Food Recognition System for Diabetic Patient Using Image Comparison

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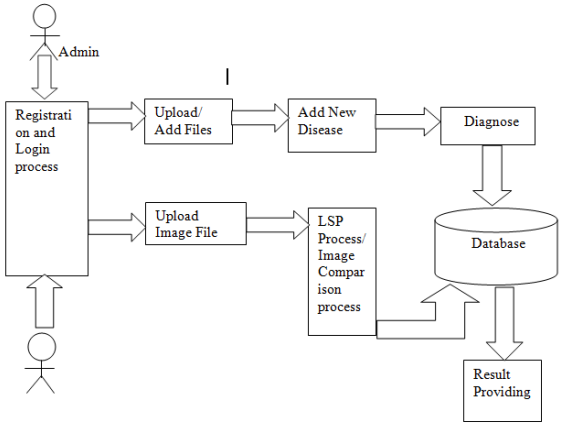
Abstract- **In this way, the feature vector clustering procedure can be omitted; however, less information is considered by the model which might not be able to deal with high visual variation. Moreover, the proposed system requires a colored checker-board captured within the image in order to deal with varying lighting conditions. In an independently collected dataset, the system achieved accuracies from 95% to 80%, as the number of food categories increases from 2 to 20. The last few years food recognition has attracted a lot of attention for dietary assessment, most of the proposed systems fail to deal with the problem of the huge visual diversity of foods, so they limit the visual dataset considered to either too few or too narrow food classes, in order to achieve satisfactory results. The present study makes several contributions to the field of food recognition. A visual dataset with nearly 5000 homemade food images was created, reflecting the nutritional habits in central Europe. The foods appearing in the images have been organized into 11 classes of high intra variability. Based on the aforementioned dataset, we conducted an extensive investigation further optimal components and parameters within the Bag Of Feature architecture. It is applicable for all places such as Hospitals, Restaurants and anywhere else.**

Index Terms- **Food recognition, diabetic analysis using image comparison.**

I. INTRODUCTION

Computer vision-based food recognition could be used to estimate a meal's carbohydrate content for diabetic patients. This study proposes a methodology for automatic food recognition, based on the bag-of-features (BoF) model. An extensive technical investigation was conducted for the identification and optimization of the best performing components involved in the BoF architecture, as well as the estimation of the corresponding parameters. For the design and evaluation of the prototype sys-tem, a visual dataset with nearly 5000 food images was created and organized into 11 classes. The optimized system computes dense local features, using the scale-invariant feature transform on the HSV color space, builds a visual dictionary of 10000 visual words by using the hierarchical k-means clustering and finally classifies the food images with a linear support vector machine classifier. The system achieved classification accuracy of the order of 78%, thus proving the feasibility of the proposed approach in a very challenging image dataset. The increased number of diabetic patients worldwide, together with their proven inability to assess their diet accurately raised the need to develop systems that will support T1D patients during CHO counting. So far, a broad spectrum of mobile phone applications have been proposed in the literature, ranging from interactive diaries to dietary monitoring based on on-body sensors. The increasing processing power of the mobile devices, as well as the recent advances made in computer vision, permitted the introduction of image/video analysis-based applications for diet management. In a typical scenario, the user acquires an image of the upcoming meal using the camera of his phone. The image is processed—either locally or on the server side—in order to extract a series of features describing its visual properties. The extracted features are fed to a classifier to recognize the various food types of the acquired image, which will then be used for the CHO estimation.

II.SYSTEM ARCHITECTURE

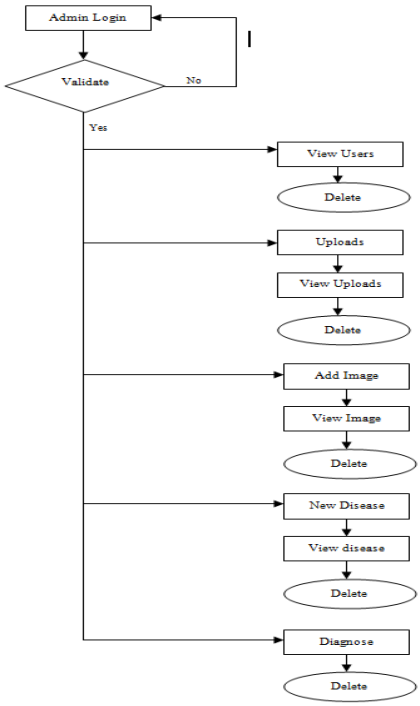


A system architecture or systems architecture is the computational design that defines the structure and/or behavior of a system. An architecture description is a formal description of a system, organized in a way that supports reasoning about the structural properties of the system. It defines the system components or building blocks and provides a plan from which products can be procured, and systems developed , that will work together to implement the overall system. Implementation is the stage in the project where the theoretical design is turned into a working system. The most critical stage is achieving a successful system and in giving confidence on the new system for the users, what it will work efficient and effectively. It involves careful planning, investing of the current system, and its constraints on implementation, design of methods to achieve the changeover methods. The implementation process begins with preparing a plan for the implementation of the system. According to this plan, the activities are to be carried out in these plans; discussion has been made regarding the equipment, resources and how to test activities. The coding step translates a detail design representation into a programming language realization. Programming languages are vehicles for communication between human and computers programming language characteristics and coding style can profoundly affect software quality and maintainability. The coding is done with the following characteristics in mind.

