I J C T A, 9(5), 2016, pp. 2165-2171

Recognition of Nutrition in food by Texture Analysis

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ABSTRACT

Dietary habits play a significant role in our health and mortality of all humans the consumed fuels and expended energy brings either starvation or excessive reserves of adipose tissue, called as body fat. Poor intake of many vitamins and minerals may lead to diseases that can have far-reaching effects on health. Diabetics and obesity are the major problem in day to day life. Diet maintenance is important for both cases. In order to control and correct the dietary habits of those people our proposed method can detect the nutrients like protein, fat, calorific value etc. in the food item based on the texture analysis. Texture is the colour, coerciveness, shape, geometrical pattern of food particle or ingredients. Local Binary Pattern (LBP) are used for texture analysis of complex ingredients in the food item .Texture analysis is used to detect texture value from food image this pattern able to remove any blurriness in the image to obtain the accurate result

Keywords: histogram, texture analysis, local binary pattern, Nutrients, diet maintenance

1. INTRODUCTION

Food is a substance consumed to give nutritional support for the body. It is usually of plant or animal origin, and contains essential nutrients. The substance is ingested by an organism and assimilated by the organism's cells to provide energy, maintain life, or stimulate growth. Nutrients in food are grouped into several categories. Macronutrients are protein, fat, carbohydrates, minerals and vitamins. Additionally, food contains water and dietary fibre. Dietary habits play a most important role in the health. Some nutrients are stored internally. Poor health can be caused by a deficiency of adequate nutrients or, in extreme cases, too much of adequate nutrient.

There is a growing concern about nutrient defiency diseases and other health problems such as obesity and diebetics. Dietary intake, the process of deciding what someone eats during the course of a day, it gives appreciable insights for intervention programs for prevention of many nutrient deficiency diseases. Most foods contain a mixing of part or whole nutrient types, together with other substances, such as toxins and other chemicals. Determining accurate dietary intake is almost an open research problem in the health and nutrition fields. The growing prevalence of obesity among the youth is of great concern.

The rest of paper follows as: In section 2, we mentioned literature review which is close to proposed mechanism. In section 3 introduces the system model with proposed techniques elaboration. In Section 4, explain about experimental result and discussion. In section 5, concluded the overall work with future enhancement.

2. LITERATURE REVIEW

In this paper [1] Diet Cam consists two major components, ingredient detection and food classification. Food ingredients are computed by two methods such as deformable part-based model and a texture verification model. Texture classification deals with STF are an image segmentation and classification method that generates soft labels for each pixel by their local texture properties. This is achieved from

learning manually labeled sample images and building decision forests. Flexible part based model tells That distribution of food ingredients has different geometric patterns because of their intraclass deformation. Therefore, they model the deformation in a high level by the distribution of texture parts. The distribution of the texture parts is obtained based on analyzing the arrangement of features from the food image Sometimes misinterpretation of food ingredients may possible. In this paper [2] a novel mobile telephone food record that will provide an account of daily food and nutrient intake. Images obtained before and after foods are eaten are used to detect the volume of food consumed. wastage of food is not considered here. In this paper [3] an automatic sensor systems to monitor ingestive behavior of individuals. Simple sensor system and other two methods like signal processing and pattern recognition is used to estimate periods of food intake depends on non-invasive monitoring of chewing. Movement of lower jaw is not same all persons so, this method not give efficient result. In this paper [4] Computer based food recognition could be used to estimate a meal's carbohydrate content for diabetic patients. an automatic food recognition method is called bag-of-features (BoF) model, optimization of bag of features (BoF) model need identification of more parameters. In this paper [5] A wearable system like a necklace, which aggregates data from an piezoelectric sensor capable of capturing skin movement in the lower trachea during ingestion. The skin movement gives an output voltage with varying frequencies over time. Based on skin motion we cannot predict accurate result. In this paper [6] The sensor tag and reader system is used to achieve, long-term, and on-demand wireless monitoring of food quality, especially for more-quantity applications and monitoring from place of manufacturing to retail stores is a loss of time, not suitable for small quantity applications, electrodes are more sensitive to PH value of the food. In this paper [7] An hardware prototype is designed to collect food intake sensor data, which is highlighted based on high-fidelity microphone worn on the human neck to record acoustic signals while eating in a non-invasive manner. The acoustic data are pre-processed and then sent to a mobile via Bluetooth, where food items are recognized. detection based on acoustic signals may leads to inaccurate results due to attenuation. In this paper [8] a framework including differential classification in geolocalized settings and the concept of geolocalized models, the models are based on the collection of hotel and jagk food items. They determine the food item but not give the nutrition value. In this paper [9] a pattern recognition algorithm to detect chewing cycles and food type in data from an ear-pad chewing sound sensor. The recognized information is used to predict bite weight .Deviation may occur during biting the food material. In this paper [10] recognizing eating food item by tracking wrist motion. Eating gestures are activities undertaken while consumption of a meal, such as sipping a drink of water .Each of these gestures leads to a pattern of wrist motion that may be tracked to automatically identify the activity only wrist motion can't be enough to predict nutrient value.

