

A Survey on Face Recognition through Mobile Cloud Computing Environment

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Abstract-Face recognition has become a major important research area nowadays. The law prosecution uses a software for crime fighting tool using facial recognition. The mobile device usage and the growth of the mobile application has been increased by face recognition. There are many challenges in mobile device which are facing in problem resources like computing power, limited bandwidth, battery life and storage so for this, the mobile cloud computing has been developed a potential technology for mobile service to solve the problem of mobile resources i.e., offloading the processing and the storage of data out from mobile to the cloud computing. The computing power can be exploit easily by mobile cloud computing. This gives the further explanation like mobile cloud computing definition, face detection, face recognition and workflow of face detection. The algorithm used in this proposition is Eigenface algorithm. The result demonstrate that mobile cloud computing will reduce the overall processing time.

Keywords: *Cloud computing, IAAS, Mobile cloud computing, Image processing, Face detection, Face recognition, PAAS, SAAS, Web.*

I. INTRODUCTION

Face recognition has become most recent research method. The biometric is an automatic method used to identify the individual features by face or physical characteristics[1]. Face recognition given the attention towards the security, psychology and image processing. The law enforcement, surveillance, airport security is the most important application for the face recognition. The mobile cloud computing is the one of the most important branch in cloud computing. Mobile devices have resource challenges like energy, power and data storage these problems are solved by mobile cloud computing which significantly moves the power and data storage away from mobile devices into the cloud. The limitations of mobile devices are computing and power supply, due to mobile cloud computing users can see a large number of new features to intensify their mobile phones. The Centralized monitoring

has increased the security level in mobile devices and maintains the software in the cloud as it combines the cloud computing into mobile surroundings. It gives many facilities for mobile device users to take full advantage of cloud computing. Due to the significant amount of processing required to perform face recognition which is captured from the mobile phone it needs a large data base to store the images, this application is not sufficient using the mobile devices to compute, so it is require to access from the cloud computing.

We have focused our work towards the developing a real time face recognition using Eigen face algorithm[7]. The Eigen face algorithm use in this approach as advantages over in terms of speed simplicity, learning capability and robustness. Face recognition algorithm analysis the image, such as shape, size and position of the facial features like nose, eyes and mouth and then use these extracted features to search a facial database to locate the matching images. While there are many applications that will benefit from the collaborative of coupling mobile and cloud computing. Cloud computing is typically defined as a type of computing that relies on sharing computing resources rather than having local servers or personal devices to handle applications[2]. The clouds provide a pooled network resources such as, CPU, RAM, storage, software on the web.

Peter Eisert explains the paper about the state of art of computer vision techniques related to faces. This includes the both cognition and (face detection and recognition) applications of these method in media production and access through the digital services. Movie productions takes a lot of time to capture a image and takes a lot of effort in capturing the perfect image.

Zohreh Sanaei[11], explains about the mobile cloud computing heterogeneous it gives multidimensional result and code fragmentation issues that prevent development of mobile applications through cross platform which described in mathematically. The influence of heterogeneity in mobile cloud computing are systematically

examined such as related opportunities, challenges identified. The strongest heterogeneities handles like virtualization, middleware and service oriented architecture are discussed.

XiaoweiLi[8] explains about EEG based attention recognition(AR) Attention recognition is a major important application it focuses on the face detection, eye centre localization, eye centre tracking techniques. This paper describes about the electroencephalography(EEG)signals that will extend the current approach and applications.EEG classification algorithms are applied to identify the EEG data into a group of features so that it can be implemented effectively in AR.

II. RELATED WORK

2.1 Cloud computing

Cloud computing is typically defined as a type of computing that relies on sharing computing resources rather than having local servers or personal devices to handle applications.

A. The service model of cloud

There are three service models as described below in figure 1:

- **SAAS**(software as a service):The capability to use application supplied by the service provider in a cloud infrastructure, (eg.,web-based email).
- **PAAS**(Platform as a service):It gives the capability to deploy consumer-created or acquired applications using programminglanguages and tools supported by the provider,(eg.,execution runtime and database.
- **IAAS**(Infrastructure as a service): The capability to provision processing, storage networks, and other fundamental computing resources, example virtual machines, load balancing.

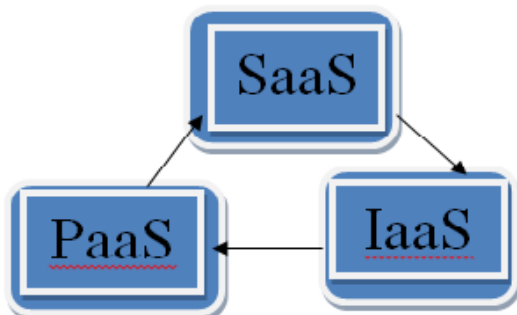


Figure:1 Service models of cloud computing.

B. The several models of the cloud

There are three different clouds as shown below in figure 2:

- **Private Cloud:** The infrastructure is operated solely for an organization. It is managed by the organization or a third party.
- **Public Cloud:** The infrastructure is made available to the general public or a large industry group and it is owned by the selling cloud services.
- **Hybrid Cloud:** The infrastructure is a composition of two or more clouds(private and public).

