Determines Food Calories using Computer Vision

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Abstract

The system which extract information from images and videos using intelligent application, after that manipulate and process it is computer vision. This system helps us in scene recognition, character recognition, motion detection, object recognition on the bases of shapes, and so forth. As for example, automatic vehicle number plate, bank check, face, postal-code recognition work on this idea.

During Summer Undergraduate Research Program (SURP) we created software application which can recognize food on the bases of its color and determines its calories. The application can determine food such as burger, French fries, soft drinks, apple, salad, and pizza using features like color, octave, angle, response and so on to determine the average calories in food and then in our next step we would like to apply machine learning algorithm to make this application more precise which will be able to recognize more food.

Introduction

The research project aims to develop computer application which solved real world problems. In our recent project, we use high level programming language like C++ (this is the computer language which has power to go inside the hardware of computer system) and C# (through which we can develop desktop and mobile native application using visual studio). Moreover, we use computer vision library like OpenCV for C++ and EmguCV for C#, which has same concept but built for two different programming languages. Abstract concepts, like velocity or force, are used in science to explain and interpret measurements and observations. An experiment is captured by a live camera and displayed on the computer screen together with some graphical representation that is calculated on the fly based on the acquired image. This methodology has been adopted by commercial products such as Google Glasses, Microsoft HoloLens and Canon Mixed Reality. The digital camera captures images that are interpreted by Computer Vision to identify objects and features in experiment's scene. Graphical objects are then placed in the scene at the corresponding positions in the captured images and then displayed on the screen superimposed on the original image.

Health disparities for minorities is a significant problem in this country. The two largest minorities are African-Americans and Hispanics. Our goal in this project is to develop methods to make the minorities aware of the resources available to them to address their healthcare needs. In this paper, we are highlighting the methods that we have developed to address this problem. One piece of information that we are seeking in this regard is to get some health information from the minorities that does not violate their privacy. All data used in this project deal with de-identified population. In this regard, we have developed a machine learning algorithm that helps identify the caloric

intake in food consumed by individuals. We expect the participants to upload an image of their food plate to our dedicated website. Once the image is received the program would take the image and estimate the caloric content of the food in the plate. This information will be added to the de-identified person's profile using date and time stamp. We will gather additional information from such individuals through the use of a kit that we are developing for distribution. The main aim of the kit is to provide tools to the participants for sharing with us other health information such as blood sugar, blood pressure and physical activity in the form of distance traveled as part of normal activities. The goal in each of these aspects is to automate the data acquisition from the appropriate devices provided to the participants.

Materials

- Computer

Methods:

The demo application we develop is user interface which can work on windows machine. The image frame can be opened from computer to process it and saved in matrix form in "Mat". In next step, we resize the image in specific format by using "CvInvoke.Resize()" function and send image to another function for furthermore processing where, it will transform into gray-scale format using "CvInvoke.CvtColor()" function, apply thresholding which can transform gray-scale image into binary formation as shown in figure 1 and then we apply morphological processing a collection of non-linear operations related to the shape or morphology of features in an image. This operation on binary image created a new binary image in which the pixel has a non-zero value (black pixel – 1 and while pixel -0) only if the test is successful at that location. There are two fundamental operations erosion and dilation which shows how this operation works, but in our application, we use dilation because it adds layer of pixels to both inner and outer boundaries of regions and makes the image more robust. Moreover, now we apply "CvInvoke.FindContours" which is Contours can be explained simply as a curve joining all the continuous points (along the boundary), having same color or intensity. The contours are a useful tool for shape analysis and object detection and recognition.

Figure 1 Gray-Scale Image v/s Threshold Image

Speeded-Up Robust Features (SURF) is local features detector and descriptor, used for object recognition, classification, and image registration; this is partly inspired by Scale-Invariant Feature transform (SIFT). There are several features which can be extracted such as key points, pyramid layer octaves, and class ID (1 or -1). On the other side, we are processing the original image to remove background, so we can only have food in our image, and then we get BGR value of each pixels. We do this processing for about ten images and finds average value of each features which can be used to set value from some specific range to determine the food. Finally, the information about food and its calories will be display on screen after required processing.

