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Recognition of Images Formed in Pho on the Eyes of different Subjects

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Abstract

With each passing day resolutions of still image/video cameras are on the rise. This amelioration in resolutions has the potential to extract useful information on the view opposite the photographed subjects from their reflecting parts. Especially important is the idea to capture images formed on the eyes of photographed people and animals. The motivation behind this research is to explore the forensic importance of the images/videos to especially analyze the reflections of the background of the camera. This analysis may include extraction/ detection/recognition of the objects in front of the subjects but on the back of the camera. In the national context such videos/photographs are not rare and, specifically speaking, an abductee's video footage at a good resolution may give some important clues to the identity of the person who kidnapped him/her. Our aim would be to extract visual information formed in human eyes from still images as well as from video clips. After extraction, our next task would be to recognize the extracted visual information. Initially our experiments would be limited on characters' extraction and recognition, including characters of different styles and font sizes (computerized) as well as hand written. Although varieties of Optical Character Recognition (OCR) tools are available for characters' extraction and recognition but, the problem is that they only provide results for clear images (zoomed).

Key-words: Face Recognition, 3D Imaging, Security, Visualization.

1. Introduction

During the time period specified, the main task was to combine different 3D data and then provide scalable visualization in a client/server context with heterogeneous network, computation, and memory capabilities. We took advantage of the discrete wavelet transform (DWT) from the state-of-the-art JPEG2000 codec's multiresolution nature for scalability. Data unification was accomplished via DWT domain blind data hiding, which may be completely or adaptively synchronous.

A typical surface-based 3D visualization necessitates at least two pieces of data: a 2D intensity image, referred to as texture, and a matching 3D shape displayed as a range image, a shaded 3D model, and/or a mesh of points. The pixel value in a range picture, also known as a depth image, reflects the distance between the sensor and the imaged surface. The texture is a matching 2D color picture that is placed over a model created by triangulation from the depth map.

A very less amount of work has been done on using eyes to interpret the world surrounding the person to whom the eye belongs. Nishino & Nayar were the first who work on this idea [1]. They have worked on still images. Extraction was performed using geometric based technique. Problem with their work is that they have performed extraction on optically zoomed images wherein the contemporary resolutions constrained the distance between the subject and reflecting objects was too low – one can say that they photographed eyes - not the subjects. With the advent of high resolution, the case of large distances may well be addressable in the contemporary scenario [2].

The range data was initially treated to DWT for data concealment, while the texture data was sent into the JPEG2000 encoder. After the DWT phase, the texture JPEG2000 coding process was halted, and the DWT domain range coefficients were inserted in all or a portion of texture sub bands. At the same time as the interruption, the embedded data was restored to the JPEG2000 pipeline. The resulting code may be transferred across any communication channel like any other JPEG2000 file since the JPEG2000 format is preserved during the procedure.

As a result of incomplete or delayed data transfer, the resolution scaling of wavelets and the synchronized nature of our approaches permitted a 3D display even with less than original resolution bands. As a result of the approach, it was possible to create a visualization from a subset of data in the form of the lowest sub band at a certain resolution level [3]-[5].

As reflected images constructed in human eyes are not always clear to external constraints (resolution of camera/video, lightening factors, distance) so, there is need to apply some image processing techniques like thresholding and segmentation to enhance the image quality. We will be vying for algorithms that would be able to recognize characters, even on the basis of considerably low information content of the reflections formed on the eyes of the photographed subjects.

On the basis of above discussed constraints, we aim to construct, as a by product, a quality database for images of eyes, which may will be useful for future research and researchers. To the best of our knowledge currently there is no such parameterized database of reflection images of eyes, available for the researchers.

The Scope of this research is to:

- Extract the information from human eye in high resolution still images and also from high definition videos.
- Handling of the imaging parameters such as lighting at capturing time, camera noise distance from objects etc.
- Analysis of under what circumstances of image capturing parameters, we can extract robust features from eye retina and their impacts.
- Development of the image data base, that have tackle all type of image capturing parameters.

