

# Identification of Early Osteoporosis Using Intensity Slicing method

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*Received: 7 December 2011 Accepted: 1 January 2012 Published: 15 January 2012*

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## Abstract

Osteoporosis is a disease characterized by low bone mass and deterioration of bone tissues, leading to bone fragility and, consequently, an increase in fracture risk [2-6]. Loss of bone mass occurs as part of the natural process of aging [4]. Bones naturally become thinner (called osteopenia) as one grows older, because existing bone is broken down faster than new bone is made. As this occurs, the bones lose minerals, heaviness (mass), and structure, making them weaker. With further bone loss, osteopenia develops into osteoporosis. The thicker bones are, the longer it takes to develop osteoporosis. Although osteoporosis can occur in men, it is most common in women older than age 65. Since osteoporosis can develop undetected for decades until a fracture occurs, early diagnosis is important [2].

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## Index terms—

## 1 Introduction

osteoporosis is a disease characterized by low bone mass and deterioration of bone tissues, leading to bone fragility and, consequently, an increase in fracture risk [2][3] [4][5][6]. Loss of bone mass occurs as part of the natural process of aging [4]. Bones naturally become thinner (called osteopenia) as one grows older, because existing bone is broken down faster than new bone is made. As this occurs, the bones lose minerals, heaviness (mass), and structure, making them weaker. With further bone loss, osteopenia develops into osteoporosis. The thicker bones are, the longer it takes to develop osteoporosis. Although osteoporosis can occur in men, it is most common in women older than age 65. Since osteoporosis can develop undetected for decades until a fracture occurs, early diagnosis is important [2].

A BMD test is the only way to diagnose osteoporosis and determine risk for future fracture [5]. The painless, noninvasive test measures bone density and helps determine whether medication is needed to help maintain bone mass, prevent further bone loss, and reduce fracture risk. Several different machines measure bone density. Central machines, such as the dual energy x-ray absorptiometry (DXA or DEXA), measure density in the hip, spine and total body. Peripheral machines, such as radiographic absorptiometry (RA) [1], peripheral dual energy x-ray absorptiometry (pDXA). Dual X-ray absorptiometry (DXA) uses two different X-ray beams, due to which there is an increase in exposure to radiation causing harmful side effects. Special types of x-ray machines, are used. These machines are costlier. pDEXA also uses very low doses of radiation, and the results are faster than conventional DEXA measurements. pDEXA has limited usefulness (compared to DEXA) for monitoring the effect of medication used to treat osteoporosis [2]. The PDEXA equipment is much costlier than ordinary X-ray equipment. This method is not recommended for pregnant women because of the radiation exposure to the baby (fetus). Intensity slicing method is proposed to highlight the affected regions in osteoporotic x-ray images in order to assist the doctors in the identification of osteoporosis affected regions which cannot be visually identified.

Author : RMK Engineering College, Kavaraipettai Tamilnadu, India. E-mail : rsk.ece@rmkece.ac.in II.

42 **2 Material and Method**

43 We have made use of X -rays of osteoporotic and non osteoporotic patients at different locations of the body  
44 collected from hospitals and processed it using image processing tools of MATLAB.

45 This method for the detection of osteoporosis consists of two modules.

46 **3 a) Intensity Slicing for Bone Structures**

47 This module is used to highlight pores and the regions that have low Bone Mineral Density, which could be of  
48 very great use to the doctors in identifying the affected areas which are otherwise not visually detectable. In this  
49 method the radiograph is loaded as bitmap image and converted into gray scale. Then the region of interest in  
50 gray scale image is chosen, in order to neglect the black background of the radiograph, the mean is computed for  
51 the region of interest omitting the pixel intensities that are less than a scale of 5. This ensures that there is no  
52 interference due to the black even if it is accidentally chosen in the region of interest.