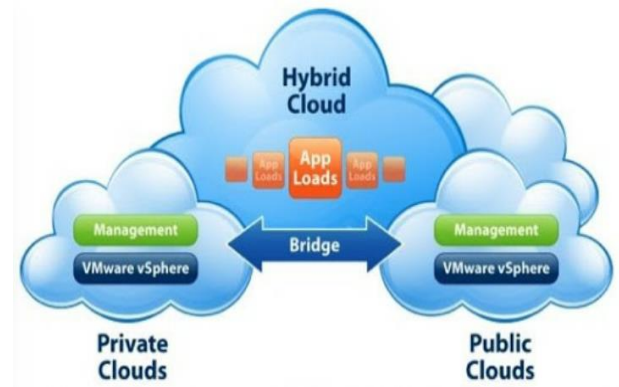


Figure:2 Types of clouds.

III. MOBILE CLOUD COMPUTING

There are different definitions for mobile cloud computing as defined below.The first definition is mobile cloud computing is a combination of cloud computing, mobile computing and wireless networks to bring rich computational resources to mobile users, network operators, as well as cloud computing.Second definition is mobile cloud computing is an model in which mobile applications are performed, powered and accessed using cloud computing.

A. Why mobile cloud computing

Mobile cloud computing it provides a mobile user a feature-rich application delivered over the internet and powered by cloud backed infrastructure. Most applications built for smart phones requires intensive computing power and software platform support for application execution. Many low-end but browser-enabled mobile phones are unable to support such applications. with the advent in mobile cloud computing, the resources in terms of computing, storage and platform support to execute these applications are available through cloud.

- It provides the high computational power, technical functionalities and applications.
- It improves reliability, scalability and data storage capacity.
- It extends the mobile battery life time it helps to overcome the limitations of mobile devices.

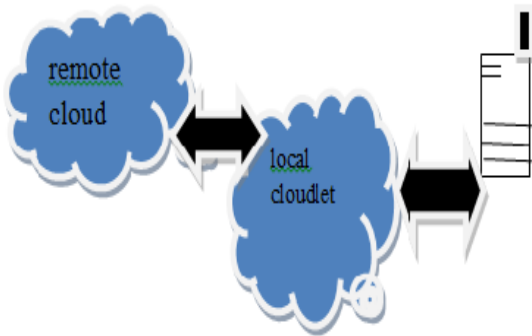


Figure:3 Mobile cloud.

The figure.3 shows that the mobile device offloads its data to a cloudlet. Mobile device moves the computation power and storage data into the mobile cloud applications from that face recognition using this approach. The cloudlet are decentralized and widely dispersed internet infrastructure and storage resources can be leveraged by nearby mobile computers. A cloudlet can be viewed as a data center in a box. The simplicity of management corresponds to an appliance model of computing resources and makes it trivial to deploy on a business premises such as coffee shop. Internally, cloudlet may be viewed as a cluster of multicore computers.

B. Architecture of mobile cloud computing

The mobile cloud computing is composition of three parts they are mobile devices, cloud computing and mobile internet.

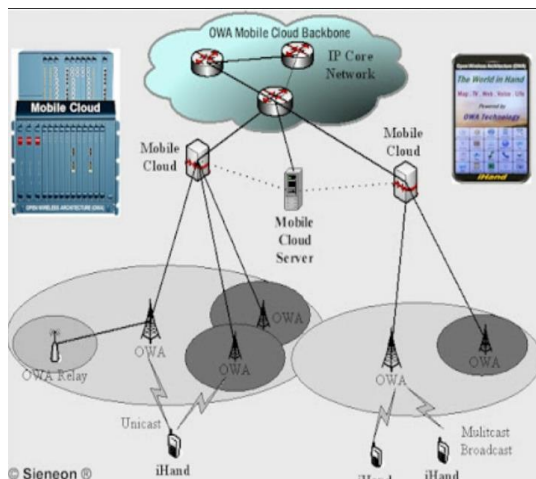


Figure:4 Architecture of mobile cloud computing[9].

In this above architecture presents, in remote centralized cloud structure the cloud resource is placed. The backbone network is accessed by the mobile device via 3G/4G cellular networks or through WiFi access points[9]. The information and request of mobile devices are transmitted to the central processors which are connected to the servers which gives mobile network services after completing the request are delivered through the internet to the cloud. In the cloud, cloud controllers request has been processed to the mobile users with the corresponding cloud

services and sends back the response to the mobile device through internet.

C. Mobile cloud computing applications models

Mobile phones are now capable of supporting a wide range of applications, many of which demand an ever increasing computational power. Mobile cloud applications are categorized into four types that are shown below[6].

- *Energy based application model*

Energy based application models are using the cloud resources to reduce the energy consumption in mobile device. This can be achieved by computational offloading to the cloud. Subsequently, in the cloud the resource computational task are performed and applications consume less energy on mobile phones.