3. SYSTEM MODEL

The proposed method work as follows, the camera gives the image of the static food that is kept for the observation. The texture analysis gives whether the given food is in solid, liquid form or semi-solid form. Texture value calculated through LBP (local binary pattern) then modeling process with regression can detect the approximate nutrient content in the food.

3.1. Texture

An image texture is a set of metrics calculated in image processing designed to quantify the obtained texture of an image. Image texture produces the collection of information about spatial distribution of color or intensities in image or selected region.

3.2. Flow of texture analysis

There are four major aspects in texture analysis: 1) Feature extraction: to calculate a characteristic of a image used to numerically define its texture properties; 2) Texture discrimination: to divide a

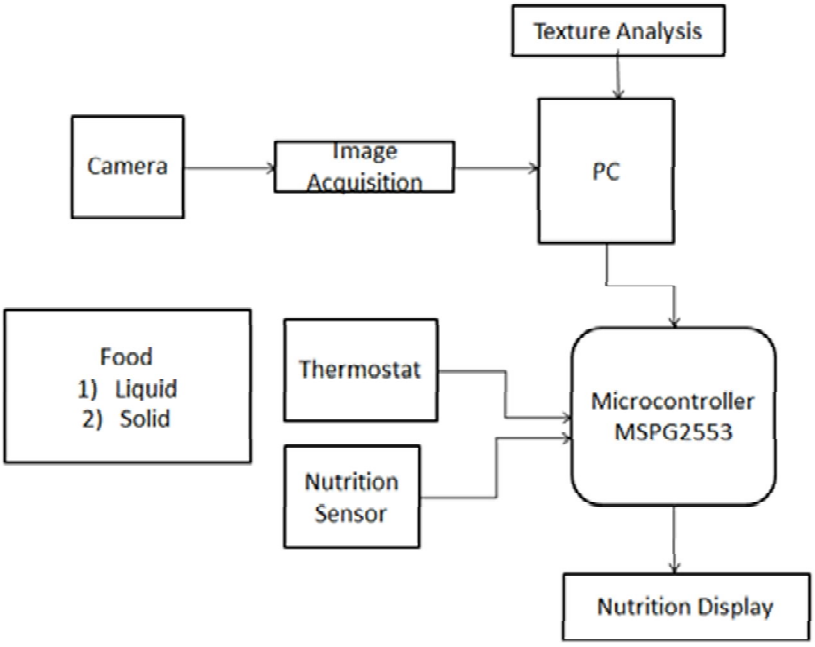

Figure 1: System block diagram

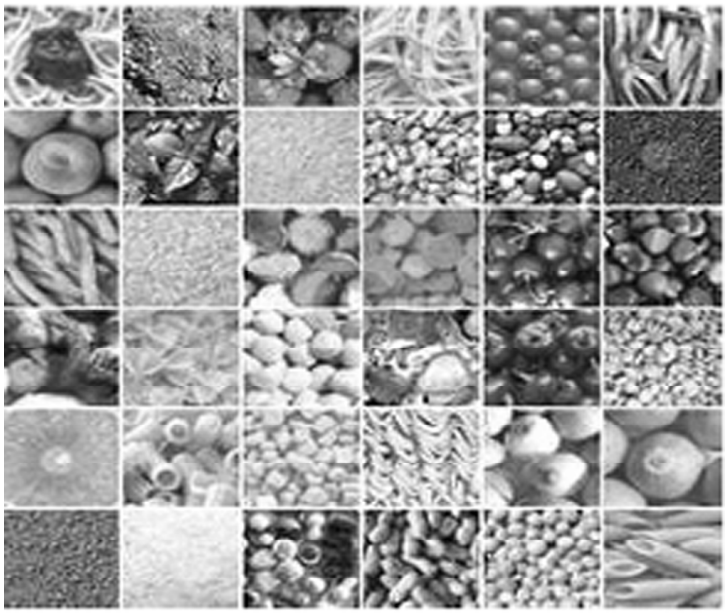

Figure 2: Example of different texture

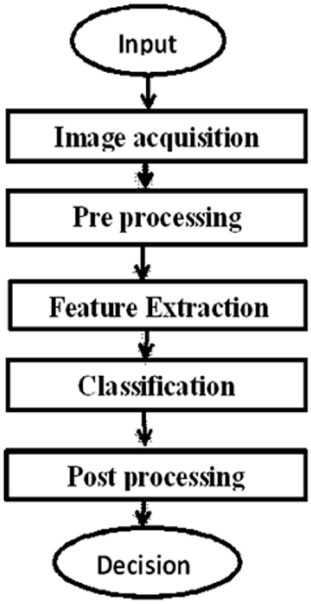

Figure 3: Flow of texture analysis

textured image into regions, each region corresponding to homogeneous texture (leads to image segmentation); 3) Texture classification: to detect which of a finite number of defined classes (such as normal and abnormal tissue) a texture region belongs; 4) Shape from texture: 3D surface geometry is constructed from texture information. Feature extraction is the initial step of image texture analysis. Results obtained from this step are used for texture discrimination, classification or object shape determination. This review is mainly based on feature extraction and texture discrimination techniques