- Ease of design to code translation.
- Code efficiency.
- Memory efficiency.
- Maintainability.

The user should be very careful while implementing a project to ensure what they have planned is properly implemented. The user should not change the purpose of project while implementing. The user should not go in a roundabout way to achieve a solution; it should be direct, crisp and clear and up to the point. Implementation is the stage of the project when the theoretical design is turned out into a working system. Thus it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective. The implementation stage involves careful planning, investigation of the existing system and it's constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods.

III. WORKING PROCEDURE



The first experiment proved the superiority of dense key point extraction which was able to produce the required large number of patches with minimum overlap between them. The second experiment investigated the effect of the descriptor's size on the final performance. The best results were obtained by the combination of descriptors with sizes 16, 24, and 32. By using descriptors with different sizes, the BoF system gained multi-resolution properties that increased the final performance, since the food scale

may vary among the images. Then, the hsvSIFT was chosen among 14 different color and texture descriptors as giving the best results. hsvSIFT constitutes a differential descriptor that describes the local texture in all three different color channels of the HSV color space. This fact enables it to include color information, apart from texture, but also keep some invariance in intensity and color changes. The color capturing ability of hsvSIFT was also proved by the descriptors' fusion experiment that failed to increase the performance after combining it with the best color descriptors. As regards the learning of the visual dictionary, k-means was compared to its hierarchical version hk-means. The latter managed to produce almost equivalent results with k-means, for the optimal number of visual words, while being extremely computationally efficient. The optimal number of words was determined to be approximately 10000, since fewer words resulted in clearly worse results and more words did not improve the performance. For the final classification, two linear and four nonlinear machine-learning techniques were employed, with the linear giving the best results, especially for large number of features. This is probably caused by the high dimensionality of the feature space, as this makes the problem linearly separable, at least to some extent.

New user signup:
Here the new user can sign up and can create a new account to login the system. The user needs to provide the information such a name, mobile number, contact information and the email id which acts as the userid and a password. The password and confirm password is validated to be the same, and the email id needs to be unique. If all the information are valid then the user is created an account to login the system. Once the id is created the user can login the system.

User list:
This module allows the administrator of the system to view all the users who have login the system. This information is displayed in the table view. Additionally a Delete link is also provided. If the admin needs to delete the unwanted users, he can click the link and the system prompts the administrator whether to delete the user permanently. If the administrator presses cancel, then the user account is not deleted. If the administrator clicks the ok button then the user record is permanently removed from the system.

Uploads:
Here the administrator can upload new food items. This module prompts the administrator to enter the food name, calories level for the food, and the food image. Once all the information are given, the information is uploaded to the database. There it is stored in the corresponding tables. The food image is used to compare with the image that is being uploaded by the user.

Add image:
This module helps the administrator to add the image of the food to the existing images of the particular food. So admin can upload numerous images of the food in the database. This improves the search to be easy for the users. In this module administrator selects the existing food name and adds the image to the existing food item. The uploaded image is stored in the server and later used in the food item search.

Disease:
In this page administrator can create new disease information such as the name of the disease and the allowed calories level for the food. Once the information is given, it is stored in the database. This information later used in deciding the calories level for each user.

Diagnose:
Here administrator stores the disease information about each user. If the particular user is ailed by a disease then the administrator stores the user information and disease information to the database. Later if the user logins the system, the disease information is taken from this table and is compared with the food calories level which is uploaded by the user. This calories level is compared with the food calories level which is uploaded by the user. If the calories level is within the limit of user's allowed calories level, it is suggested that the user can take the food. If the foods calories level is greater than the allowed calories level of the user then the user is instructed not to take the food.

Food result:

This module is given to the user of the system. Once the user is logged in the user can upload the food image through this module. The uploaded image is compared with the images which are already uploaded by the administrator. If a match is found then the corresponding food is fetched from the database and its calories level is also fetched from the database. All these information are stored by the administrator already in his module. Once the calories level information is fetched, it is compared with the allowed calories level for the particular user. The information is calculated automatically when the user logs in. The information is fetched from the diagnostic information which is given by the admin. It contains the disease which ails the user and the corresponding allowed calories level is also fetched.

IV. CONCLUSION

We propose a BoF-based system for food image classification, as a first step toward the development of a portable application, providing dietary advice to diabetic patients through automatic CHO counting. A series of five major experiments was carried out for choosing and optimizing the involved components and parameters of the system. The experiments were conducted on a newly constructed food image dataset with 4868 images of central European food belonging to 11 different food classes. The final, optimized system achieved ORA in the order of 78%, proving the feasibility of a BoF-based system for the food recognition problem. For future work, a hierarchical classification approach will be investigated by merging visually similar classes for the first levels of the hierarchical model, which can then be distinguished in a latter level by exploiting appropriate discriminative features. Moreover, the enhancement of the visual dataset with more images will improve the classification rates, especially for the classes with high diversity. The final system will additionally include a food segmentation stage before applying the proposed recognition module, so that images with multiple food types can also be addressed. As a final stage, food volume will be estimated by using multi-view reconstruction and CHO content will be calculated based on the computer vision results and nutritional tables.

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