# Project Spec: Egg Quality Detection

**Name:** Lakshmi Jitta
**Course:** HCI 584
**Project Name:** Egg Quality Detection

## 1. General Description of the Project:

Egg grading is an essential task in poultry production and food quality control. Manual assessment of egg quality based on shell color is time-consuming and often inconsistent. This project aims to develop a computer vision prototype that automates part of this process using basic image processing techniques.

In its current form (Version 1), the project focuses on detecting a single egg in a video frame and classifying its quality as either “Good” or “Bad” based on the dominant HSV color extracted through KMeans clustering. Initially, a fixed-size bounding box is used to isolate the region of interest, though this method has proven to be limited in robustness. In response to feedback, a bounding box derived from an ellipse fitted to the egg contour will be implemented in the next iteration. This will help ensure more reliable and adaptable detection regardless of egg position.

Unlike the original plan, size estimation and crack detection are not included in Version 1. These features were deferred to future versions because they add significant complexity and depend on additional visual markers or contour analysis. Similarly, the GUI component originally proposed for Version 2 is still on the roadmap, but no longer a required part of the core scope.

The current system runs as a script that processes either a live webcam feed or a pre-recorded video of a known set of eggs. The classification results are overlaid on the video frame using OpenCV, and the processed video is saved. The color classification relies on threshold rules derived from real egg samples captured under consistent lighting conditions.

Future work will focus on integrating the professor’s improvement for ellipse-based detection, logging classification results to CSV, and optionally offering a GUI interface.

(Revised sections: Removed crack and size detection from Version 1, removed GUI as guaranteed milestone, added dynamic bounding box from ellipse as Version 2 goal)

## 2. Task Vignettes

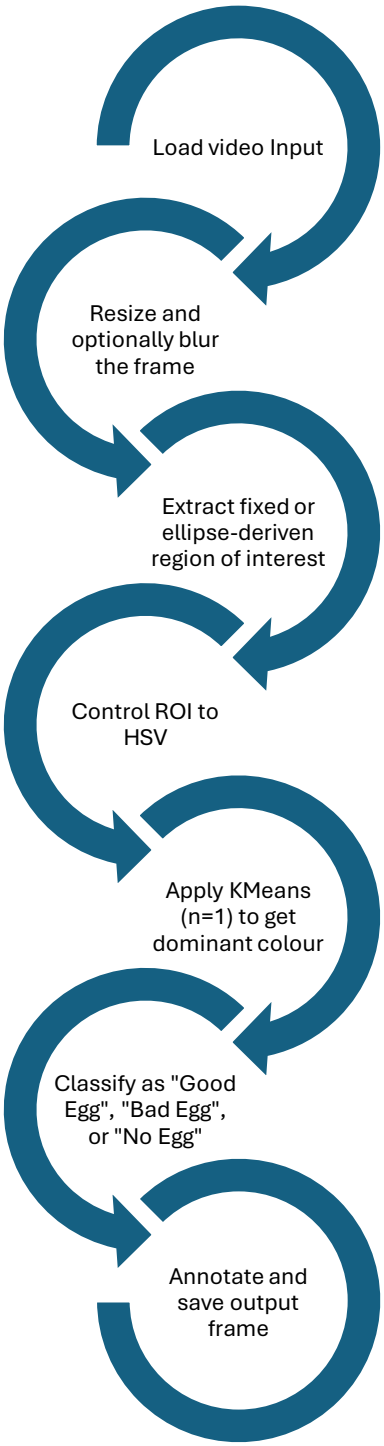
**Vignette 1: Load Video and Start Detection**
The script is run from the command line and takes either a video file or live webcam feed as input. It loads the input source and begins frame-by-frame processing. A message is printed indicating that detection is active.

**Vignette 2: Extract ROI and Classify Egg Color**
Each frame is resized, and a fixed region is initially used to extract the egg region. This will soon be replaced by a dynamically fitted ellipse. The region is converted to HSV, and KMeans clustering is applied to find the dominant color. Based on this, the egg is labeled “Good” or “Bad,” and the label is drawn on the frame only if an egg is detected.

**Vignette 3: Save Results**
The annotated video is saved, with each frame displaying the detected label when applicable. The video demonstrates egg classification with real-time visual feedback.

(Revised: Removed image input mode, marker-based size measurement, and crack detection)

## 3. Technical flow




In Version 2, the fixed ROI will be replaced by an ellipse-derived bounding box.

(Revised: Removed preprocessing steps for edge detection and marker size estimation)

## 4. Final Self-Assessment (Revised)

The original project spec included features like crack detection and size estimation using a physical marker. After implementing Version 1 and receiving feedback, I decided to simplify the project by focusing entirely on color-based classification of a single egg using video input. This was a realistic adjustment that allowed me to make steady progress and avoid getting stuck on more complex features that were not core to the initial goals.

I am confident that I can complete the next version of the project by integrating the professor's suggested ellipse detection method. My system already classifies eggs reliably when they appear within the bounding box, and the logic is consistent when the lighting is controlled. The biggest challenge was ensuring that the bounding box only appears when an egg is present, and this was resolved by adding threshold checks in the classification logic.

Going forward, I would like to improve the robustness of egg localization by implementing dynamic ROI detection, and I may optionally log classification results for later analysis. I do not plan to change the egg dataset, as I want to keep the environment consistent and focus on algorithmic improvements. I may consider adding a GUI if time permits, but it is not a current priority.