Chapter 11

No reference medical image quality assessment for image security and authorization

Sima Sahu

Malla Reddy Engineering College (Autonomous), Hyderabad, India

Nishita Priyadarshini

AIIMS Bibinagar, Hyderabad, India

Amit Kumar Singh

NIT Patna, Patna, India

11.1 Introduction

Medical image security and authorization ensures integrity, confidentiality, and availability of patient medical information. Quality assessment of medical images has a great role in evaluating the fidelity of medical images, tamper detection, and suitability for the intended purpose. The requirements of quality assessment in medical images in security and authentication are [1]:

- **Image Quality**: The quality of the medical images must be verified to ensure that the quality is sufficient for disease diagnosis, disease treatment, and research.
- **Authenticity**: Medical images must be authenticated that they are genuine and not altered or tampered.
- **Integrity**: Medical image integrity should be verified that they are not modified and corrupted during transmission, storage, and processing.
- **Confidentiality**: Medical images must be protected from unauthorized access and disclosure to maintain patient privacy.

Image quality is important to ensure that appropriate techniques and standards are applied to safeguard patient information and maintaining the trust of patients and healthcare providers. It helps in detecting distortions in an image, making it easier to analyze and detect any tampering or modifications [2]. Medical image authentication and security are important issues in the healthcare industry, as they play a crucial role in ensuring the privacy and confidentiality of sensitive patient information. Medical images contain a wealth of personal and confidential information that must be protected from unauthorized access and manipulation. There are several ways to address the challenge of medical image authentication and security [3]:

- **Encryption**: Medical images can be encrypted using various algorithms to protect the confidentiality of the information contained in the images. This makes it difficult for unauthorized users to access the data [4].
- **Access Control**: An access control mechanism such as user authentication and authorization can be put in place to ensure that only authorized individuals can access the medical images.
- **Digital Signature**: A digital signature can be used to verify the authenticity of medical images and ensure they have not been tampered with.

- **Watermarking**: Watermarking is a technique for embedding information in an image that can be used to track the origin and authenticity of the image.
- **Auditing and Logging**: Keeping track of who accesses the medical images, when and for what purpose can help detect and prevent unauthorized access.
- **Cloud Storage**: Storing medical images on secure, HIPPA-compliant cloud servers can help ensure the security of the data [1].

Keeping patient information secure and private is a very crucial task when communicating medical data through insecure channels. Medical data may be maliciously tampered with and illegally copied without authorization. These causes necessitate the application of integrity authentication and copyright protection in medical images. Many studies have been proposed for medical image authorization and security. These methods require a good robustness against noises and distortions like Gaussian noise, blur, and channel fading.

An approach for medical image security was introduced by Alqahtani et al. [4]. Their approach was based on Fractional Fourier Transform (FFT) and Jigsaw Transform (JT). They considered different noise effects like Gaussian noise, Salt and Pepper noise, Speckle noise, and Poisson noise in encryption and decryption efficiency.

A medical image authentication method was proposed by Sun et al. [5] by using wavelet packet decomposition. The authors verified the robustness of the result in resisting both additive and multiplicative noises.

The perceptual quality of medical images can be assessed automatically by using Image Quality Assessment (IQA) methods. Medical image quality assessment can be performed by subjective and objective approaches. A subjective assessment approach is carried out by measuring the image quality. Mathematical calculations are required for objective assessment approach. The objective approach results should match with the subjective approach results. Distortion in medical images may be caused due to several factors, such as operator mistake, fault in equipment, acquisition, compression,