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Review on Analysis of Anthropometry Parameters of Femur

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Abstract: The correct leg length and the position of the hip rotation center are the most important parameters for hip implant surgery. Until now there exist no suitable methods to measure it objectively. Several methods currently exist to determine the leg length and hip rotation center (e.g. tape measure or placing blocks under the shorter leg). Until now, such systems did not provide an objective determination of both parameters and are not accurate enough. Errors >2cm are possible. More accurate measurement methods (e.g. radiological procedures like X-ray images or CT-scans) are cost-intensive and lead to unnecessary radiation for the patient. The image does not offer a view of the hip joint as single structure. Additional X-ray images are required. The aim of this work is the development of a cost-efficient system for the determination of leg length and hip rotation center using machine learning.

Index Terms - Total hip replacement, implant, x-ray, machine learning.

I. Introduction

The field of orthopaedics at the time became more important as the number of patients suffering from osteoporosis increased every year [1]. According to experts the conventional detection method was used to search for a suitable implant for the patient. The method involves using the implant templates supplied by the supplier, and then the image of the implant is measured by doing image mapping on a patient's scanned X-ray. This step was used repeatedly until the appropriate implant of the patient encountered. However, the survey found that this procedure requires a long time, and is said to be less efficient.

Demand for orthopaedic medicine has increased over the past 20 years, based on the increasing number of patients each year [3]. Before surgery is performed, a conventional orthopaedic image identification is done by manually matching the articial implant image with a patient X-ray by an orthopaedic specialist. This method is a conventional method to determine the patient's implant size. But the manual or observational procedures require a long time to recognize the size of the patient's implant because the method used is repeated several times.

Thus, the manual procedure should be changed to a digital and automated technique, or more accurately by using software. This technique helps the surgeon identify the appropriate patient's implant size digitally and automatically. Several studies have shown that a digital technique can improve the placement of a total hip implant.

Hip replacements are among the most common orthopedic procedures. When a hip replacement is performed, the arthritic, damaged hip joint is removed. The ball-and-socket hip joint is then replaced with an artificial implant. The materials used in the implant depend on different factors, including:

Age of the patient

Gender

Height

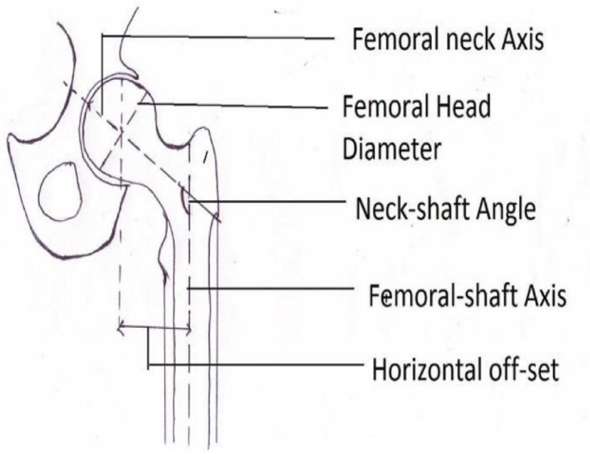
Weight

Waist

Leg length

II. PROPOSED WORK:

The present study was undertaken to measure **using machine learning** the important parameters of upper end of femur in elderly Eastern Indian population which will help the prosthetist to manufacture ideal implant for the local population. This will also help the orthopaedic surgeons while positioning the implants during total hip replacement (THR) procedure in this population.



III. LITERATURE REVIEW:

Total hip replacement, pioneered by Charnley in the 1960s, is a widely used surgical procedure, which is beneficial to a great number of patients suffering from osteoarthritis. However, a major complication accompanying this procedure is mechanical loosening of the implants. Loosening of the hip implants can be the result of inadequate initial fixation, mechanical loss of fixation over time or a biologic loss of fixation caused by particle-induced osteolysis (bone resorption) around the implant [4]. It was reported that 90% of dislocation cases had evidence of impingement. The impingement can occur between bony geometries, prosthetic implants [1]. Preoperative templating of total hip arthroplasty consists of determining the magnification of the hip on a radiograph and applying identical magnification to the radiograph and the template. The traditional planning relies on visually comparing acetate templates and analogue radiographs over a white light-box[4]. Before surgery is performed, a conventional orthopaedic image identification is done by manually matching the articial implant image with a patient X-ray by an orthopaedic specialist. This method is a conventional method to determine the patient’s implant size. But the manual or observational procedures require a long time to recognize the size of the patient’s implant because the method used is repeated several times[5]. The database consists of many parts of the support implant that are stimulatory generated by FEM with various patterns and stress for a 3D geometric model. So, searching the most fitted model from database is performed with genetic algorithm [6]. Each patient reacts differently to gait dysfunctions, so each should be treated in a personalized manner, according to the problem gravity, age, weight, anthropometric dimensions, previous illnesses and so on. This is the reason why the assessment methodology should be flexible and adjusted to each studied subject. [7]. In general these systems contain one or a couple of generic models, reflecting the normal anatomy. In order to use these systems as tools for preoperative planning, it must be possible to generate computer models from real patient cases. This is relevant also when these systems are used for training and education, since the surgeon can practice on a variety of real cases, ranging from routine procedures to more complex or more unusual tasks. This work focuses on reconstruction hip bones including femur and pelvic bone using CT images of in vivo in order to generate patient specific computer models [8]. The software solution automates many parts of the determination procedure and guides the user through the single steps by activating and deactivating functions dynamically within the current determination progress. In future, the design of the test rig should be improved by simulating the clinical environment more in detail [9]. Our observations further emphasize the need for design improvement of the modular junctions to minimize micromotion, plastic deformation, and subsequent corrosion and the generation of the corrosion products. Micromotion at the taper junction accompanied by high stresses led to the fretting and pitting corrosion, as also confirmed by the finite element analysis [10].

