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Cloud-Based Picture Archiving and Communication System (PACS)

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Abstract
Revolution in medical imaging systems generate high-resolution images. This revolution has created new challenges in accessing, sharing, archiving, and protecting medical images. The number of these images has also increased significantly over the past decade, which is create another challenge. Recently, the health care industry has started noticing cloud computing as a solution because of its elasticity and scalability, which contribute to avoiding hardware obsolescence, providing universal access to medical images anywhere and anytime, and increasing their availability. This paper introduces the main characteristics of the cloud-based picture archiving and communication system (PACS) and highlights its technical and nontechnical advantages. Moreover, this paper illustrates challenges in cloud-based medical image exchange, regulation, and interoperability as well as how medical image existence can affect cloud users. Furthermore, the paper concludes with directions for future research in medical imaging.

Keywords
PACS, DICOM, HL7, medical imaging, cloud computing

1. Introduction
Over the past decade, most health care providers have transitioned from film-based image management systems to those that are fully digital (filmless and paperless) (Yang et al. 2010). However, the benefit of this shift is limited to conversion from paper to digital image. With the advance technology in digital image, picture archiving and communication systems (PACSs) (Stephens 2021) (Erickson & Kitamura 2021) have been introduced as highly redundant archives that integrate with radiology information systems to increase productivity in radiology and medicine. Today, a PACS is one of most valuable tools facilitating medical decisions and treatment procedures. PACSs enable the storage and retrieval of medical images as well as their distribution among health care professionals.

Cloud computing is a trending approach that facilitates sharing files over the Internet. Cloud computing allows access to applications and data without any infrastructure inside the medical organization. However, despite cloud computing's opportunities, it also features some unique challenges that must be carefully addressed. This paper is a survey paper that highlights current efforts in developing cloud-based PACSs and the challenges of this research.

The paper is organized as follows: Section 2 provides an overview of work related to cloud-based applications in health care and some cloud-based PACSs. In Section 3, we overview three medical terms associated with medical imaging: PACSs, Digital Imaging and Communications in Medicine (DICOM), and Health Level Seven (HL7). The latter two terms represent well-known health standards. Section 4 evaluates cloud-based PACS and illustrates the process of and reasons behind the development of cloud computing's interaction with medical imaging. Section 5 presents current challenges in cloud-based PACS research. Section 6 concludes the paper.

2. Related Work
The health care industry is challenged by significant pressures to decrease the costs associated with providing health care services, adopt new electronic health care systems, and communicate data with other health care professionals and government agencies quickly and securely. Traditionally, the health care industry been slow to accept new technologies for reasons related to infrastructure supporting back-office operations. Many hospitals and medical care organizations keep their servers and desktops two to three years longer than the average for non-health care organizations (Alley et al. 2012).

Despite the challenges of cloud computing, the health care industry has started considering cloud computing as a solution. In some specific areas, the industry can use cloud computing solutions to enhance its operations and provide better, more cost-effective patient care.

Liu and Park (Liu & Park 2013) compared current e-health care applications and those that are cloud-based. Common challenges include hosting, access gateways, security, and interconnection service management. However, cloud-based applications are much more challenging than eHealth, where there is a need to reach a new maturity level. eHealth has been successful in applications such as electronic medical records, electronic health records (EHRs), electronic personal records, hospital information systems (HISs), clinic information systems, radiology information systems (RISs), PACSs, and many other applications in the health domain.

Some work has been focused on developing different forms of electronic records, with solutions aimed at providing better scalability, lower initial costs, and increased health compliance. In China, Lin et al. (Lin et al. 2014) developed and proposed an EHR system to solve the challenges of preventive medicine and chronic disease management. The HER system, based on a cloud-computing architecture, was developed and deployed in Xilingol League of Inner Mongolia. The system used several computing resources to deliver services over the health network using the Internet. However, the system faced challenges, such as integrating the health care system's various levels, and made it difficult for officials to obtain the information needed to implement public health efforts and manage chronic diseases.

