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Smart Camera Network Supervision for Competent Exploitation of Energy Recourses in vision Task

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Abstract

Face Detection by Smart Camera Network in static mode and dynamic mode is done by the allocation of multitasking. This might result in the absence of some of the pedestrians and consumption of more energy for single target. This paper mainly presents most widely used energy optimization technique in dynamic mode. Tasks are scheduled on periodic basis, with inadequate time period for target switching and task switching. Face Detection in vision task is done by rectangular features of Haar and AdaBoost in Viola Jones Algorithm. Energy utility factor is allocated on Largest Task first algorithm basis. Task is allocated to the camera with uppermost amount of utility rate that can detect the face more approximately. Energy Consumption is optimized by the distributive market based bidding process and Adaptive strategy selection. This boosts existence of camera and drop in the power consumption with restricted amount of Camera's.

Keywords*: Computer Vision Task, Viola Jones, Rectangular Features, Multi-Tasking, Face Detection*

1. Introduction

Face detection plays prominent role for secular surveillance in present society using smart camera network. When a camera is active all the time and captures the image or intimation of unknown activity results in the wastage of much amount of energy for undefined resources. As the camera is active lifespan decreases and goes to dump state with in a limited period of time. To increase the life time of a camera, Camera's will be made in to on state dynamically only when a face is detected. Previous papers had maintained the usage and change of energy resources based on the assumed values without considering the real time examples and application in a camera network. This paper mainly presents results that takes place when an Face Detection is mainly done based on viola Jones algorithm. Initially Camera's will be on only for particular period of time. if it doesn't recognize any face, based on the previous state comparison present state is determined. Viola Jones Algorithm is mainly done based on the integral image, Adaboost function and the Cascaded Classifiers. When a face is detected an image is captured and the rectangular features are implemented to check whether the complete face is detected or not.

2. Block Diagram

Task is allocated periodically on the basis of application. Periodic task assignment shifts from one task to other task periodically. All Cameras' will come into active state at this periodic basis. Rest of the time, Camera's which can detect the target and having highest utility rate.

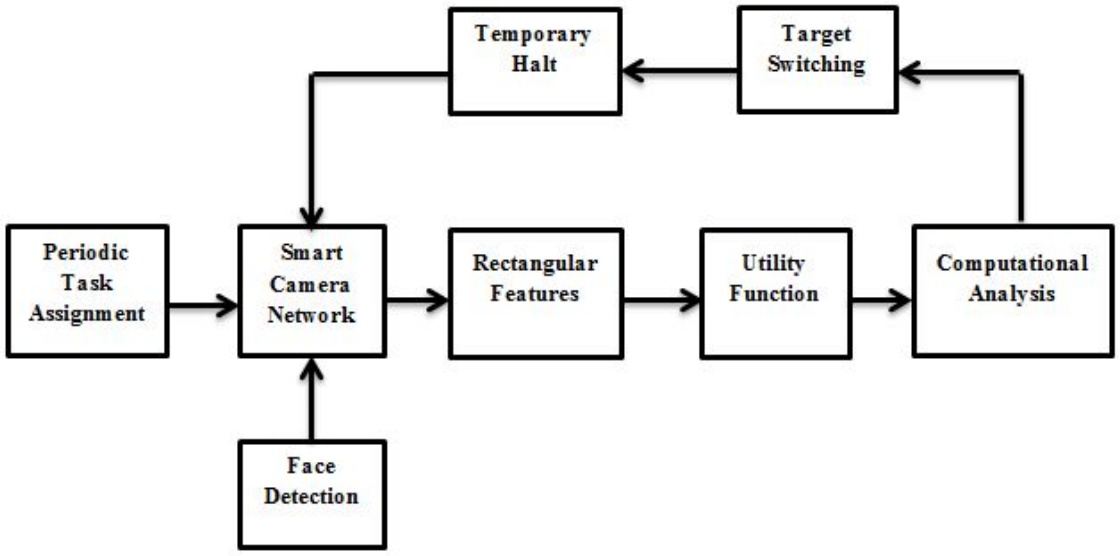


Figure 1. Block Diagram of a Smart Camera Network In Vision Task

2.1 Smart Camera Network

A normal camera will be active all the time either in static mode or dynamic mode. It just takes photos and videos based on the human command. It doesn't consider any target is present or not. In closed circuit (CC) Camera, Camera's will be on all the time and records the video. Normal camera needs External remote sensor network to capture the images and store it in prescribed memory or to send determined location. Coming to SCN, Camera's will be in static or dynamic mode based on the application. A Smart Camera can be made active all the time for most complex high security areas. A Smart Camera can come into ON state dynamically only when object is detected. It can identify number of surveillance, human behavior and Unknown in-determined aspects.

