Computer Vision For Food Quality: The Case of Injera

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Abstract

The use of Teff as an exclusive crop for making Injera, a national staple, has changed overtime. Driven by the ever increasing price of Teff, producers have added other ingredients, of which some are good (maze and rice), while others are not. Hence, households opting for the industrial solution of Injera, are disturbed by the fact that they can not figure out what exactly is contained in their Injera. Thousands of local producers and local shopkeepers work together to make fresh Injera available to millions around the country. However, consumers are finding it more and more difficult to find a safe Injera for purchase.

Problem Description

Injera is usually sold unpacked, unlabeled and in an unsafe way through local shops. This being so, consumers face more and more health risks, all the more as it is impossible to evaluate the ingredient contained in the Injera they are buying There are two kinds of risks: (a) the local producers might try to reduce the cost by using cheap ingredients, including risky additives, and (b) the shops might sell expired Injera warmed up. We discuss here the growing food safety problem faced by millions of Injera consumers in Ethiopia, and the possibility of using AI to solve this problem.

Why AI

Food manufacturing industry is among the pioneers to use machine vision technology to inspect the quality of food by controlling the process, the materials handling and the product grading (Blandino et al., 2003). Computer vision techniques allow to perform non-destructive testing of the product under scrutiny. These techniques has proved to allow for an objective evaluation of food products (Zegeye, 1997). This implies the capturing, processing and analysis of images, and the definition of objective evaluation criteria to asses the relative visual quality of food products (Zegeye, 1997). Such techniques have great potential and are simple, cheap, and fast. The inspection process can also be achieved for real time use.

Proposal

The quality control of Injera can be framed as a classification problem. The task is to classify or possibly score an item (image of Injera) using a pre-designed safety metrics. By relying on a set of relevant features, we can build a model to distinguish between safe Injera and unsafe ones with an acceptable accuracy.

A reference feature for such kind of modeling can be extracted from a positive set of training example. The relevant feature include color, flatness and texture. By relying on these feature we can identify quality aspect: ingredient (composition) and duration after production. In the case of the composition for example different input result in different characters in the final Injera (e.g more teff in the composition would make Injera whiter and flat). On the other hand an expired and a warmed up Injera, even hard to identify instantly, would have a distinct characteristics in terms of color and flatness. The variation between the positive (safe Injera) and negative item (unsafe Injera),though hard to identify for the human eye, can now be done (i.e. learned) via image processing techniques.

Evaluation

Success in our proposed solution is objectively measurable. We have two challenges to address designing a safety metrics that can be evaluated from a real data and building a classification model that can score new input. The model can be evaluated using standard machine learning evaluation approaches such as precision, recall and f-score. The interpretation of these scores can used as a feedback to reach to an acceptable model accuracy.