Barua et al. (Barua et al. 2011) proposed a personal health information (PHI) system based on cloud computing. In their proposed PHI system, patients have self-controlled access privileges to highly sensitive PHI. The system is aimed at ensuring the achievement of high security standards by allowing data requesters to have varying access privileges based on their roles in the use of encrypted cloud data. However, PHI remains incompatible with health standards and legislation.

Guo et al. (Guo et al. 2010) proposed a cloud-based intelligent hospital file management system (HFMS) aimed at improving some of the limitations that characterize traditional hospital management systems (HMSs). The HFMS connects various medical departments by using strong information technology resources and optimizing patient information flow.

Focusing on medical imaging applications, there have been few cloud-based medical implementations. However, some efforts to develop cloud-based PACSs have been recognized. Table 1 summarizes these efforts, which can be classified into three categories: (1) individual researchers' cloud-based PACS initiatives; (2) government cloud-based PACS initiatives; and (3) commercial cloud-based PACS initiatives.

2.1. Individual Researcher Cloud-Based PACS

Alley et al. (Alley et al. 2012) introduced a prototype of a medical image archive solution aimed at proving that cloud computing platforms can deliver a long-term offside medical image archive solution. The authors implemented the prototype using Microsoft Windows Azure. The prototype included a DICOM server responsible for standard store, query, and retrieve requests; a DICOM image indexer that parsed the metadata and stored them in an Azure SQL (Structured Query Language) database; and a web UI for searching and viewing archived images based on patient and image attributes. The authors claimed that the system had lower storage, lower management costs and higher disaster recoverability. Moreover, the system benefitted from Azure's features, such as its security protocols and Azure SQL. However, future work is required to enhance security, such as implementing IP filtering and a DICOM Part 15 security profile. Additionally, the system must be fully compliant with the Health Insurance Portability and Accountability Act (HIPAA).

Yang et al. (Yang et al. 2010) produced a medical image file accessing system (MIFAS) for exchanging and storing medical images and sharing them between different hospitals. The authors claimed that the system was aimed at enhancing the efficiency of sharing information between patients and their health care professionals to allow them to make the best possible patient care decisions. The authors built the system on the Hadoop platform to overcome issues with exchanging, storing, and sharing medical images.

Liu and Park (Liu & Park 2013) presented a PACS cloud architecture module to achieve interoperability with DICOM devices. The authors claimed that some medical devices cannot communicate with cloud computing interface directly. Thus, the PACS cloud gateway is mainly focused on translating commands from DICOM to non-DICOM and vice versa. This module's main features include its ability to store medical images in any cloud player because its implementation does not depend on any provider. Moreover, it can translate commands from DICOM to non-DICOM and vice versa, where all data are ciphered, and the provider has no access to the keys. Omotosho et al.(2019) proposed a cloud-based PACS framework was designed with features that allow images to be captured and stored in the cloud storage platform. The proposed framework embedding security features, takes care of medical images and their transmission through the internet until they are finally rested in the cloud.

2.2 Government Cloud-Based PACS

At the government level, the French Ministry of Health is taking great initiative related to cloud-based PACSs (Lin et al. 2014). It launched a project referred to as the Filmless Region in 2009 to handle the use of PACSs, RISs, and medical image archiving system shared between health care providers. The program offers three types of cloud-based services: an archive for facilities that already have an RIS and a PACS; PACS software with an online archive for image prefetching, acquisition, and viewing; and finally RIS and PACS software. The program allows health care providers and professionals to access images and share their access with colleagues, and it can even be used from home. Additionally, sharing data between health care providers allows for sharing efficient workflows in PACS and RIS services. The system benefits from cloud computing by avoiding unnecessary costs through a pay-as-you-go billing model priced by use and is subject to the platform's fulfillment of stringent service-level agreements.

