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# Prediction of Therapeutic Data Analytics: Analysing the Mode of Pain in Periarthritis Shoulder Using Apache Pig with Hadoop

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***Abstract***

The patients suffering from various types of Shoulder pain are increasing day by day. Accumulating, managing and analysing the large volume of heterogeneous data produced from various sources is difficult. Big data Analytics has an ability to collect and analyse the huge amounts of data related to shoulder pain. Periarthritis shoulder pain is an aching and disabling disorder effecting 3% to 5% of population in which the shoulder joint capsule that surrounds the glenohumeral joint of the shoulder becomes inflamed and rigid there by limits the motion and causes chronic pain. This generally, happens when shoulder has not been mobilized for a period of time due to surgery, a fracture or injury. Correct diagnosis of Periarthritis Shoulder pain is supportive in providing reasonable and effective treatment for patients. This paper has provided Apache Pig framework built on top of Hadoop for predicting the mode of pain in Periarthritis Shoulder pain which could be useful for physiotherapist to take correct decision.

***Keywords:*** *Bigdata Analytics, Periarthritis Shoulder, Diagnosis, Hadoop, Apache Pig*

## I. INTRODUCTION

Big data in Healthcare indicates about huge amount of data that healthcare provides. Faced with the challenges of healthcare data volume, velocity, variety, and veracity, Big data plays a pivotal role of gathering, loading, and evaluating this data to produce actionable insight. In context to Periarthritis Shoulder pain Big data will provide new means of collecting and analysing the data and provide enhanced capability to detect and analyse the pain in their early stages, assigning more effectual physiotherapy treatment based on a patient's condition, and progress effectiveness.

Various shoulder conditions which are considered by limitation of passive range of motion, mainly abduction [1], adduction, elevation, flexion, internal rotation and external rotation are referred as Periarthritis Shoulder or Stiff shoulder or Frozen Shoulder or adhesive capsulitis. First Frozen shoulder was called as periarthritis in 1872 by Duplay. In 1934 Codman referred it as 'frozen shoulder'. After J.S. Naviaser named it as 'adhesive capsulitis' in 1945[8]. Periarthritis Shoulder is estimated to affect 3-5% of the general population [2]. Periarthritis Shoulder usually refers to restriction of shoulder motion without irregularities of the joint surface, rupture or displacement. This problem arises mainly in middle aged people and is generally self-limiting but the extent and severity of effect may vary greatly [3].Evaluations of the cumulative annual rate of shoulder complaints differ from 7 to 25 per 1000 overall practice consultations [1,4]. Mostly the patients with such complaints are took cared in primary level. Treatment comprises advice, analgesics, non-steroidal anti-inflammatory drugs, steroids, and physiotherapy [5]. A broad method of physiotherapy is used to treat shoulder disorders [6,7]. This paper provides the means of predicting the mode of pain in the patient suffering from Periarthritis Shoulder, so that effective physiotherapy treatment protocol can be established for treating the patient to decrease the pain and increase the range of motion.

*May – June 2020*
*ISSN: 0193-4120 Page No. 5789-5793*

## II. BIGDATA

Big Data has brought a change in the way of managing, analysing and controlling the data in any field. The challengeable areas where it can be useful to make an enormous change is healthcare. Health data is growing day by day than compare to manufacturing, financial services, or media. HealthCare have a capability to have better insights to decrease costs of treatment, predict epidemics outbreaks, restrict preventable diseases and progress the quality of life. Hadoop is an open source software framework for distributed storage and processing of bulky datasets. Hadoop ecosystem includes the components HDFS, Map Reduce, YARN, Hive, HBase, Pig, Aviro, Thrift, Drill, Mout, HCatalog, Scoop, Flume, Oozie, Zookeeper, Ambari.