53 The histogram (Histogram plot the pixel intensities in x-axis and the corresponding number of pixels in the  
54 y-axis) of the image is computed and stored in a variable, and then the index value of the histogram that has  
55 the maximum number of pixels is noted. The size of the region of interest is stored in a variable. Let the index  
56 value of the histogram that has the maximum number of pixels be L. Then the pixels with the intensity lesser  
57 than the mean value and lie within the range L-10 & L-30 are displayed as red pixels that visually highlight  
58 the affected regions. This module is used to highlight striations within the bone structures that have very  
59 low calcium deposits, striations are caused due to drastic reduction of Bone Mineral Density. This method for  
60 detecting the will be of very great use to detect striations which are not visible to the naked eye. In this method  
61 the radiograph is loaded as bitmap image and converted into gray scale. Then the region of interest in gray scale  
62 image is chosen, in order to neglect the black background of the radiograph, the mean is computed for the region  
63 of interest omitting the pixel intensities that are less than a scale of 5. This ensures that there is no interference  
64 due to the black even if it is accidentally chosen in the region of interest. Then the region of interest is fully  
65 scanned for intensity variations, this can be done by monitoring the variation of intensities from pixel to pixel. If  
66 the variation of pixel intensity is over the threshold value then the pixel with lesser intensity is displayed as red  
67 pixel. Consider the following figures 2.6 & 2.7. If the threshold value is set as 5, then all the pixels which have  
68 intensities 5 greater than that of the previous pixel in the same row and pixels which have intensities 5 greater  
69 than that of the next pixel in the same row will be highlighted as shown in figure ?? III.

70 **4 Results and Discussion**

71 **5 a) Results Of Intensity Slicing for Bones**

72 The results of intensity slicing for bone structures are displayed in the following page, figures 3.1, and 3.3,3.5  
73 display the image of the osteoporotic bone and the corresponding outputs of intensity slicing method for bone  
74 structures are displayed in the figures 3.2, 3.4, and 3.6 respectively. By examining the osteoporotic images and  
75 their corresponding output for intensity slicing method for bone structures it would be clear that, the regions that  
76 have low calcium deposits are highlighted clearly .The pores within the bone structures which are hardly visible  
77 to the naked eye are clearly highlighted in the outputs The results of intensity slicing for tracing striations are  
78 displayed in the following page, figures 3.7,3.9,3.11 display the image of the osteoporotic bone with striations, the  
79 corresponding outputs of intensity slicing method for tracing striations are displayed in the figures 3.8,3.10,3.12  
80 respectively. By examining the osteoporotic images and their corresponding output for intensity slicing method  
81 for tracing striations, it would be clear that, the regions having low calcium deposits are highlighted clearly  
82 .The striations within the bone structures which are hardly visible to the naked eye are clearly highlighted in  
83 the outputs . From the analysis of various radiographs using Intensity Slicing method produce accurate results.  
84 Thus using this method, detection of osteoporosis can be done with a minimum exposure to radiations and it  
85 can be of very great use to the doctors in the analysis of xray images for detecting osteoporosis.