Table 1. Cloud-Based PACS

Ref.	**Cloud-Based PACS**		
	Project Title	**Objective**	**Features and Limitations**
(Yang et al. 2010)	"Implementation of a Medical Image File Accessing System on Cloud Computing"	The MIFAS is aimed at enhancing the efficiency of information sharing.	**Features:** - Built on the Hadoop platform to overcome medical image exchanging, storing, and sharing issues **Limitations:** - Hadoop does not provide storage or network-level encryption - Security issues need more work
(Alley et al., 2012)	"A Medical Image Archive Solution in the Cloud"	This medical image archive solution prototype system is aimed at delivering a long-term offside medical image archive solution.	**Features:** - Lowers storage and management costs - Increases disaster recoverability - Benefits from Azure's features, such as security protocols and Azure SQL **Limitations:** - Requires more efforts to enhance its security, such as IP filtering and DICOM Part 15 security profile - Is not compliant with HIPAA
(Alley et al. 2012)	"A PACS Gateway to the Cloud"	A module of PACS cloud architecture to grant interoperability with DICOM devices. It is mainly focused on translation of commands from DICOM to non-DICOM and vice versa.	**Features:** - Storage of medical images in any cloud host company -Translation of commands from DICOM to non-DICOM and vice versa - All data are ciphered, and the provider has no

			access to the keys **Limitation:** - Compliance with health policies and standards is not mentioned
(Lin et al., 2014)	"Healthcare Software as a Service: The Greater Paris Region Program Experience -- The So-called 'Région Sans Film' Program"	The Filmless Region is a program launched by the French Ministry of Health in 2009 to handle the use of PACSs.	**Features:** - Access and sharing of medical images among health care providers and professionals from anywhere - Sharing of efficient workflows in PACS and RIS services - Benefit from cloud computing by saving costs using a pay-as-you-go billing model - Because it is run by the Ministry of Health, there are no policy or regulation concerns **Limitation:** - No competition allowed - Integration with on-premise not mentioned

Commercial Cloud-Based PACS

In the commercial market, PACSs have been around for more than 20 years (Barua et al. 2011)(Guo et al. 2010), during which time health care professionals have recognized some benefits of using them. Now, the PACS market is starting to adopt cloud-based PACS. Guo et al. (Guo et al. 2010) compared current PACS vendors and illustrated how cloud-based systems arose in the market.

There are real cases demonstrating that cloud-based PACSs have started gaining popularity. For example, Naples Community Hospital (NCH) (Teng et al. 2010) had images on various media because its media tool changed every one or two years. This continuous change affected hardware upgrades and required more space and migration of data to the new media. Another challenge was supporting two off-site archives for disaster recovery capabilities. NCH moved to the cloud as a solution for these challenges by implementing the Dell InSite One archiving solution for medical image storage and distribution services (Silva et al. 2011) and has had no problem adding modalities and expanding the system across the enterprise. For disaster recovery, acquired images are automatically sent to Dell InSite One's Connecticut data warehouse. From there, they are transferred to a secondary site in Arizona.

Another real case of Dell Unified Clinical Archive (Silva et al. 2011) use is that of Regional Medical Center (Boiron & Dussaux 2011), which switched to a cloud-based PACS to reduce retrieval times, enhance patient care, and lower storage costs by 25 percent. In the same way, (*MIM Software - Beijing - Press Release - MIMcloud 2.0*, n.d.) MIMcloud by MIM Software provides a secure, low-cost way to manage, retrieve, and archive DICOM images while sharing them among health care professionals. MIMpacs functions as a central DICOM repository for imaging, registration, and contour data, with automatic redundancy and backup. CoActiv (*CoActiv Medical | Customized Image Management Solutions | 24/7 Support*, n.d.) offers a vendor-neutral, cloud-based EXAM-VAULT archive, where images are stored locally. For fast access by authorized users, images are also stored off-site on CoActiv's cloud archive. The market includes other commercial cloud-based PACS, such as PicomCloud (*Cloud PACS | PicomCloud*, n.d.), Cloud PACS from ScImage, Inc. (*Secure Cloud PACS From Picom365*, n.d.), and the Ultima 3rd Generation PACS by Paxeramed (*Web Based PACS | Multimodality Diagnostic Viewer, PaxeraUltima*, n.d.). The list of cloud-based PACS has grown over time.