Results & Discussion

To determine the accuracy of the application we process ten different images of each food and extracted information like RGB (red, green, blue) color value of each pixel, key-point, and octave; the graph shows how many images was successfully recognize after processing.

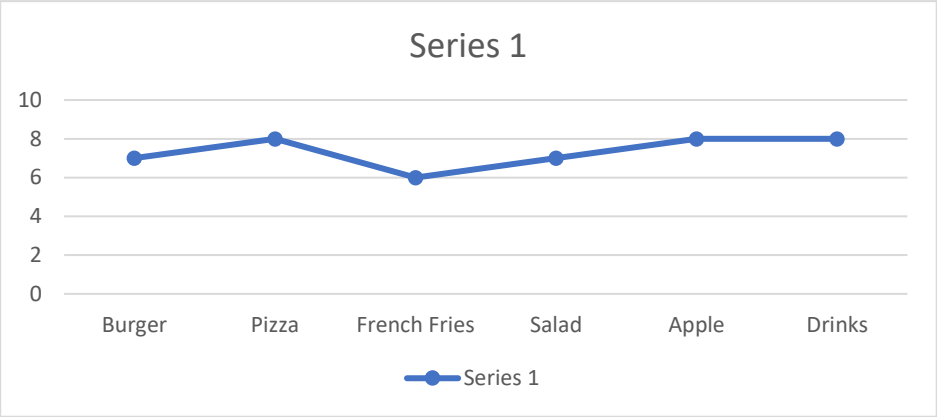

Figure 2 Graph explains food recognize successfully

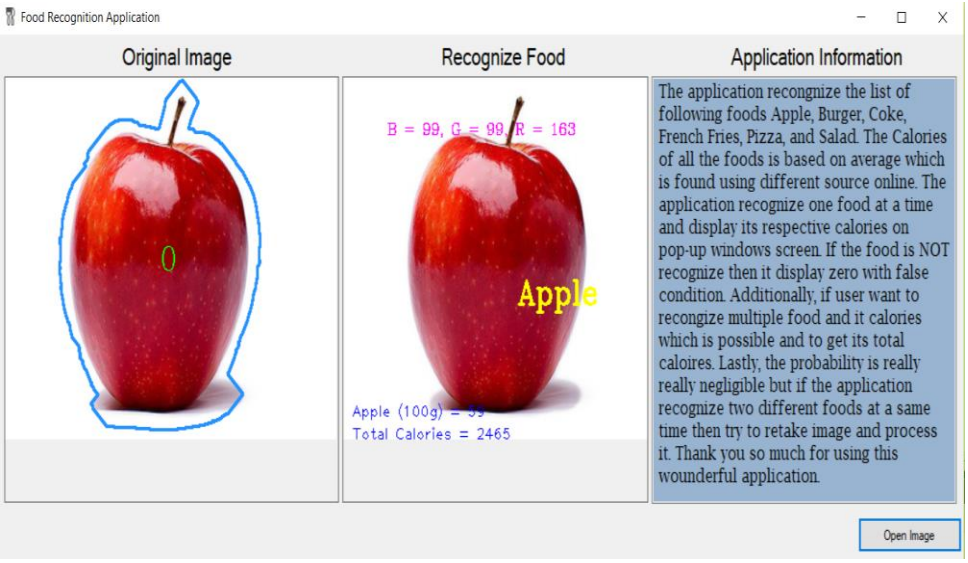

Figure 3 Apple recognize successfully

The Figure 3 shows the apple which display average calories of it and aslo the average BGR (blue green red) value. We use certain rules to determine the object and design specific range of value for each features.

Figure 4 shows the burger which is recognize by the application and draws light blue lines around it on Original Image box. While the Recognize Food display show the average calories of it and aslo the average BGR (blue green red) value.

