

# Analytical Study of Medical PET Images by DWT and PCA

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## Abstract

The PET medical images need clarification to reach a correct diagnosis of the disease by removing noise from them, and this is done by applying several techniques, including DWT, PCA. DWT is an algorithm that compresses an image and removes noise by dividing the image into several levels, removing the unnecessary (neglected) part of the image. The PCA algorithm compresses the error parameters in the image and then reconstructs them.

**Key Words :** PET Medical Image , DIcrete of Wavelet TRansform ((DWT)) , Principal Component analysis((PCA)) , .



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## 1. Introduction:

Image processing and computer vision based an image enhancement which classical problem. Enhancement of Image is to Erase details which undesirable or increase contrast in image and to improve attributed of an image to make suitable for specific observer [1]. Medical images are special type of image which desired by surgeons to assist diagnosis and interpretation [1,2].

PET scan image (Positron Emission Tomography) is powerful functional image modality. PET scan image can detect molecular \_ level activity by specific tracers [2]. The PET scan image noise is caused by the low coincident photon counts detected when a given scan time and physical degradation factors [2].

DWT is The discrete wavelet transform and PCA is Principle Component Analysis used for de-noising from PET image but in different level. The quality of PET medical image limited by details and various factors of degradation, when applying DWT and PCA [2].

## 2. Discrete Wavelet Transform (DWT):

This transform is an effective method for medical image distribution and de-nosing[3] because :

1. Wavelet transform has multi resolution analysis property[4].
  2. Wavelet transforms has very –well spectral localization property [3,4].
- Multiresolution analysis (MRA) is better theory for mathematically, that compression , several methods for image processing such as sub bands and coding, quadrature mirror filtering and pyramidal image processing[5].The wavelet transform in a discrete way refers to the (DWT) [6]. This technique of DWT based on input image of size N then apply decomposing medical image into quadrants (four) sub bands : (LL ,HL,LH, HH). DWT technique is used for compression and decomposition of image by the lifting[5,1].

## 3. Principal Component Analysis (PCA):

Liner Transformation of data(PCA) represented an eigenvector, that refer to coordinate new system [7].

PCA is an appropriate model for liner data. Gaussian distribution generated this data. In the otherwise, second-order correlations represented as best described data. Gaussian distribution represent lossy compression[8].

Eigenvector PCA and linear technique is widely used in many applications in data processing and image enhancement [7].

The linear and PCA Powerful transformation defined of the form :

$$y = Wx \dots \dots \dots (1)$$

The data stochastic transforming data  $X \subset R^N$  in to vector;  $R \subset y^k$

the Matrix is Use  $W \subset R^{N \times K}$ ,  $R \subset X$  dimension reduction by:

$K < N$  when the output is display.

## 4. Conclusions :

1. The medical image contains less details than the nature image, which means increasing in compression process rate.
2. PCA and DWT algorithms when applied in PET medical Image, PCA eigenvectors can be vector result is several dimensional. While DWT technique when applied PET image divided image into four levels.
3. PCA and DWT are compress image , image source is loss information because converting color image to gray scale image in PET. \_\_DWT algorithm applied with

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PET image affected by factor, The medical images contain less details than the nature image; which means; increasing in the compression rate compared to the nature image.

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## دراسة تحليلية لصور PET الطبية بواسطة DWT و PCA

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### المستخلص :-

ان الصور الطبية PET تحتاج الى توضيح للوصول الى تشخيص المرض بصورة صحيحة من خلال إزالة الضوضاء منها ويتم ذلك بتطبيق عدة تقنيات منها DWT, PCA . DWT خوارزمية تعمل على ضغط الصورة وإزالة الضوضاء من خلال تقسيم الصورة الى عدة مستويات، وإزالة الجزء الغير ضروري ( المهمل) من الصورة . اما خوارزمية PCA ( خوارزمية التحليل الأساسي ) تقوم بضغط معلمات الخطأ في الصورة ثم إعادة بناءها.

**الكلمات المفتاحية :** تحويل المويجات المنفصلة ، تحليل المكون الرئيسي ، صور PET الطبية

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