Computational Analysis for smart camera network is mainly done in two ways

a. Distributive Market Based Bidding Process Algorithm
b. Adaptive Strategy Selection

2.2 Distributive Market Based Bidding Process Algorithm

Task is allocated to each and every node of the smart camera network. When a target enters in to the region of the task, the target is detected by all the camera's in nearby location and the utility rate of each and every camera is compared with each other. By the comparison of utility rate of each and every camera, handover the task to the camera having highest bidding rate. The camera having largest utility rate is given highest priority. The camera which is away from the target or having lowest utility rate and less amount energy resources will be in ideal state. Distributed market based bidding process results in the wastage of power as multiple cameras operate on the same target and also results in the wastage of power and correlation of tasks.

2.3 Adaptive Strategy Selection

Adaptive energy oriented multitasking is mainly done on bidding process for the reduction of wastage of power consumption and correlation of tasks. In adaptive strategy selection bidding process is done for all the cameras. When a target enters in to the region of coverage of multiple cameras, task is assigned to the camera having highest priority. The energy utility rate of each task is changed in accordance with the distance and the coverage area of each camera. Due to this energy consumption for multiple tasks at the same time is reduced and the energy utilization by single camera is also changed by application.

3. Face Detection

Viola Jones Algorithm is the most common and efficiently used algorithm for Face Detection. Face Detection is mainly done by the introduction of the new image by integral image and applying the haar algorithm for the detection of particular image. Implement the AdaBoost Algorithm for the selections of appropriate Features in that object and send this features to classifier which decides, whether the image has face or not. Integral image mainly represents the sum of the pixels on the top and left of particular region. Integral Image mainly depends on the main two features of accuracy and speed. Integral image adeptness is double the model image. Rectangle in the image is designed based on the four catalogues of integral image.

AdaBoost Algorithm has two Features

a. Two-Rectangle Feature: The Region of Eye will be brighter than eyes and cheeks
b. Three-Rectangle Feature: The Eyes will be brighter than the border of Nose.

Haar Features mainly represents the common Features all human faces. Haar Features are

a. Two-Rectangle Feature
b. Three-Rectangle Feature
c. Four-Rectangle Feature

These Features mainly represents the Eyes, Nose and Mouth Region of the face detected based on the Orientation of the pixels. This is mainly done by the difference of the sum of white pixels from sum the sum of black pixels.