2. Literature Review

During the past decade, Camera resolutions have sky-rocketed and today even an ordinary gadget, like a mobile cell phone, comes with a camera of around 14 mega pixels, not to speak of still image cameras and camcorders. High resolutions imply that one can safely zoom in on parts of such pictures by many factors without observing any significant artifacts. Human eyes have always been not too bad reflectors of light incident on them, meaning that a reflection of the scene opposite a person can always be a possibility. Reconstructing such scenes, or a part thereof, from the reflection formed on the eyes of the photographed subject, must have an excellent potential in the field of digital image forensics. In this research we would try to capitalize on this potential since we believe that, from the reconstructed scene, one can identify texts, objects, faces, human(s) or other figures and the like [6]-[8].

The task would be faced with two main challenges, viz. refinement of the images and recognition of texts/objects. In the former case, sound state of the art digital image processing techniques may be needed to denoise, deblur and enhance the images cropped from the eyes of the subjects in photographs. Once refined, the challenge would come down to the segmentation, classification and recognition of objects and texts. In this latter context one can start from text and go on to cover other objects. Even with the text, one can go for printed texts of various fonts and sizes and then expand it to handwritten texts. All these correspond to OCR. Alongside, one can expand this to recognize objects, like buildings, human figures, faces and gestures, paintings and photos on the back of the photographer, animals, tree formations, vehicles and many others [9]-[10].

The work may have a statistical aspect at the start, perhaps, as optimization of parameters related to the photographing environment is quintessential to the task. Such parameters may include but not limited to:

- Camera resolutions,
- Captor's type,
- Subject's distance from camera,
- Subject's personal attributes, like age, eye-color, sex, cosmetics etc.,
- Light conditions, both outdoor, indoor
- Effect of camera flash
- The angle at which the reflections are formed on the eye.

Once optimized, these standardized parameters can be utilized to go for the above defined goals. Since a lot of photography would be needed, the by product of the research may hopefully be a large database of images for future research and citations.

With the ever-ameliorating resolutions of still and video cameras, the forensic value of the information, extracted from the reflected images from the eyes of different photograph subjects, increases day by day. The combination of the cornea of an eye and the camera capturing the appearance of the eye can be viewed as catadioptric (mirror + lens) imaging system. This system has been referred to as corneal imaging system [1], as the reflecting element (the cornea) is not rigidly attached to the camera.

From literature survey we come to know that bundle of work has been done on identification of people from their iris textures [2, 3]. But virtually a very less amount of work has been done on using eyes to interpret the world surrounding the person to whom the eye belongs. Nishino & Nayar were the first who work on this idea [1]. They have worked on still images.

Extraction was performed using geometric based technique. Problem with their work is that they have performed extraction on optically zoomed images wherein the contemporary resolutions constrained the distance between the subject and reflecting objects was too low –one can say that they photographed eyes - not the subjects. With the advent of high resolution, the case of large distances may well be addressable in the contemporary scenario.

No doubt, eyes are one of the most important features of human beings. Eyes provide us a lot of information regarding the physical world. Due to the phenomenon of reflection, the image of subject opposite to photographed person is mirrored in his/her eyes. This visual information can be extracted from eyes and can be used for further processing in many applications. In visual recognition, the extracted information can be useful for the identification of location and circumstance of the person.