3. Medical Terminology

Picture Archiving and Communications Systems (PACS)

A PACS is capable of acquiring, transmitting, storing, retrieving, and displaying digital images and relevant patient data from various imaging sources. Usually, a PACS is used in conjunction with a hospital's EHR and information systems and is capable of communicating the information over a network (de Araujo et al. 2022).

Huang (Huang 2011) defined a PACS as a collection of technologies used to carry out digital medical imaging. PACSs are used to digitally obtain medical images from numerous modalities, such as computed tomography (CT), magnetic resonance imaging (MRI), ultrasound, and digital projection radiography. The image data and relevant data are transmitted to other locations over networks, where they may be displayed on computer workstations for soft-copy viewing in multiple locations. A PACS has four main components: image acquisition devices, a system for data storage and retrieval, workstations for image display and interpretation, and a network over which to transmit information. Table II summarizes errors that may result from current PACS components' failures.

Table 2. PACS components and possible errors

PACS Component	Possible Errors
Acquisition errors	Improper technique selection Performance of wrong exam Image deletion
Archive errors	Storage media corruption Storage failure Sequestered exams
Display errors	Mis-calibration Failure to display associated data Artificial shutters
Network errors	Image loss Image corruption Inability to transmit
PACS Component	Accrual of errors

Digital Imaging and Communication in Medicine (DICOM)

DICOM (Kuhl 2015) is an international standard describing how radiology images are identified and formatted and how imaging devices communicate with one another. Jointly developed by the American College of Radiology and the National Electronic Manufacturers Association, DICOM supports a wide range of medical images across the fields of radiology, cardiology, pathology, and dentistry. DICOM uses Transmission Control Protocol/Internet Protocol (TCP/IP) as its lower-layer transport protocol. Table 3 summarizes current DICOM medical imaging challenges in radiology.

Table 3. DICOM Medical Imaging Challenges

Challenge	Possible Errors
Radiology imaging center	Errors in collecting DICOM data from various modalities
Teleradiology center	Networking and remote data access errors
Hospital	Errors aggregating medical data
Image-processing laboratory	Errors integrating and completing data from digital medical images
Expanding radiology system networks	Errors with complex hardware or with the entire radiology DICOM workflow
Standards and policies	Errors related to compliance with security policies and system management profiles in DICOM images' complex network environment

Health Level Seven (HL7)

HL7 is an American National Standards Institute-accredited standards developing organization operating in the health care arena. HL7 is one of the world's most extensively applied standards for health care information. HL7 is a messaging standard that allows health care applications to exchange key sets of clinical and administrative data. Moreover, HL7 describes the data to be exchanged, the timing of the interchange, and the communication of certain errors to the application. The standard addresses messaging and data exchange, decision support, rules syntax, visual application integration, insurance claims, clinical documents such as discharge summaries, product labels for prescription medication, EHRs, and PHRs (*Health Level Seven International - Homepage | HL7 International*, n.d., p. 7).

4. Evolution of Cloud-Based PACS

Health care providers are facing a massive increase in the number of medical images they must manage, share, and process. In the United States, about 600 million imaging procedures—including CT scans, X-rays, ultrasounds, and MRIs—are performed each year by health care providers. There are many factors contributing to this increase, including the following: increasing health expenditure, which is positively correlated positively with the patient population's age (*MIM Software - Beijing - Press Release - MIMcloud 2.0*, n.d.); new medical imaging technologies, such as 3D imaging; PET/MR scans; increased amounts of study data (*CoActiv Medical | Customized Image Management Solutions | 24/7 Support*, n.d.); legal requirements that health care providers must keep images for a certain period; and finally the high costs of upgrading and maintaining IT infrastructure. The wide adoption of cloud computing in the health care domain comes with promising opportunities and challenges. Cloud-based PACSs have the potential benefit of sharing images and medical data.