86 **6 OUTPUTS OF INTENSITY SLICING FOR VARIOUS IM-**  
87 **AGES**

88 **7 OUTPUTS OF INTENSITY SLICING FOR VARIOUS IM-**  
89 **AGES**

90 **8 Global Journal of Researches in Engineering**

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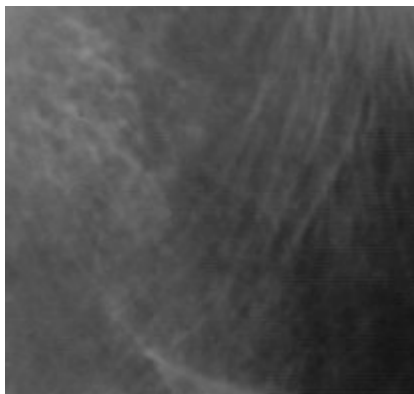
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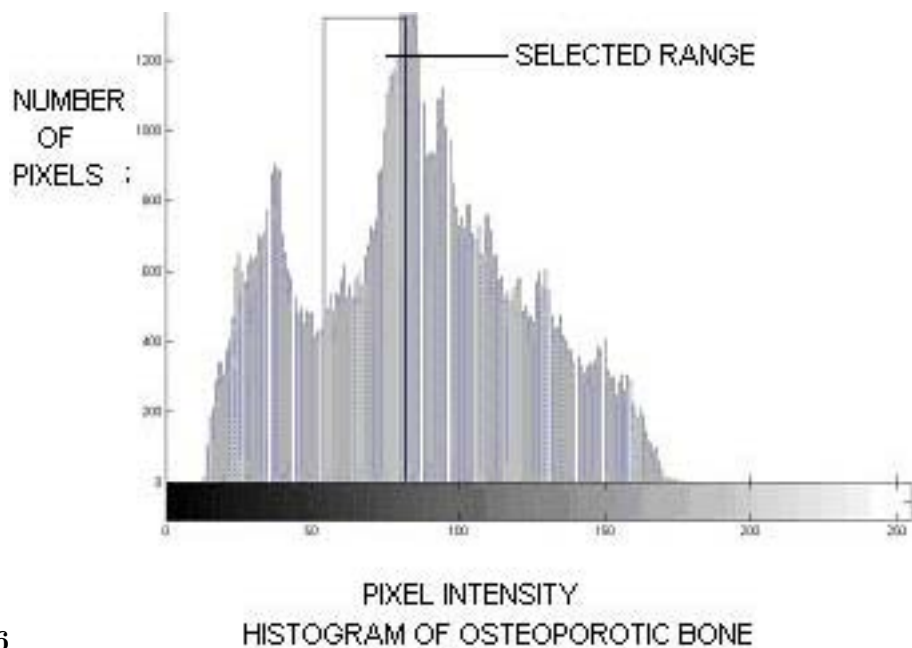


Figure 1:



2122 OSTEOPOROTIC X-RAY

Figure 2: Figure: 2 . 1 Figure: 2 . 2 Figure



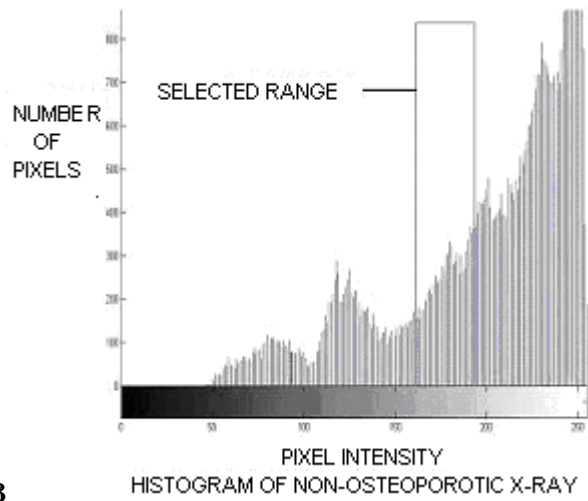
26

Figure 3: Figure 2 . 6 :