- *Performance based application model*

The primary goal of this application is, by utilizing cloud resources we can enhance the performance of mobile device application. If all the resources are offloaded to the cloud in a high speed computation, the performance can be accessed in less time compared to mobile devices.

- *Mutli-objective application model*

In this model the main objective is to achieve the multiple objectives mainly energy efficiency and performance at the same time between required objectives. This model is a most effective one as it supports multiple objectives and unlike the energy based models and performance are designed in a such a way that to achieve the singular objective and it sacrifices the energy efficiency.

- *Constraint based application model*

This model is designed in such a way that it as to execute the resources in a constraint environment (smart phones) by using cloud resources, for example consider an mobile device which as overload resources for execution of an application. In this application model the light weight models are executed on a mobile devices where as resource intensive components are executed in a cloud.

IV. THE INTERACTION BETWEEN MOBILE AND CLOUD

In the mobile device the communication can take place through the via protocols Remote procedure call (RPC) and Remote Method Invocation (RMI) both RPC and RMI are well supported APIs. Based on service oriented architecture such as REST and SOAP, the application programming interfaces are used to build mobile applications. Through the interfaces the mobile

application can connect and request the services which are hosted on a remote.

There are two standard protocols in web service one is SOAP and other is REST. In this paper the REST web service is used for the face recognition application. Through the HTTP protocol the mobile communicates to the REST web service but the body of message can follow in any format for example JSON and XML. In this paper we described that the image is sending a JSON object format and as well as the clients and service provides should agree on it. REST web service as an advantage that it responses very fast through the HTTP protocol.

V. FACE RECOGNITION

As we said earlier the face recognition is the most important research area it is a most biological feature recognition to the cognitive rule on human beings. There are two parts first part is face recognition and second part is face detection. The first part is used to identify the human faces and locate the position, size, brightness and condition. The second part is to recognise the face as it compares with detected face which has already stored human faces in created data base.

A.Face Detection

In this approach we are going to use a face detection algorithm called haar classifier detection algorithm proposed by Jones and Viola [12]. This algorithm gives the 95% accurate result for detection of a human face. In the haar classifier detection algorithm how it works means if any of the feature is found the algorithm goes to the next stage for further detection. The one advantage of using this algorithm is that it eliminates the non-face candidates fast, so that for further stages there should be no difficulty to find the faces. If the matches were found or fail in any stage it will exit the algorithm.

B.Face Recognition

The most important part is face recognition in which it is based on the geometric features of face the first recognition method is marker points (position of eyes, nose, ears and other) are used to create a feature vector (distance between the points and angle between them). This has been done by calculating the Euclidean distance between the reference image and vector [3][7]. There are two types of algorithm one is Eigenface and Fisherface in this paper we used a Eigenface algorithm. The Eigenface works as it takes the detected face from haar classifier method and detector and then it converts into a set of Eigenfaces, which are all Eigenvectors. This can be done through a sequence of steps.

In the next the set of all faces are combined together and placed into a database set. Then the average of database set is calculated and subtracted from the database set of each image. The covariance matrix is used to calculate the each eigenfaces and eigenvectors.

The last and final step is to select the best eigenfaces which has the highest eigenvalues. The eigenvalues are compared to each other so that to identify which face been matched with which face. Then lastly if the eigenvalues of two faces are similar, then they have the same faces.

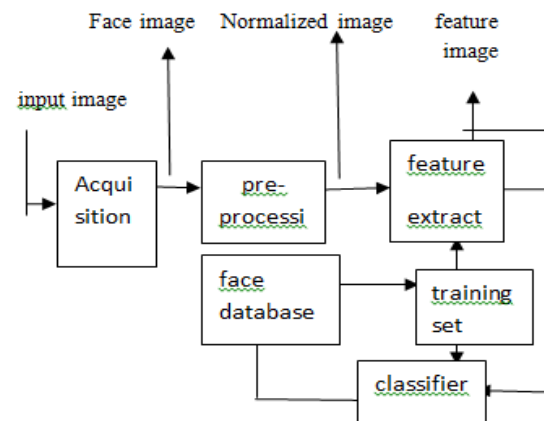


Figure 5: Workflow of face recognition.

VI. CONCLUSION

Mobile cloud computing consist of three types of parts cloud computing, mobile device, mobile internet. For the mobile users the mobile cloud computing provides a best services such as developing a huge application with computational power, like face recognition which is a most important application for the mobile users it is a most important platform. With the help of mobile environment, the mobile cloud computing interact with the cloud computing so that to overcomes the limitations of mobile devices such as battery life, storage, processing, bandwidth, and surroundings like scalability, heterogeneity, and security such as reliability and privacy.

ACKNOWLEDGMENT

The authors would like to thank the editor, mystifying reviewers for their priceless suggestions that appreciably improved the eminence of this paper.

I heartily thank to Principal, B M S Institute of Technology & Management, Bangalore, HOD Department of CSE, B M S Institute of Technology & Management, Bangalore.

Finally thankful to our friends and faculties, Department of CSE B M S Institute of Technology & Management, Bangalore, affiliated to Visvesvaraya Technological University, Belagavi, Karnataka, India

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