4.1 Cloud Computing

Cloud computing, which is aimed at being global, is the fifth generation of computing. The first four generations were mainframe computing, personal computing, client–server computing, and web computing. Cloud computing is all about hosting and delivering services over the Internet. This feature attracts most stakeholders' attention. Buyya et al. (Buyya et al. 2008) defined a cloud as "a type of parallel and distributed system consisting of a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more united computing resources based on service-level agreements established through negotiation between the service provider and consumers." The National Institute of Standards and Technology (NIST) (*Secure Cloud PACS From Picom365*, n.d.) defined cloud computing as "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimum management effort and service provider interaction."

The NIST (*Secure Cloud PACS From Picom365*, n.d.) defined a cloud's essential characteristics:
On-demand self-service: A customer can allocate and de-allocate computing capabilities, such as server time and network bandwidth.
Broad network access: Resources are accessible over the network through standard mechanisms that promote use via heterogeneous thin or thick client platforms.
Resource pooling: Cloud providers serve multiple consumers by sharing resources and costs. Thus, the infrastructure can be centralized, the capacity can be increased, and the utilization and efficiency can be improved.
Rapid elasticity: This is a synonym for rapid scalability and indicates a cloud's ability to immediately address user demands.
Measured service: Cloud computing can be financed with a metered (pay-as-you-go) approach.

4.2. Business Models

Cloud computing has four deployment models based on the location from which a cloud is hosted: (1) A private cloud is operated and managed exclusively for one consumer. (2) A public cloud is owned by one organization and available to all. (3) A community cloud is shared by many organizations in one community, such as a health community, an education community, or even a government. (4) A hybrid cloud comprises two or more clouds. Table 4 illustrates the four models of cloud-based PACSs.

Table 4. CLOUD-BASED PACS business models

Type	**Cloud components**	**Advantages**	**Disadvantages**

Private cloud	● Archive facilities for RIS and PACS ● PACS as software	● For use by a single organization ● Rapid deployment	● Expensive ● Host healthcare organization must provide power and cooling
Public cloud	● Archive facilities for RIS and PACS ● PACS as software	● Low usage cost ● Scalability and flexibility	● Owned by third-party provider ● Limited privacy and data security
Hybrid cloud	● Archive facilities for RIS and PACS ● PACS as software	● Low usage cost ● System efficiency	● Limited inter-cloud operator portability
Community cloud	● Archive facilities for RIS and PACS ● PACS as software	● Low usage cost	● Server failure

4.3. Cloud-Based Service Model

Cloud computing can be described as a transition from computing as a product that is purchased to computing as a service that is provided to consumers over the Internet from large-scale data centres—clouds. Cloud computing is a computing paradigm that requires health care providers' attention to resolve IT centres' issues. There are three service models for medical imaging services:

Infrastructure as a service (IaaS) (Patel 2012) is promised to deliver new forms of health care IT solutions for medical applications. Cloud computing differs from the classic client–server model by providing applications from a PACS server that are executed and managed by the client's side without installing any applications or supported tools.

Platform as a service (PaaS) provides a standard development platform for developing PACS solutions. It would be a good choice for a health care organization's internal needs or for radiology solutions.

Software as a service (SaaS) provides instant deployment and scalability, helping health care IT businesses realize the benefits of cloud computing quickly and at a reduced cost.