3.1 Detection techniques & outputs

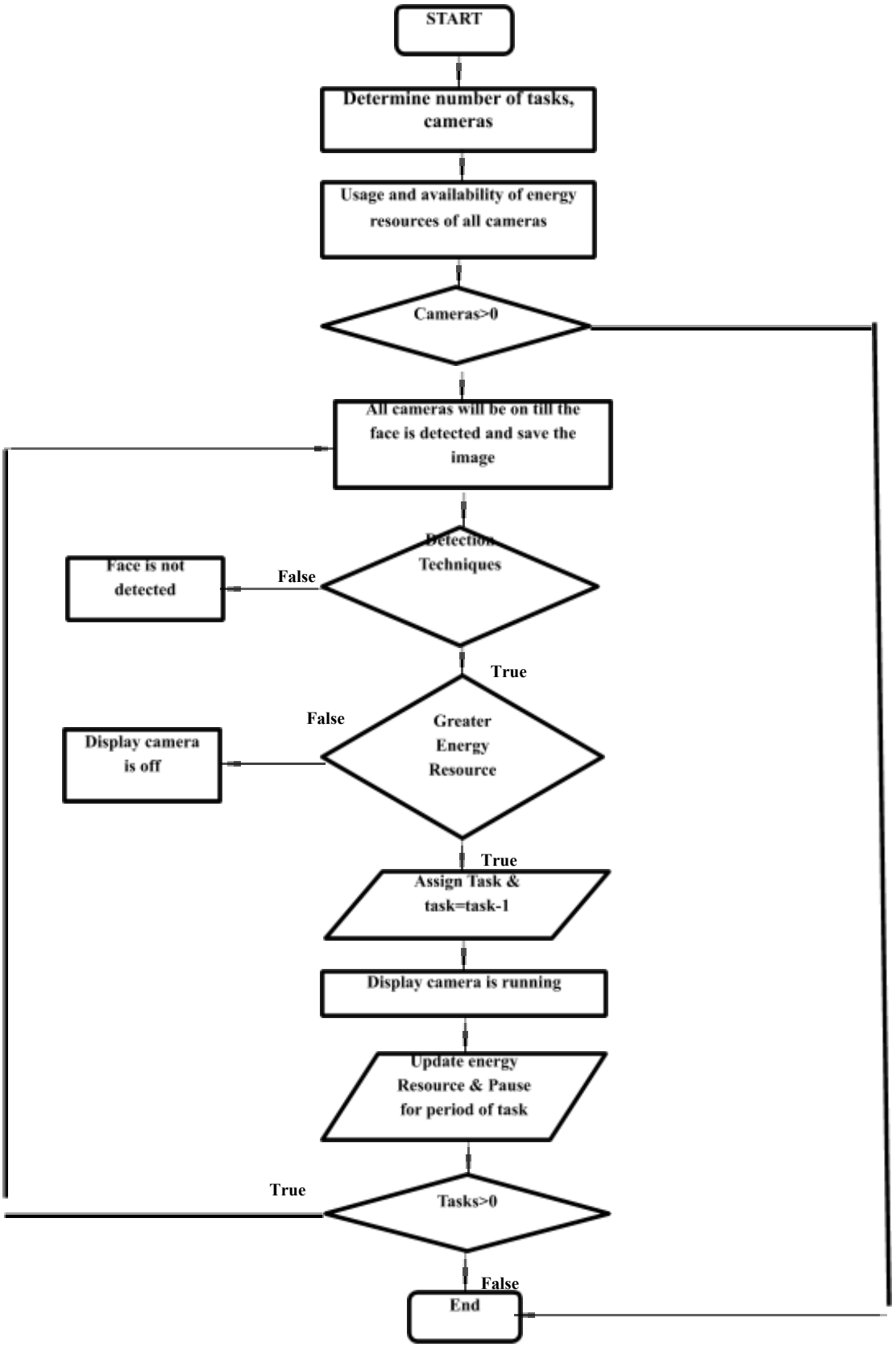
Face detestation mainly depends on the brightness, color, background and lightening of the image. Absence of any of this might result in the mismatch of the face detection techniques. For this reason the captured image is again detected by Face, Eyes, Nose and Mouth. If any of this fails to capture the image, that camera is not considered as face is detected. Eye is detected on the eye pair big. Nose and mouth are detected on the dimensions and merging threshold values. The Face detector can detect the faces that are tilted by ±15 degrees, ±45 degrees up to and out of the plane. This will result in the detection of the wrong images. The outputs that are generated rectangular face detection are shown in (figure 2)

```
BBF =

   570   415    92    92


BBE =

  0×4 empty double matrix


BBM =

   594   498    50    30
   192   431    56    33
   146   533    57    34
   333   838    97    58
   441   598   163    98


BBN =

   596   479    48    40
   127   507    64    54
```

Figure 2. Rectangular Features of Tilted face

Eyes Detection and Mouth Detection can't be done exactly when a human turns aside or tilts. The human Face Wearing Spectacles or Scarf can't be recognised by vision task. As the Eyes of the Human being is not seen in the tilted direction, Two-Rectangular features of a human being can't detect the mouth, nose and eyes of a human being exactly.

4. Flowchart


START
Determine number of tasks, cameras
Usage and availability of energy resources of all cameras
Cameras>0
All cameras will be on till the face is detected and save the image
Detection Techniques
False
Face is not detected
True
Greater Energy Resource
False
Display camera is off
True
Assign Task & task=task-1
Display camera is running
Update energy Resource & Pause for period of task
Tasks>0
True
False
End

5. Algorithms

Algorithm 1 represents the face detection by multiple cameras at the same time by live video acquisition technique. Cameras will be active initially till the face is detected. Cameras will be active for particular amount of frame counts. If face is not detected by any camera within period of time, present capture of the camera is compared with the previous one and changes in the scenario is determined. The captured image will show the minute in the moment of any object. This returns with the image of a detected face. Displays the image that is captured based on the detected face.