Initially it can acquire the image through the image acquisition tool of Matlab .Then preprocessing can segment image into disjoint regions. Feature extraction compute a characteristic of image based on the texture properties .image classification can define the class a homogeneous texture region belongs. after post processing it take decision

3.3. Local Binary Pattern

Local binary patterns (LBP) are a type of feature mostly used for classification in computer vision. LBP is the special case of the Texture Spectrum model, It has been found to be a powerful feature for texture classification; it has further been determined that when LBP is paired with the histogram and notation of the histogram is given by

$$LBP_{P,R}^{u2} \tag{1}$$

*U*2 stands for using only uniform patterns. The subscript represents using the operator in a (*P*, *R*) neighborhood

The LBP operator was particularly designed for texture analysis. The operator assigns a label to each and every pixel of an image by thresholding the 3 × 3-neighborhood of each pixel along with the center pixel value and producing the result as a binary number. The feature vector may be processed using the Support vector machine or other machine-learning algorithm to define the classes of images.

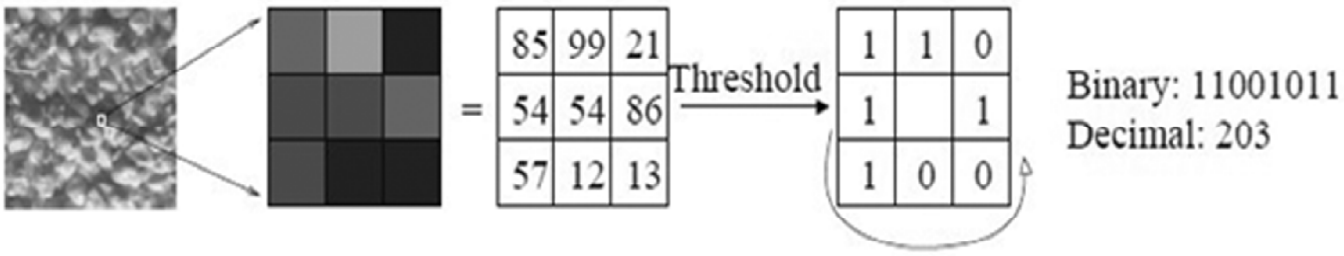

Figure 4: The basic LBP operator

4. RESULT AND DISCUSSION

4.1. Basic histogram analysis

The histogram of a digital image along with intensity levels in the range [0, L –1] is a discrete function

$$h(r_k) = n_k.$$

Here, r_k is the kth intensity value and n_k is the number of pixels in the image