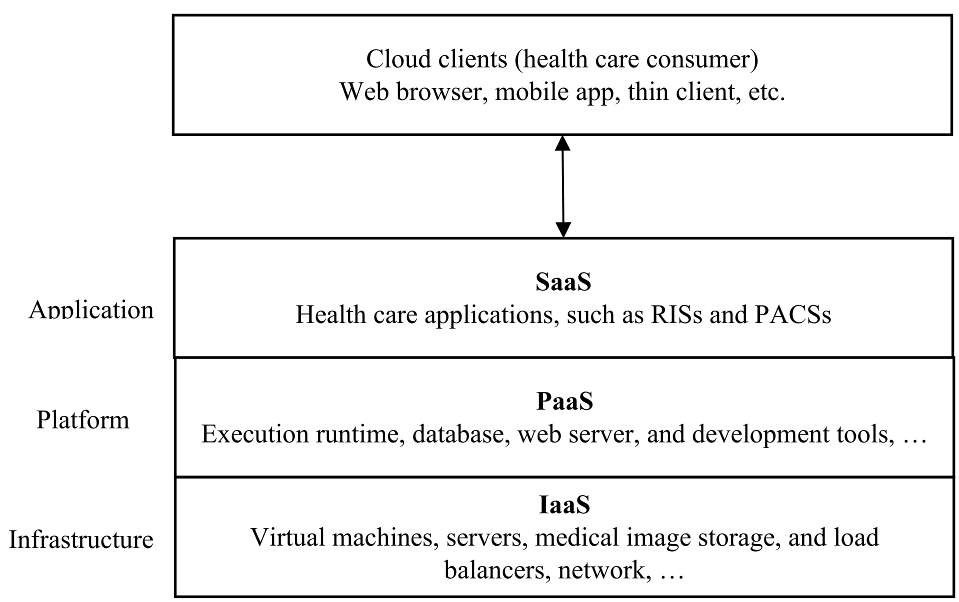

Figure 1. CLOUD services

Benefits of Cloud-Based PACSs

According to the previously mentioned driving force, cloud-based PACSs carry many benefits, including the following (Patel, 2012):

Technical Benefits: Industry-leading PACS capabilities: Organizations can benefit from advanced reading and reporting tools without capital investment concerns.

Elastic growth: Cloud services can maintain health care systems easily when adding new modalities, facilities, or specialties.

Disaster recovery: Health care providers no longer need disaster recovery plans. Cloud computing providers manage disaster risk at a much lower cost.

Continuous technology upgrades: Cloud providers can release health care providers from upgrade task, where physical IT infrastructures are becoming increasingly expensive because of technological advancements and the need to meet security standards.

Reliable archiving: An uptime assurance helps health care providers provide continuous health care improvements.
Nontechnical Benefits
Predictable expenditures: There is no need for capital expenditures because cloud computing uses a pay-as-you-go model.

Work from anywhere and at any time: As long as they have Internet access, health care professionals can work from anywhere. This competitive feature can help health care professionals improve their work–life balance.
Increased collaboration: Health care professionals located anywhere can sync up at any time to work on shared images and reports simultaneously and thus enhance patient care. Moreover, patients can view and share their personal imaging data with other specialists and physicians.

5. Cloud-Based PACS Research Challenges

Security Challenges in Cloud-Based Medical Image Exchange

Security is one of cloud computing's critical challenges that has the top priority in all domains. Accordingly, cloud-based medical image sharing has the same concern. In general, security is defined as physical, technological, or administrative safeguards or tools used to protect identifiable health data from unauthorized access or disclosure (Awokola et al. 2019) (França et al. 2022).

The American Institute of Certified Public Accountants (*Health Level Seven International - Homepage | HL7 International*, n.d., p. 7) and the Canadian Institute of Chartered Accountants (*Hospitals Struggle to Store Images From MRIs, CT Scans and More - WSJ*, n.d.), in their Generally Accepted Privacy Principles, defined privacy as "the rights and obligations of individuals and organizations with respect of the collection, use, retention and disclosure of personal information" (Westerhout 2006). Security is an essential aspect when it comes to medical data, and Shini et al. (*CoActiv Medical | Customized Image Management Solutions | 24/7 Support*, n.d.) stated that it comprises four main components: privacy, confidentiality, integrity, and availability. Security and privacy requirements include the storage environment, data protection, and disaster recovery representing. Securing medical images is much more challenging than other aspects of electronic health data management. Privacy requires the protection and careful use of patients' personal information. Confidentiality is the guarantee that sensitive information will not be disclosed for any situation. For instance, medical image data should not be accessed by unauthorized parties. Integrity-checking mechanisms prevent unauthorized data modification. For instance, medical images should not be modified during transmission. Strong data availability means that data and services are available for use when needed. In (Shini et al. 2012) reflected some security challenges related to medical image exchange, which include the following:

