Computer Vision For Food Quality: The Case of Injera Problem Introduction

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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. This 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

1. Introduction

Injera is central to Ethiopian cuisine and it has been a staple for Ethiopians for centuries (Abraha, 2017). It is a thin bread produced from flour, water and starter. Teff is the most common grain for making Injera. Other grains such as sorghum, maize, barley, wheat and finger millet are also used. The major quality of a good Injera is its slightly sour flavor (S.Mangale and Thombre, 2007). Injera is undisputedly the most popular food of Ethiopians (Vijayarekha, 2012). About two-third of Ethiopian diet consists of Injera, accounting mostly for the daily protein intake of Ethiopians. The number of people relying on local producers for their daily consumption is a growing. The increased urbanization is the primary driving force to expand these market. Providing consumer the option to understand what is used in the making of their daily food have a significant impact .The production and distribution Injera has never been regulated by the government whatsoever. The space is waiting for innovation for so long. Introducing an element of transparency, in a short term, would have positive impact by helping consumer whom to trust to buy their daily Injera. In the long run, these would help in filtering out bad actors market. 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. Recently automatic quality inspection techniques based on camera technology have been used to analyze and study agricultural food products. 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 appreciate the relative visual quality of food products (Zegeye, 1997). Computer vision systems are highly suitable for controlling the quality of agricultural products. Indeed, they have great potential and are highly beneficial: the systems are simple, cheap, and fast. The inspection process can be achieved in real time use.

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2. 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. Positive feature for the case of Injera 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. A new item closely similar to our positive example would have a higher safety score than the dissimilar ones. 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. From the model side, a potential misclassification (false positive and false negative) mislead user into believing that an unsafe product is safe or safe is unsafe. Such kind of risk can be tested early on using standard model evaluation techniques.

3. 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.

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(Abraha, 2017) (Vijayarekha, 2012) (Zegeye, 1997) (Blandino & Al-Aseeri, 2003) (S.Mangale & Thombre, 2007)