

XSITRAY: A Database for the Detection of Osteoporosis Condition

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In the medical era, health of a bone is accessed by the bone mineral density (BMD) test. Bone fracture risk in the humans are estimated or evaluated by the BMD test. The test statement recognizes the presence of signs of presence of the frequent occurring disease in the bone called as osteoporosis. In the earlier stage, the challenge in the BMD measurement is that traditional x-rays are used with a step wedge made from an aluminum or ivory phantom. At each step of the phantom with the known densities, bone content present is intended by a illustration assessment of the density present in the bone. Effectiveness in the value and feasibility in the X-rays compared to cutting-edge methods divulge the potential for novel medical relevance among the investigators. So it is obligatory to enclose a customary database in X-Ray images for the young bud researchers to capture up the dealings to the advance stage by accurate examination of the medical results of the images. The projected X-Ray database is termed XSITRAY, characterizes an early attempt to offer a group of X-Ray images of Spine, Femur, Clavicle, Extremity & Ankle, Extremity & Hand and Knee bones. The details such as age, gender and unique Id of the patient are interpreted in the database.

Keywords: X-Ray database, XSITRAY, BMD, Femur bone , Knee and Ankle.

Biomedical engineering is the division which chains medical and biological sciences with engineering values to plan and generate different equipment's, devices and algorithms used in healthcare. To solve various medical problems, it fetches together information from various sources of medicine and engineering to carry out the research needed now. Biomedical engineering field in today's role, is linking the breach between engineering and medical field. In present scenario, the investigators are merging the design and problem solving capability of engineering with biological sciences to carry out treatments in

medical field such as diagnosis, intensive care, avoidance of diseases and rehabilitation.

In Later stage of X-ray, expansion in the field of quantity of bone density was the recognition of single-photon absorptiometry (SPA) by Cameron and Sorenson in the year 1963. In terms of amount of BMD, SPA showed a superior place, but limited its use in the site of the measurement. In the recent development, struggling in the Dual energy is betrothed in Dual-photon absorptiometry (DPA), helping the synchronized transmission of gamma rays with the energies of the photon¹. The bone and bone tissue densities are measured by the

Algebraic derivations. In late 1980s, grander and luxurious radioactive sources have been outdated by the use of single x-ray absorptiometry (SXA) and Dual Energy X-ray absorptiometry (DEXA). Compared to other predictable scanning, the success rate of SXA and DXA is also very high used for measurement of bone content². The main principle in the BMD measurement is to assist the physicians to perceive osteoporosis and envisage the danger of bone rupture. Thus osteoporosis affects the various regions of the skeleton with dissimilar cruelty. Most women are affected by the osteoporosis.

The key complexity of osteoporosis is rupture happening after tiniest trauma. Hip fractures are linked with enlarged short term mortality and high morbidity. The major regions such as Hip, vertebral, and radius fractures escalate the risk of upcoming break in various bones³. Thus it is an obligatory step for investigators in biomedical domain, to yield suitable preclusion methods or efficient treatment processes for the patients. A bone mineral density (BMD) test processes the prediction of calcium and other kinds of minerals are in the part of the bone⁴. Based on above said literature, in this proposed work we developed a database of X-Ray images which we baptized it as 'XSITRAY Database', for the profit of biomedical engineering research people. Even though a lot of medical databases are available for various imaging modalities, the significant pitfall in the bone research and development is that, unapproachability of suitable bone medical databases. Even though some survey has discussed the issues of various scan methods, they didn't offer any such databases publically accessible for the researchers.

Thus interested by the above said factors, our main offerings are:

- Generate a novel XSITRAY database, which comprises of 78 Spine, Femur, Clavicle, Extremity & Ankle, Extremity & Hand and Knee bones X-Ray scan images.
- Interprets all the subject's Gender, age and the position.

XSITRAY

In the medical era, still now there is no exact database in bone images for further research and development. Motivated by all these factors, we created a new and exceptional database,

XSITRAY database. This database is mainly focused for the BMD measurements.

X-ray bone images are retrieved from a research foundation centre. This dataset involves of 78 X-Ray scan images collected from various subjects. XSITRAY consist of 52 female and 26 male subjects. Each subject includes Spine, Femur, Clavicle, Extremity & Ankle, Extremity & Hand and Knee bones X-Ray scan images. The sample spine scan images of 5 subjects are shown in Figure.1. Similarly, the samples X-ray femur images of 5 subjects are shown in Figure.2. Table 1 and Table 2 describes the details of the subjects. The sample X-Ray clavicle scan images of 5 subjects are shown in Figure.3. The XSITRAY database is deliberated through subsequent stages:

- 1) Structure Details
- 2) Marking the XSITRAY images
- 3) Footnote

These are explained step by step.