### Apache Pig

Apache Pig is an open source platform which is used to analyse bulk data sets. It runs on Hadoop by making use of both HDFS and Map Reduce. Apache Pig has two components for performing a task. First component is Pig Latin, for writing the Pig script and second component is runtime environment (Grunt Shell, UDFs, Embedded) for executing them. Pig Latin has two executive modes. First mode is local mode suitable only for analysis of small datasets. Second mode is Map Reduce mode where queries written in Pig Latin is translated into Map Reduce jobs and are run on a Hadoop cluster. It is suitable for large clusters. Pig Latin scripts are converted it into a series of MR jobs. These MR jobs are executed and the output result is saved into HDFS by performing different operations like Parse, Compile, Optimize and Execution as below [9].The fig.1 explains about how data is been analysed in Hadoop using Apache Pig.

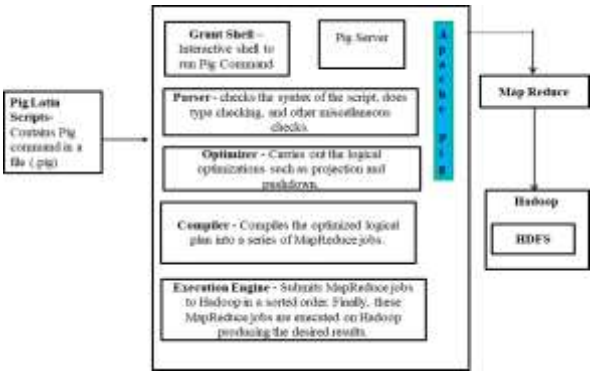



**Fig 1.** Apache Pig Architecture

## III. PERIARTHRITIS SHOULDER

Periarthritis shoulder is caused when there is a thickening, shrinkage and inflammation of capsule of connective tissue that surrounds the shoulder, leading to stiffness and shoulder pain from restricted movement. There will be restriction in active and passive range of motion (abduction, flexion, adduction, extension, internal rotation and external rotation). Periarthritis shoulder is mostly affected to female then compared to male. It mostly occurs in people aged more than 40 years. Treatment comprises intra-articular glucocorticoid steroids, nonsteroidal anti- inflammatory drugs, oral glucocorticoids and physiotherapy [10]. Patients suffering from acute pain complaints shoulder pain at night and have preserved range of motion. The patients suffering from chronic shoulder pain will develop stiffness and loss of range of motion. Periarthritis shoulder can occur after shoulder injuries or immobilisation. Acute pain may take weeks or months to reduce but chronic pain may take between 4 months to years to reduce.

### Physiotherapy

Physical therapy interventions used with patients suffering from Periarthritis shoulder regularly include modalities, therapeutic exercises and manual techniques. Physiotherapy interventions include relaxation, medicines, physical agents, assessment of shoulder movement in various directions, hangs and range of motion exercises. Physiotherapy comprises manual therapy both active and passive range of motion exercises, precise stretching and strengthening movements, TENS, ultrasound, hot and cold therapy [11] which

*May – June 2020*
*ISSN: 0193-4120 Page No. 5789-5793*

relieve pain, reduce muscle spasm, promote healing, increases joint range of motion, strengthen weakened muscles. This present paper has tried to diagnose the patients suffering from Periarthritis shoulder to find the mode of pain, so that Physiotherapy treatment can be given in instance to lessen the pain and increase the range of motion. After assessment of pain, Physiotherapy treatment is started with minimum 10 to 15 sittings and may be increased depending upon mode of pain. Treatment is given by assessing pain in patients suffering from Periarthritis shoulder using goniometer and SPADI (Shoulder pain and disability Index).

