ARKit

Models and Methods:

- ARKit: Uses visual-inertial odometry from Apple's ARKit to estimate the real-world size of objects directly without a reference object.

- Food Classification: Identifies food items through a category recognition system.

- Size Estimation: Estimates food size using AR and a quadratic curve fitting approach to relate 2D size measurements to calories.

- Calorie Estimation: Calculates calories based on the estimated food size and predefined calorie estimation curves for each food category.

3. DepthCalorieCam

Paper: DepthCalorieCam: Accurate Food Calorie Estimation Using Depth Images

Models and Methods:

- Stereo Cameras: Uses stereo cameras (available on iPhones) to capture depth information for more accurate food size estimation.

- Segmentation: Employs U-Net for food region segmentation. U-Net is a type of convolutional neural network designed for image segmentation tasks.

- Depth Estimation: Calculates the depth of each pixel in food regions using the known baseline distance between the stereo cameras.

- Food Calorie Estimation: Computes food calories based on the estimated volume derived from depth information and regression curves correlating volume to calorie content.

Summary of Key Algorithms:

1. CalorieCam:

- Segmentation: Edge detection, k-means clustering, GrabCut
- Estimation: Pixel-to-size conversion based on a reference object
- Calculation: Food calorie computation from real size

2. AR DeepCalorieCam V2:

- AR Technology: Visual-inertial odometry for size estimation
- Classification: Food category recognition
- Estimation: Quadratic curve fitting from 2D size to calories

3. DepthCalorieCam:

- Segmentation: U-Net for food region extraction
- Depth Estimation: Triangulation from stereo camera images
- Estimation: Volume-based calorie calculation using regression curves

Each method leverages different technologies and algorithms to address the challenge of accurate food calorie estimation from images, with varying levels of complexity and accuracy.