Algorithm 1 Face Detection

```
Input: Number of camera's and Tasks
Output: Image of detected target
Initialize cascade object detector, frame count and webcam
Snapshot webcam and assign frame size
Turn on video player based on frame size
While video player is on &  frame count<allotted count do
  Take next frame by Snapshot of cam and assign RGB for video frame
  Increment frame count
  If target detected do
    Assign Detection mode by bounding box XY points
    If Bbox is empty do
      Find corner points of detected region
      Reinitialize and save the points
      Display bounding box around the detected face and detected corners
      Save the image of video frame based on date and time and by which camera.
    end if
  else
    Estimate the geometric transformation between the old points
    Display tracked points and reset all
  end if
end while
Return image of a detected Target
```

Algorithm 2 Assures the detected face's whether the face is really accurate or not based on the rectangular features of the Haar and Viola Jones Algorithm. Based on the detected Bounding box values of the rectangular features confirmation is done whether the camera can detect the exact target or not. It returns the status of all the cameras on face detection.

Energy utility rate of the camera is changes based on the number of tasks and camera's. Face detection is done even when the face very closer and out camera or when tilting at some angular differences. So, rectangular features are tested independently even after testing cascaded classifiers.

Algorithm 2 Rectangular Features Pattern

```
Input: Number of camera's
Output: which camera can detect target
for every camera do
  Run Algorithm 1 for the detection of the target through Camera
  Implement Face Detection Technique on the image captured
  Implement Eyes Detection Technique on the image captured
  Implement Nose Detection Technique on the image captured
  Implement Mouth Detection Technique on the image captured
  If all are detected then
    Camera can detect target
```

```
    else
      Camera cannot detect target
    end if
  end for
  Return which camera can detect target
```

Algorithm 3 represents the energy utilization rate of each camera and arranges then in plunging order. Based on the camera's that can detect the task and the camera having highest utility rate, task is allocated to that camera.

Algorithm 3 Allocation of Energy Utilization

```
Input: Number of tasks, cameras, computational requirements and allocated time period
Output: Task allocation to camera's and utility rate of every task.
Calculate Energy Utilization Rate based on computational Requirements and allocated time
period & Arrange Utility Rate in Descending order.
Initialize task's, Utility Rate of task's to Zero
Assign tasks based on availability of cameras
for every task do
    Run Algorithm 2 to get which cameras can detect target
    for every camera do
      if camera is on then
        if larger utilization rate is enough then
          Assign task to this camera
          Update energy utilization of that task
          Display camera is running and Recording the Video
        else
          Display camera is in Idle Mode
        end if
        Display Face is not detected
      end if
    end for
Display task's allocated to each camera & utilization rate of each task
end for
```

6. Output and Results

```
loadtime =

    0.6000    0.2667    0.1000

Switching all the camera's ON for finding target face
Face is not detected by camera1
Face is not detected by camera2

after_allocation =

     0     0

Face is detected by camera1
Face is not detected by camera2
camera1 is running and recording the video

after_allocation =

    0.2667         0

Face is not detected by camera1
Face is detected by camera2
camera2 is running and recording the video

after_allocation =

    0.2667    0.1000
```

Figure 3. Face Detection Failure Case

```
loadtime =

    0.6000    0.2667    0.1000

Switching all the camera's ON for finding target face
Face is detected by camera1
Face is not detected by camera2
camera1 is running and recording the video

after_allocation =

    0.6000         0

Face is not detected by camera1
Face is not detected by camera2
camera2 is running and recording the video

after_allocation =

    0.6000    0.2667

Face is not detected by camera1
Face is detected by camera2
camera2 is running and recording the video

after_allocation =

    0.6000    0.3667
```

Figure 4. Face Detected By Multiple Camera'**s**

(Figure 3) shows the output when face is not detected by any camera. So, Task is not allocated and the energy resource is used for other tasks. (Figure 4) shows the target tracked by both the cameras but the task is allocated to the task having highest utility rate.

7. Conclusion

This paper mainly presents the usage of distributive market based bidding process and Adaptive strategy selection for smart Camera Network only in dynamic mode. Distibuted market based bidding process assigns the tasks to the cameras which can detect the target more accurately. Adaptive energy oriented multitasking reduces the energy consumption by changing the energy utility rate of all the cameras based on target that can be tracked. Face Detection is done in viola Jones Algorithm using Haar AdaBoost Features in smart camera Network. This results in the growth of existence of camera and drop in the power consumption with restricted amount of Camera's

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