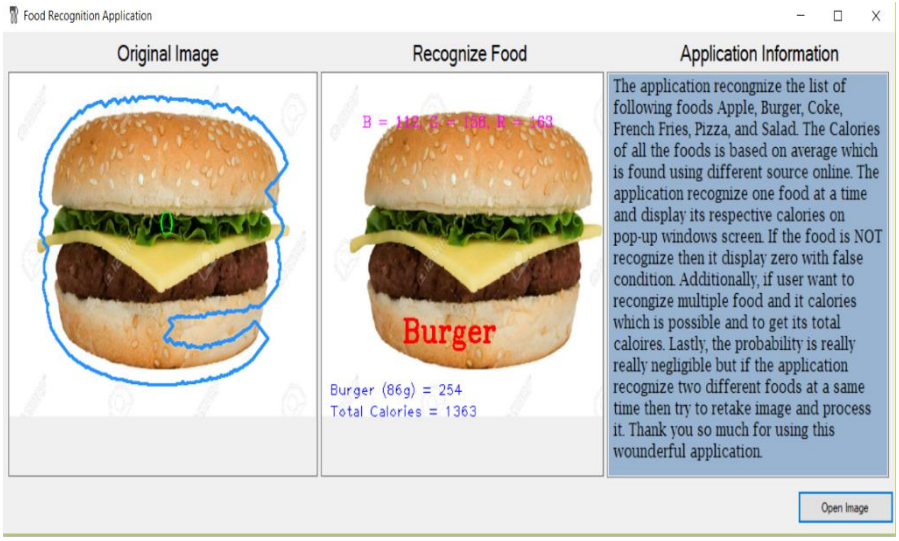

Figure 4 Burger Recognize Successfully

All below figures determine food using the same concept as mention above.