The normalized histogram may also be defined as the probability of occurrence of intensity level r_k in an image. The summation of all entities of a normalized histogram is equal to 1. The histogram of image may be viewed graphically as

$$h(r_k) = n_k \text{ versus } r_k$$
$$\text{or} \tag{2}$$
$$p(r_k) = n_k/n \text{ versus } r_k$$

Based on the characteristic of histogram, there are four basic image types. (i) Dark Image: In the dark image, the entities of the histogram are concentrated on the low side of the intensity scale. (ii) Light Image: In the light image, the entities of the histogram are biased towards the high side of the intensity scale (iii) Low Contrast Image: In the low contrast image, the entities of the histogram are concentrated on the middle of the intensity scale. (iv) High Contrast Image: The entities of histogram in the high contrast image cover a wide range of the intensity scale

The above figure 5 & 6 shows histogram variation for ordinary biscuit and vanaspathi and ghee filled since the intensity of the ghee and vanaspathi are high the peak for those biscuit was high compared to the ordinary biscuit.

The above figure 7 & 8 shows original, efficient and pixel-wise LBP pattern for ordinary biscuit. Local Binary Pattern used for the texture analysis it provides an efficient result when combine with the histogram

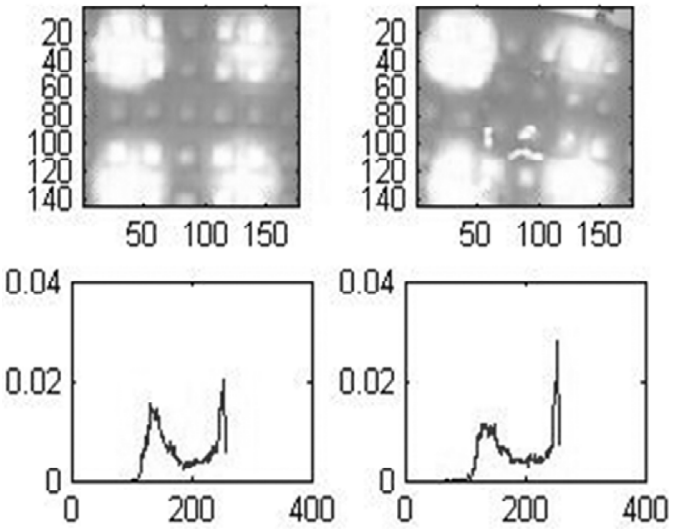

Figure 5:Histogram for ordinary and vanaspathi filled biscuit

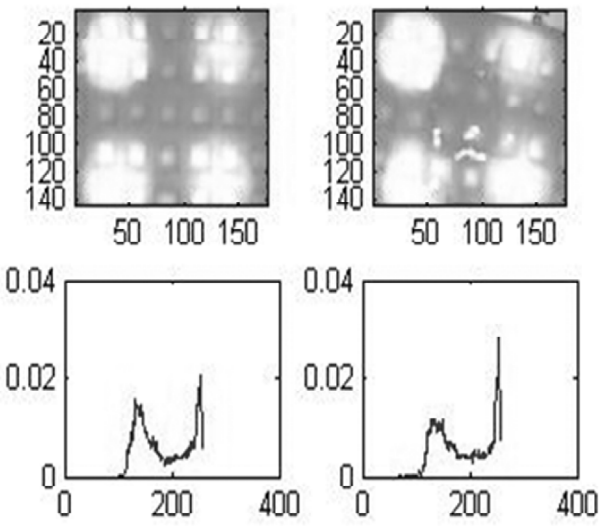

Figure: 6 Histogram for ordinary and ghee filled biscuit

Figure 7: Orginal, efficient and pixel-wise LBP image

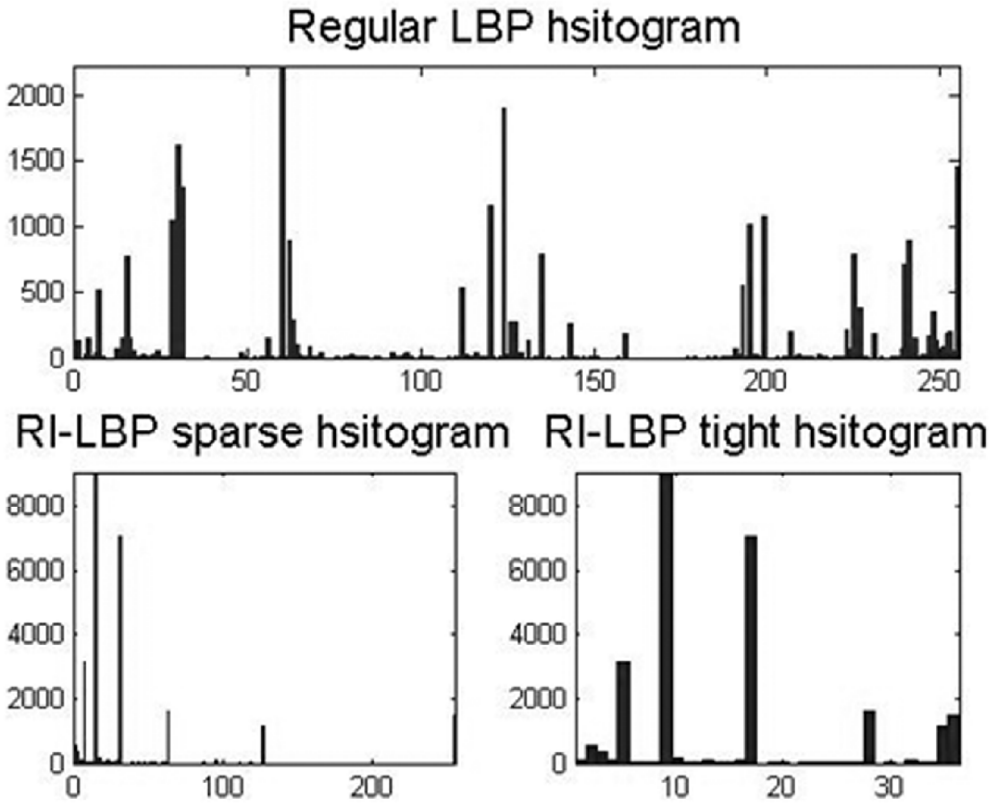

Figure 8: LBP histogram image

Table 1
Nutrient table

Food item	Protein	Fat	Carbohydrate
Ordinary biscuit	0.7g	1.45g	4.21 kcal
Biscuit filled with ghee	0.749g	12.439g	11.23 kcal
Biscuit filled with coconut oil	0.71g	1.53g	8.62 kcal