Structure Details

The standard database is created from the Indian X-ray images. In the 78 subjects, there are totally 9 Spine, 12 Femur, 28 Clavicle, 6 Extremity & Ankle, 12 Extremity & Hand and 11 Knee bones X-Ray scan images.

The images are harvested physically and hoarded as discrete images in 'png' (portable network graphics) format. The detailed information about the X Ray scan images of all the subjects, have also been delivered in the table format. The entire dataset is grouped as six groups such as XSITRAY-SP, XSITRAY-FE, XSITRAY-CL, XSITRAY-EA, XSITRAY-EH and XSITRAY-KN. The XSITRAY-SP includes the X-Ray images of 9 spine bone images. Similarly XSITRAY-FE, XSITRAY-CL, XSITRAY-EA, XSITRAY-EH and XSITRAY-KN consists of 12 Femur, 28 Clavicle, 6 Extremity & Ankle, 12 Extremity & Hand and 11 Knee bone images. The labeling of the database, encourage the investigators to understand and scrutinize the scores of the spine, femur, clavicle, Extremity & Ankle, Extremity & Hand and Knee bones separately.

Marking the XSITRAY Images

The proposed databases are labeled flawlessly for the easy understanding of researchers. The annotation involves the identification of the subject ID, part of the bone and gender. Consider an example, the marker for a X Ray image is given

as: *XRAY_SP_001.png*. Here, in the initial, X-Ray refers to X-Ray scan image, SP interprets to the spine image of subject and 001 is the ID of the subject. Likewise *XRAY_FE_002.png* mentions to X-Ray femur image of a subject with a subject ID of 002. Likewise *XRAY_CL_002.png* denotes to X-Ray clavicle image of a subject with a subject ID of 002, *XRAY_EA_002.png* states to X-Ray Extremity & Ankle image of a subject with a subject ID of 002, *XRAY_EH_002.png* denotes to X-Ray Extremity & Hand image of a subject with a subject ID of 002 and *XRAY_KN_002* raises to X-Ray knee image of a subject with a subject ID of 002.

Footnote

XSITRAY affords a complete labelling through a careful investigation of all X-Ray scan images. All the images are annotated manually with the following labels for each bone image.

- Specific ID
- Gender
- Age and
- Type of Image
- View(Anterior/Posterior)

The database creation is through the motivation by the lot of problems associated to orthopedic applications. All the medical report

Table1. Interpretation of Spine X-Ray images

Subject Id	Gender	Age	Image
XRAY_SP_001	F	37	Spine
XRAY_SP_002	F	70	Spine
XRAY_SP_003	F	58	Spine
XRAY_SP_004	F	65	Spine
XRAY_SP_005	F	69	Spine

Table 2. Interpretation of femur X-Ray images

Subject Id	Gender	Age	Image
XRAY_FE_001	F	37	Femur
XRAY_FE_003	F	70	Femur
XRAY_FE_006	F	58	Femur
XRAY_FE_009	F	65	Femur
XRAY_FE_010	F	69	Femur



Fig. 1. X-Ray scan images of spine of 5 selected subjects from the XSITRAY

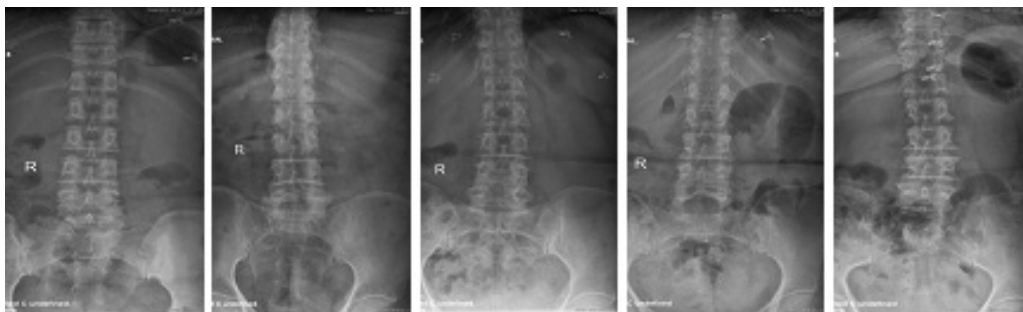


Fig. 2. Sample X-Ray Femur images of 5 subjects

values for the spine, Ankle, clavicle, femur and Knee bone images are presented which might be convenient in the development of bone research. Fig. 3 displays the sample labelling of a subject from the dataset.

Clinical Data Analysis

Osteoporosis, a disease usually connected with humans, is categorized by diminish in mass of the bone and micro architectural integrity⁵. One critical problem in the growth of osteoporosis is the achievement of apposite peak mass in childhood and later stages⁶. A disappointment in

the attainment of youth peak bone mass may be related with premature osteoporosis and augmented fracture risk⁷. World Health Organization (WHO) defines T-Score values for human beings in BMD plot as -1 SD for normal, -1 and -2.5for Osteopenia, below -2.5 SD for Osteoporosis

Table 1, Table 2 and Table 3 show the medical report of the same persons.

