CHAPTER 8

CONCLUSION AND SUGGESTIONS FOR FUTURE WORK

8.1 CONCLUSION OF THE WORK PRESENTED IN THIS THESIS

The present study was undertaken with the aim of investigating the usefulness of texture analysis in characterizing conventional radiographic images of the calcaneum and comparing the results obtained with that of the results of QUS and DXA in evaluating osteoporosis in men and women. The data presented shows that the hypothesis that texture analysis can characterize morphological complexity of cancellous bone affected by change in bone mineral density and age. The results of texture measures computed were compared with the reported results in literature. In order to validate the algorithm developed for computing fractal dimension in this study, synthetic images of known fractal dimension were run in the program and the results obtained were correlated with the previously known fractal dimensions. The ‘r’ values of the correlation co-efficient were found to be 0.9.

In our study DXA measurements at the hip, QUS bone densitometry at the heel and texture analysis at the calcaneum (heel) were carried out in the same individuals and the results compared. The results obtained suggest that trabecular assessment by texture analysis could predict the changes in the cancellous bone architecture in the calcaneum and explain part of the changes in the bone mineral content in addition to the microstructural variations in normal, osteopenic and osteoporotic individuals.
• The assessment of bone structure by texture analysis in the present study showed that Micro-architectural changes are evident when there is bone mineral depletion.

• BUA predicts 56.1% results of bone mineral density and 37.5% results of bone structure (as shown by linear regression fit with DXA derived Femoral Neck -BMD and texture parameter, the Short Run Emphasis (SRE)).

• The maximum correlation with femoral neck BMD was achieved by the texture parameter SRE (0.566) followed by Long Run Emphasis (LRE) (0.546), Run Length Non-uniformity (RLN) (0.554), Run Percentage (RP) (0.554), Gray Level Non-uniformity (GLN) (0.554), Low Gray level Run Emphasis (LGRE) (0.536). These ‘r’ values almost equal to that of the value obtained by BUA (i.e., 0.561).

• Statistical analysis (higher order statistics i.e., the run-length matrix derived parameters) seems to be better discriminators than the Structural analysis (Fractal, i.e., the Surface Area and Semivariance Methods).

• The efficacy of the statistical texture parameters is greatest in discriminating texture when computed at 45 degree orientations for Gray Level Co-occurrence Matrix and 90 degree orientation in the case of Gray Run Length Matrix.

• ROI-3 (where the compressive and tensile group of trabeculae meets) is better than ROI-1 and ROI-2 for obtaining discriminant values.

• From the ROC curve the area under the curve for the texture measure SRE (0.877 and 0.807 respectively in women and
men) is higher than for BUA (0.847 and 0.788 respectively in women and men). This result shows the higher predictability of osteoporosis by texture measure when compared to BUA.

- Trabecular quantification is possible by in-vivo assessment using higher order statistical approaches (e.g., Run Length Matrix) than second-order statistical methods (e.g., Co-occurrence Matix)

### 8.2 SCOPE FOR FUTURE WORK

- Further to this study a group of patients with osteoporotic fracture can be evaluated in the same manner to determine the importance of texture analysis.
- Digital radiography may be more appropriate for this type of analysis as this would eliminates the need of scanning films and subsequent use of the digitization protocols thus reducing the signal to noise ratio involved.
- Trabecular assessment by texture analysis can be compared with results of Micro Quantitative Computed Tomography (µ-QCT) in future for evaluation of their relative efficacy in studying osteoporosis.