IV. METHODOLOGY

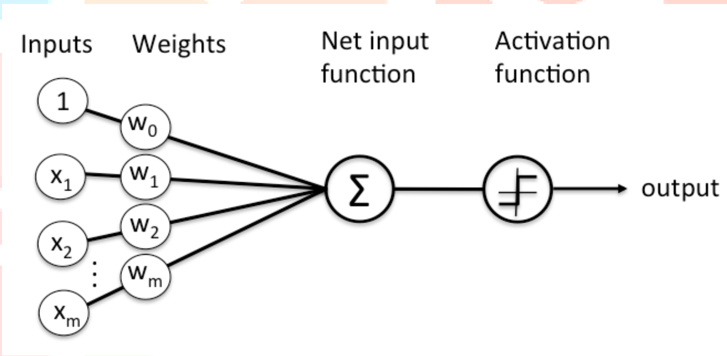
4.1 NEURAL NETWORK

A neural network is defined as a computing architecture that consists of massively parallel interconnection of adaptive 'neural' processors. Because of its parallel nature, it can perform computations at a higher rate compared to the classical techniques. Because of its adaptive nature, it can adapt to changes in the data and learn the characteristics of input signal. A neural network contains many nodes. The output from one node is fed to another one in the network and the final decision depends on the complex interaction of all nodes.

A neural network is a computing model whose layered structure resembles the networked structure of neurons in the brain, with layers of connected nodes. A neural network can learn from data—so it can be trained to recognize patterns, classify data, and forecast future events.

A neural network breaks down your input into layers of abstraction. It can be trained over many examples to recognize patterns in speech or images, for example, just as the human brain does. Its behavior is defined by the way its individual elements are connected and by the strength, or weights, of those connections. These weights are automatically adjusted during training according to a specified learning rule until the neural network performs the desired task correctly.

A neural network combines several processing layers, using simple elements operating in parallel and inspired by biological nervous systems. It consists of an input layer, one or more hidden layers, and an output layer. The layers are interconnected via nodes, or neurons, with each layer using the output of the previous layer as its input.

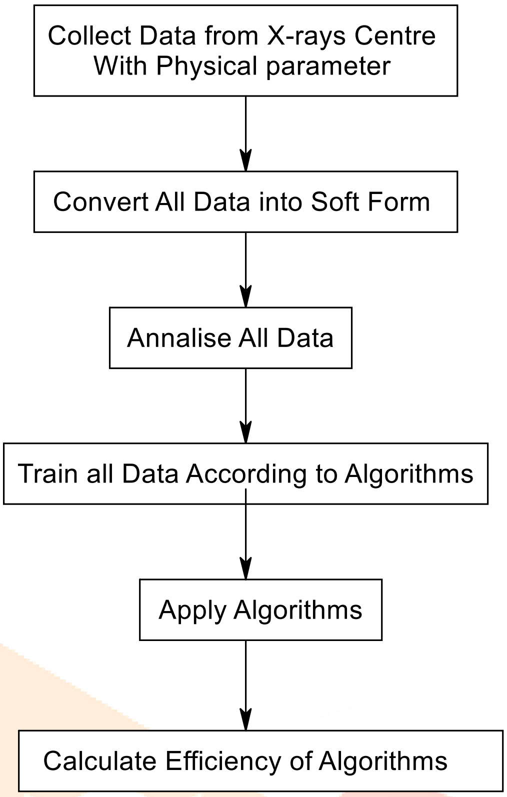


4.2 SUPPORT VECTOR MACHINES

Support vector machines are supervised learning models with associated learning algorithms that analyze data used for classification and regression analysis.

One of the supervised Machine learning approaches called the Support Vector Machine (SVM) is used to predict whether there is a high probability of landslide occurrence in the given region. Time Series Analysis is used to find the direction and periodic propagation of landslides and the total amount of their deformation. The prediction and validation results reveal that the proposed model can help in land use planning for shrinking the losses.

V. WORKING FLOW CHART



CONCLUSION

This new technique offers a simple solution to the problem of using the observational method in total hip Replacement (THR). The technique allows users to choose the acetabular implant automatically on computer prior to surgery, based on the diameter of the patient's acetabulum size. The new proposed acetabular implant detection technique also provides user-friendly and accurate computer programming surgical planning. In addition, the average time taken for the acetabular implant templating process in THR using an automated technique was much less than using the observational method.

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