Based on the BMD levels, T-score and Z-score, mild to destructive therapies are needed in the form of Hormone replacement therapy (HRT), Bisphosphonates, Calcitonin and SERMs as suggested by the orthopedician. Moreover, all patients should confirm an tolerable intake of

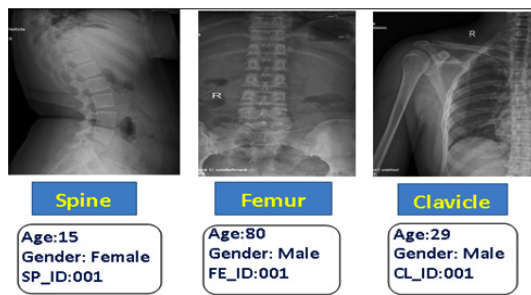


Fig. 3. Labelling of spine, femur and clavicle bone images

Table 3. Interpretation of Clavicle X- Ray images

Subject Id	Gender	Age	Image
XRAY_CL_001	F	29	Clavicle
XRAY_CL_002	F	74	Clavicle
XRAY_CL_003	F	60	Clavicle
XRAY_CL_004	F	84	Clavicle
XRAY_CL_005	F	52	Clavicle

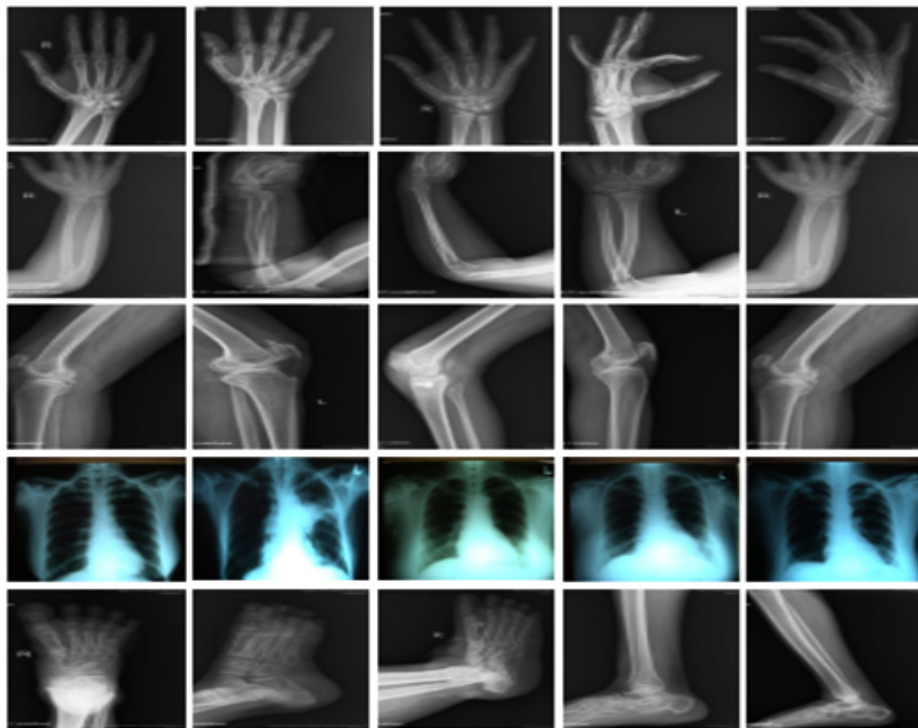


Fig. 4. Sample images from XSITRAY database: From top to bottom (a) hand (b) Hand and extremity (c) Knee and extremity (d) Clavicle and (e) Ankle and extremity

dietary calcium (1200 mg/d) and vitamin D (400-800 IU daily). By exact study of the X-Ray bone images and their reports, people can be prevented from the osteoporosis disease.

Based on the database medical reports provided by the physician/experts, the biomedical investigators can validate their accuracy of biomedical algorithms.

CONCLUSION

The projected paper presented a medical image datasets called XSITRAY, a group of X-ray scan images for healthcare and orthopedic research. It is established with the meaning of supplementing a standard for bone research and related development. The foremost features of this XSITRAY database are:

a) spine X Ray images, femur, clavicle, Extremity and Ankle, Extremity and Hand and knee, X Ray images each. b) Labeling the subject's biological data. By creating and making this database available to the research in BME community, we optimizes to promote the investigation of many indeterminate problems. XSITRAY database along with all medical measures will be made accessible for investigation purposes. The XSITRAY database can be observed and downloaded at the institutional web address: <http://www.sethu.ac.in/XSITRAY/>.

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