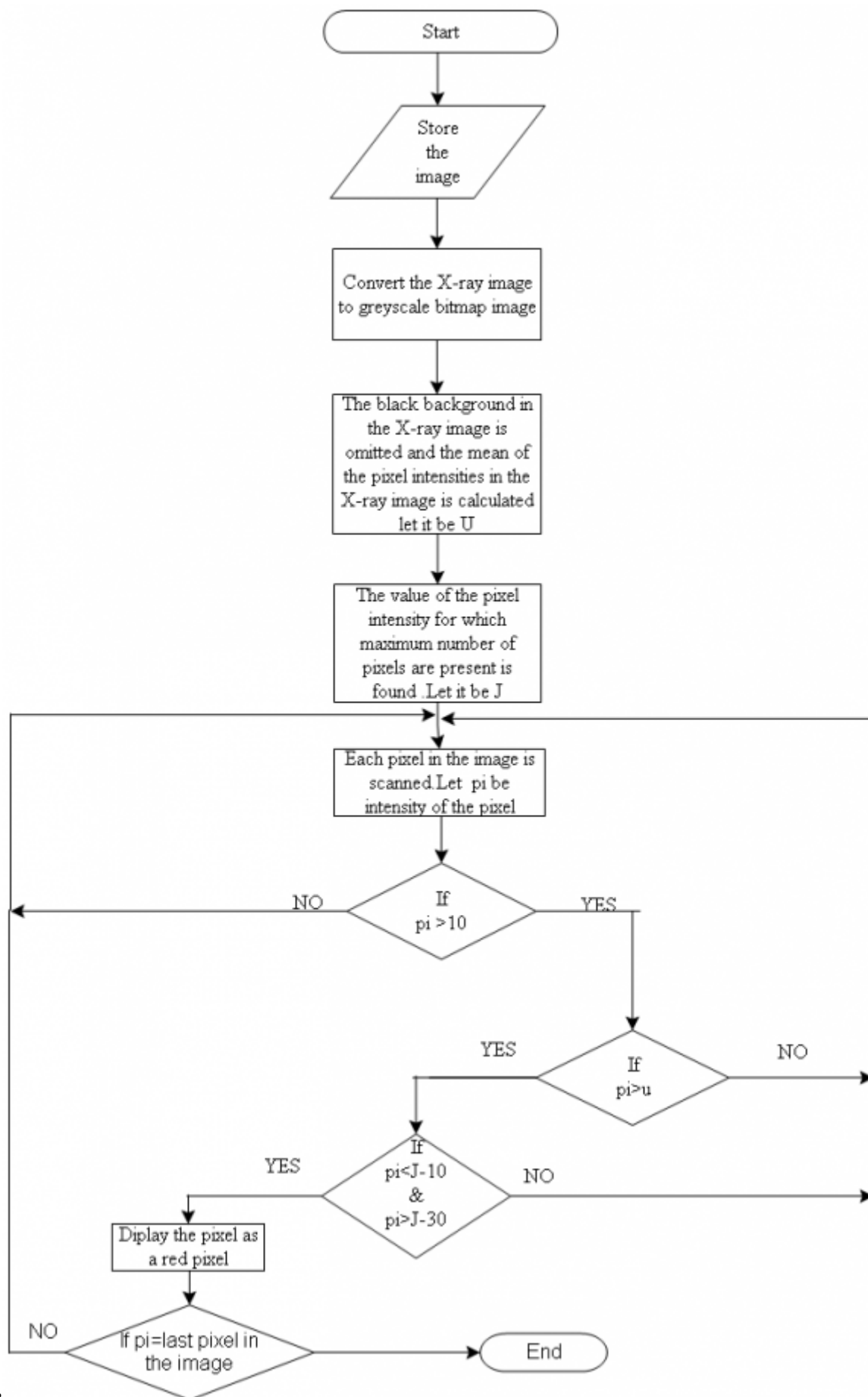
3132 NON OSTEOPOROTIC X-RAY

Figure 4: Figure : 3 . 1 Figure : 3 . 2 Figure



3

Figure 5: Figure 3 .



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Figure 6: VolumeFigure 3 .

92 .1 May J

- 93 [Deng and Liu ()] *Current Topics in Osteoporosis*, Hong-Wen Deng , Yao-Zhong Liu . 2005. World Scientific.
- 94 [Majumdar et al. ()] ‘Fractal analysis of radiographs: Assessment of trabecular bone structure and prediction of  
95 elastic modulus and strength’. S Majumdar , T Lin , T M Link , J Millard , P Augat , X Ouyang , D Newitt  
96 , R Gould , M Kothari , H K Genant . *Medical Physics* 1999. 26 p. .
- 97 [Meunier ()] *Osteoporosis: Diagnosis and Management*, Pierre J Meunier . 1998. Taylor & Francis.
- 98 [Tr and Pramudito ()] ‘Osteoporosis: Pathophysiology and Clinical Management By Eric S. Orwoll’. Mengko  
99 Tr , J T Pramudito . *WSEAS Transaction on Computers* 2004. 2003. Michael Bliziotes Edition: illustrated  
100 Published by Humana Press. 3 p. . (Texture analysis of Femur Radiographs for Osteoporosis Assessment)
- 101 [Wahner and Fogelman ()] ‘The Evaluation of Osteoporosis: Dual Energy X-ray Absorptiometry in Clinical  
102 Practise’. H W Wahner , I Fogelman . *Martin Dunitz Ltd* 1994.