Biscuit with vanaspathi	0.73g	2.45g	9.21kcal
Ordinary rice	2.7g	0.3	130 kcal
Jeera rice	2.74g	10.439	137 kcal
salad	0.74g	0	11.8 kcal

bin. It produces the uniform and non-uniform pattern, uniform pattern has the single transition but the non-uniform pattern has multiple transitions. LBP histogram gives the regular sparse histogram and the regular tight histogram. Sparse deals with compressed bins and the tight deals with expanded bins

5. CONCLUSION

Nutrition detection in food item based on the texture analysis is effective than others methods like recognition of nutrition using the wearable sensor system, based on the wrist movement of the person, lower jaw movement of the subject**.** the signals from those gadget are attenuated sometimes moreover wearing such type of the sensors are uncomfortable to the subject. Recognition of nutrition by texture analysis avoids this shortcomings of above methods .this method requires clear picture of food item, it need a Matlab platform for texture analysis. texture values are calculated by local binary pattern (LBP) This Local Binary Pattern is more efficient method then the transform based texture analysis like Fourier transform method, wavelet transform and gabor transform etc., Regression and modeling process can be followed by texture analysis, this modeling process can compute mean value for the image which is selected to detect the nutrient value .the algorithm may retrieve the nutrient value from calculated mean value. So, this can be a precise method than other existing methods. the people who has more diet conscious, diabetics patient, and other protein deficiency patients get many diet information from this method. This method is simpler to use by all people those who having the smart phones. Recognition of nutrient in food by image processing is to regulate diet for the diabetics and obesity persons

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