**Physiotherapy treatment (10 to 15 sittings)**

1. Finger walk exercises (10 minutes)
2. Towel stretch exercises (5 minutes)
3. Shoulder wheel exercises (10 minutes)
4. Pendular Exercises (10 minutes)
5. Wall finger exercises (10 minutes)
6. Hot water fomentation (10 minutes)
7. Shoulder joint capsule stretching (5 times)
8. Passive movements (15 minutes)
9. Mobilization by Glenohumeral Anterior Gliding (To improve both shoulder external rotation and extension) (5 times)
10. Mobilization by Glenohumeral Posterior Gliding (To improve both shoulder flexion and internal rotation) (5 times)
11. Mobilization by Glenohumeral Inferior Gliding (To improve both shoulder abduction and flexion) (5 times)
12. Shoulder joint capsule stretching (5 minutes)
13. Hot packs used to relax muscles around glenohumeral joint.
14. Hold and relax exercises (5 times).
15. Ultrasound: 0.8 watts having 1 MHz or 3 MHz frequency for decreasing spasm (15 minutes) or
16. TENS (Transcutaneous Electrical Nerve Stimulation) medium to high frequency with low intensity (15 minutes) or
17. Continuous short-wave treatment (wavelength between 3 to 30 m, frequency 10 - 100 MHz)
18. Wax therapy (15 minutes).

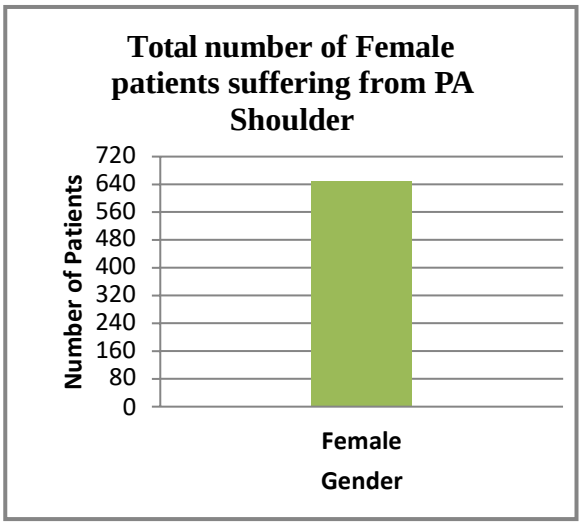
The above required treatments are given from day 1 to day 3and in the following $4^{th}$ to $6^{th}$ day and $6^{th}$ to $10^{th}$ day, in the coming sessions the time and repetitions of treatments are increased [8]. For chronic pain the sessions are increased depending upon the improvement. Physiotherapy interventions can play a pivotal role in patients suffering from Periarthritis shoulder to avoid disability, improve functional movements, provides relief from pain and improves quality of life.

## IV. EXPERIMENT SETUP AND RESULTS

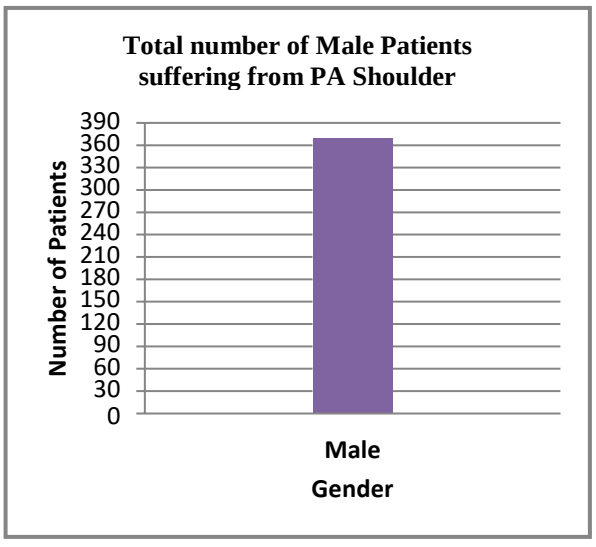
In this experimental setup, Edureka virtual machine Hadoop 2.7.3 infrastructure is downloaded with configuration single node having 8GB RAM and i5 CPU.A total dataset of 1020 patients in the year 2018-19 from the clinic Sekhar Physiotherapy Clinic and pain relief clinic, Andhra Pradesh with a confirmed diagnosis of periarthritis shoulder were included in this study. The included patients were between the ages 45-75 years with acute and chronic periarthritis shoulder. Patients suffering from periarthritis shoulder suffers from pain and restricts active and passive range of motion at glenohumeral joint. The modes of pain in patients were assessed using Goniometer and SPADI score. After assessing the pain, right treatment can be given, that develops reduction of pain and improvement of glenohumeral external rotation and other range of motions. Apache Pig is used to analyse the data and various queries can been generated. Pig programs are executed in three methods (batch mode, interactive mode and embedded mode). Pig script file can be created containing all the commands and are executed at command line. To run Apache Pig in interactive mode, Grunt shell is used line by line. Dump operator is used to enter Pig Latin statements to get output. Grunt shell is invoked at local mode by giving command pig -x local. To execute the queries the dataset related to periarthritis shoulder is loaded at local mode. The dataset is in .csv format, the dataset includes the attributes age, gender, ROM (Internal rotation, External rotation, Abduction, Adduction, Extension, Flexion) and SPADI score. After the Grunt shell is invoked the following command is used to load the periarthritis shoulder data.

```
grunt> shoulder =
load'/home/edureka/desktop/PAdata.csv' using
PigStorage(',');
```