Distributed Denial of Service (DDoS) Attacks

DDoS is an attack that threatens the availability of a cloud infrastructure and its resources. Hackers take advantage of weaknesses in cloud defense methods, utilizing cheap, easily accessible tools to launch these attacks. Data centers and cloud operators are poorly prepared to defend against them, and existing solutions mainly focus on justifying these attacks.

Confidential Data Leakage

Some cloud providers are taking steps to ensure their clients' confidentiality; cloud computing leaders (e.g., Microsoft

(*Microsoft – Cloud, Computers, Apps & Gaming*, n.d.), Google (*Google - About Google, Our Culture & Company News*, n.d.), and Amazon (*About Amazon*, n.d.)) have made commitments to use suitable policies and practices to secure customers' data and privacy. These security techniques include encrypting medical images before sending them to the cloud or ensuring they can be accessed only with a password.

Access Control

Misuse of cloud authority by cyber criminals is the core threat to cloud contents' security. For instance, cloud providers allow any user with a valid credit card to register and use cloud services.
The suggested solution is outsourcing access control to ensure that the access control structures are not disclosed to the cloud provider while still allowing remote sites to use this information to verify access rights and help in applying access privileges.

Data ownership

Ownership defines as an owner or a creator of information or even an information owner who is the person that responsible for the information. The embedding of an ownership seal in an image is achieved using watermarking and encryption techniques.

Zero tolerance

Because of the encryption or watermarking used with medical images, a spot may appear in a medical image retrieved from a cloud. Thus, a doctor may give a faulty diagnosis. To prevent this problem, watermarking must be performed carefully.

Bandwidth Challenge

Medical imaging files are measured in terabytes. A busy radiologist may get tired of a slow connection. One article (Khajeh-Hosseini et al. 2010) reveals that health care organizations facing bandwidth-related challenges lack sufficiently high-bandwidth connections to the Internet or require external service providers to achieve appropriate levels of performance.

Regulation and Compliance Requirements

Cloud-based PACSs should be compliant with the policies of health care authorities and practices (Koch 2012). For instance, HIPAA and the Personal Information Protection and Electronic Documents Act require that health data be processed in certain prescribed ways. Moreover, the regulations of the countries in which cloud computing organizations host their servers and other regulations related to personal data must be taken into account.

Medical Data Interoperability

Data interoperability is defined as the capacity for communication and exchange of data between two or more systems, which can lower the costs and encourage the sharing of information among patients and providers. Data interoperability requires loading, storing and transferring data in distinctive organizations and sites. The obvious solution is to find out a standardized interface [1]. This issue has the priority of the health IT market, vendors, government agencies such as the Office of the National Coordinator (ONC) for Health IT (*ONC | Office of the National Coordinator for Health Information Technology*, n.d.), and cloud health care providers.

Integration into On-Premise IT

The integration issue has the priority of the health IT market, vendors, and government agencies such as the ONC.

Vendor-Neutral Archive

A vendor-neutral (VN) archive enables hospitals to send images to the cloud from any PACS and access these images from any PACS. For instance, a hospital can send images to the cloud from PACS A to be viewed by another hospital from PACS B. Vendor-neutral can be achieved by supporting health care standards such as DICOM and HL7 while integrating with other software and by storing images in non-proprietary DICOM formats across all DICOM SOP classes (Mather et al. 2009).

Conclusion

Medical imaging and cloud computing are coming across to find new opportunities to assist physicians and clinicians in making better decisions. The health care domain has started placing more trust in cloud computing despite its current challenges. This paper discussed cloud-based medical imaging mechanisms and analysed the various challenges associated with this approach. It examined the current solutions and discussed their limitations. Finally, it discussed directions for future research.

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