3. Research Methodology

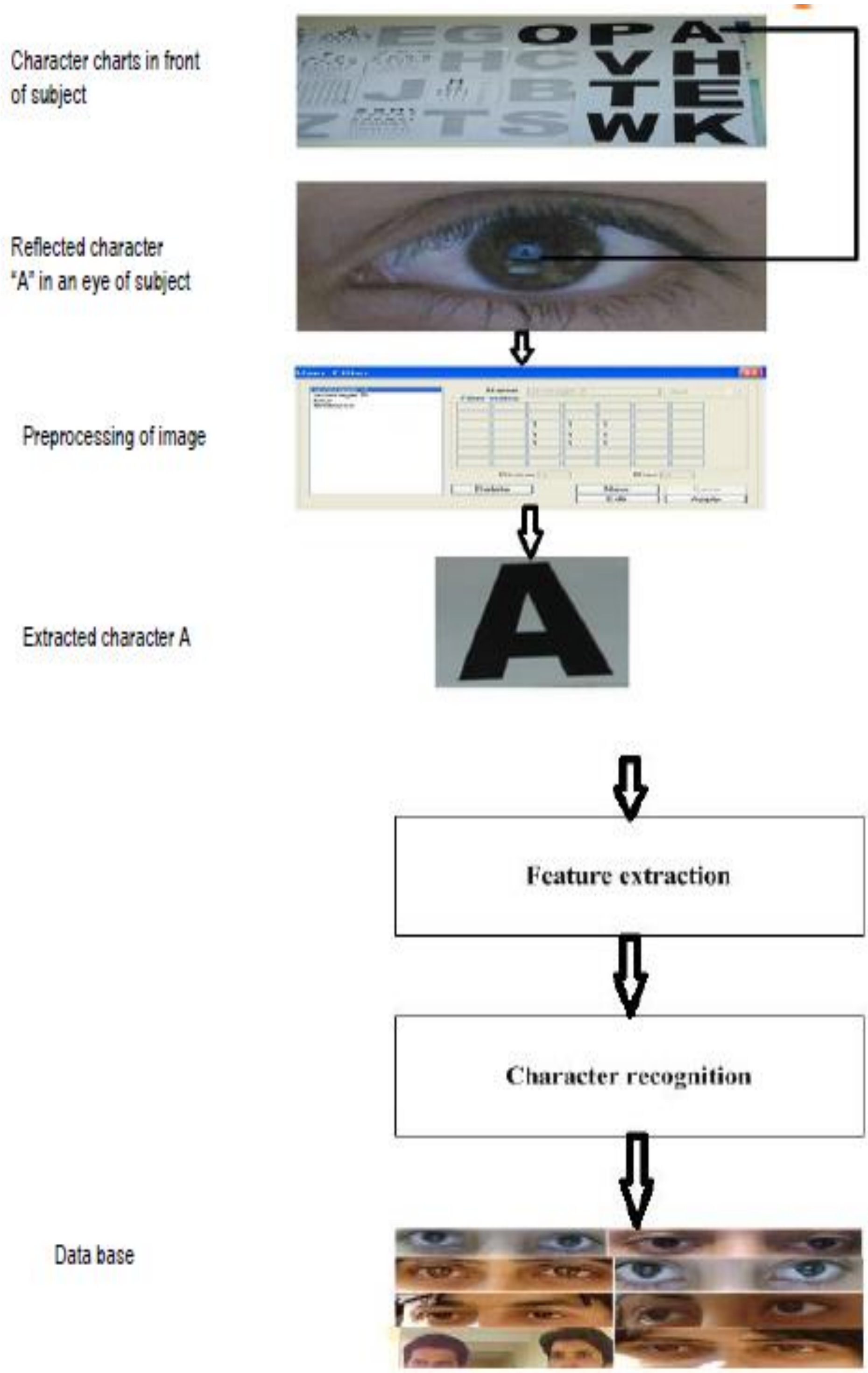
Our research is divided into the following steps:

- Take photographs/videos of different subjects using different resolutions, and different parameters discussed above, with various known brands of cameras in different environments (indoor, outdoor).
- Crop the eye portions of the subjects and enhance the resultant cropped images.
- Apply segmentation techniques to identify objects/texts.
- Use machine learning techniques to achieve the robust features of extracted images.
- On the basis of extracted features recognize the images.
- The process will help to set statistical thresholds on the parameters to the forensic value of the content.
- In addition, a database of such images will be conceived for future research.

After experimenting with characters, our next target would be to go for object extraction/ recognition from images of eyes. Finally, we would perform the task of human detection and recognition from both still images and videos. In order to conduct all these experiments, we would require an extensive photography and videos of different scenes and environments (both indoor and outdoor). In addition, we would also consider the following constraints during photography/ video:

- Different resolutions of different brands of digital cameras and videos.
- Different font sizes of different styles and formats.
- Age, Sex and Eye colour of a photographed person.
- Distance of photographed person from the captured scene and from the person taking photograph or making video.

Fig. 1 – Block Diagram for Proposed System



4. Conclusion

The impact, as obvious from the above discussion, would be twofold. Firstly, the research has the potential of not only enhancing the forensic value of future images and videos but also the

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archived ones. Historically important images can yield results that should be emotionally and educationally very important. Secondly the database which may result with our investigation may well prove a very important research platform. Since the research in this direction may continue even after the completion of the research, a considerable number of researchers would get trained not only during the course of the research but even after it. The equipment and the manpower would definitely enhance the research capability of our institution would be a leap forward in establishing a research group on the subject.

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