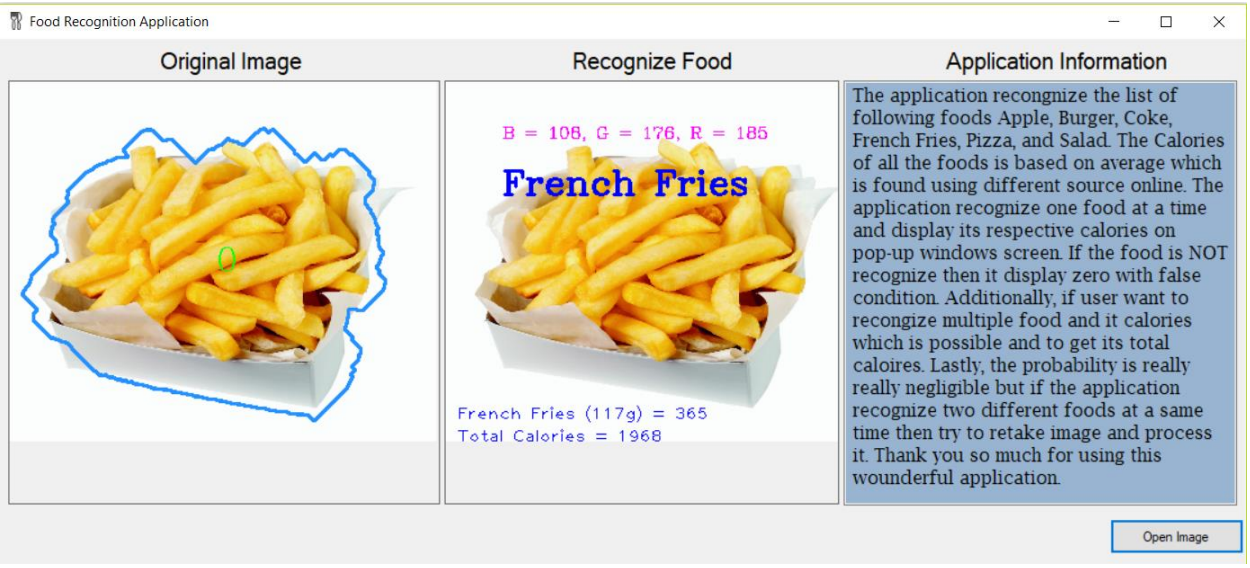

Figure 5 French Fries Recognize Successfully

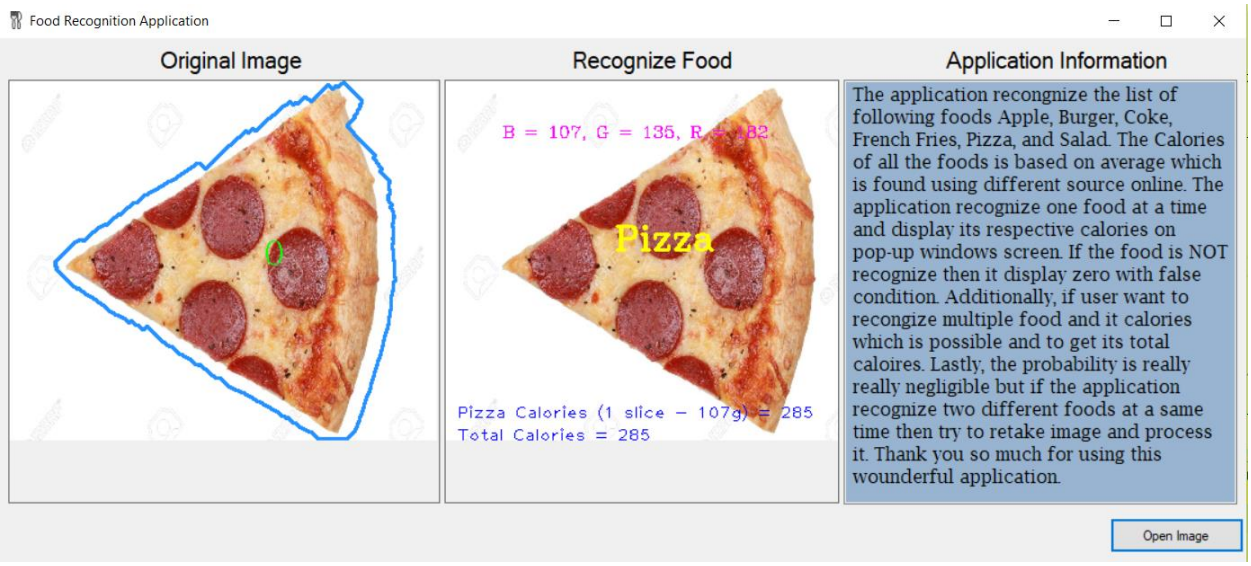

Figure 6 Pizza Recognize Successfully

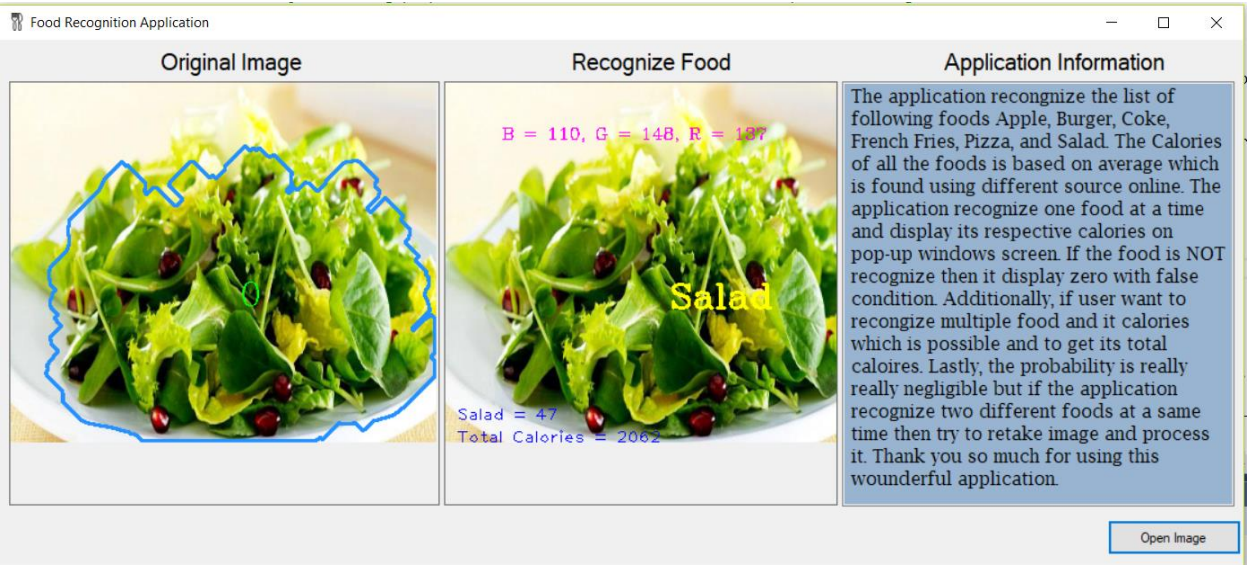

Figure 7 Salad Recognize Successfully

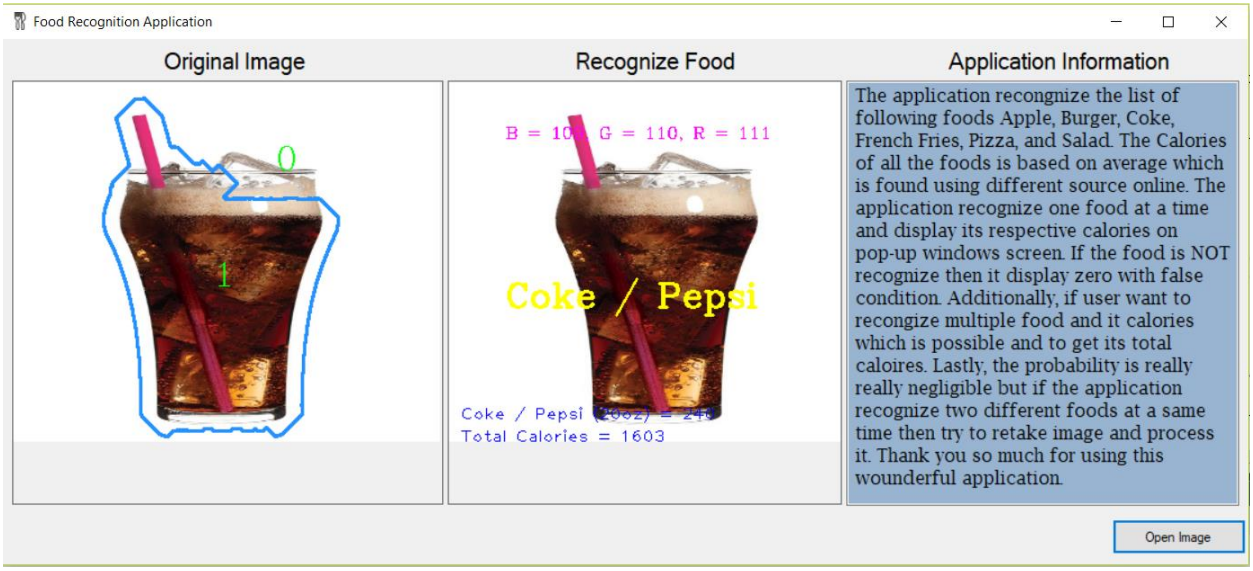

Figure 8 Beverages Recognize Successfully

Conclusion

There are many more possible science experiments which can be program like collision of atom, find total number of protein inside microscopic cell, and Collecting data of patience for couples of years and predict what kind of medical prescription they need for future. Moreover, the next stage of survey application will use pdf file and transform it into image (.jpg or .png) and process each image one-by-one and save the desire result in spreadsheet and e-mail to respective person. In addition to this, automatically grading handwritten letters and words by using camera, which will

reduce lots of work in the field of education, automatic address checking for post office, reading application for college – immigration office.

Reference

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