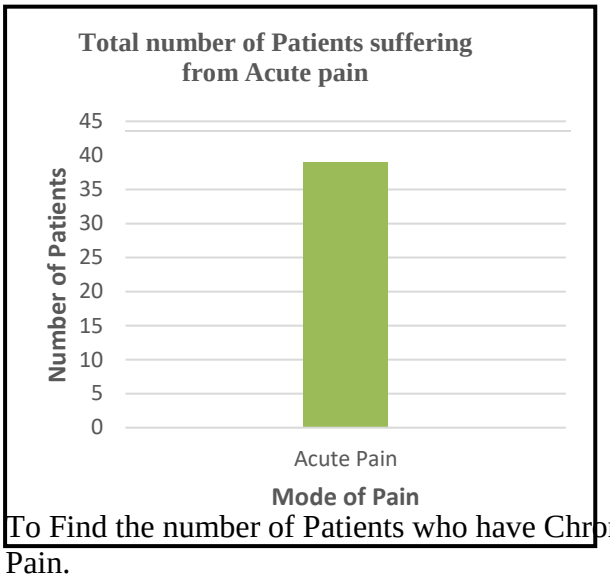
To Find the number of female patients who have PA shoulder pain
grunt>fcount = group fgen all;
grunt> fcount1 = foreach fcount generate COUNT(fgen);



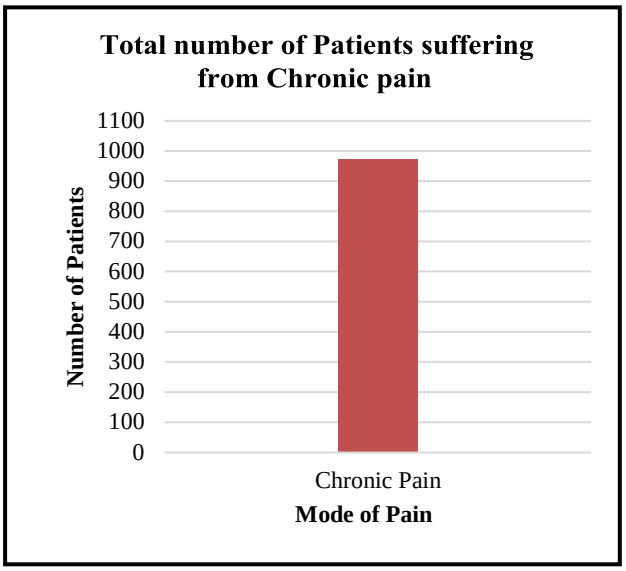

To Find the number of male patients who have PA shoulder pain
grunt>mcount = group mgen all;
grunt> mcount1 = foreach mcount generate COUNT(mgen);




To Find the number of Patients who have Acute Pain.
grunt>countAcut = group acutpain all;
grunt> countAc1 = foreach countAcut generate COUNT(acutpain);

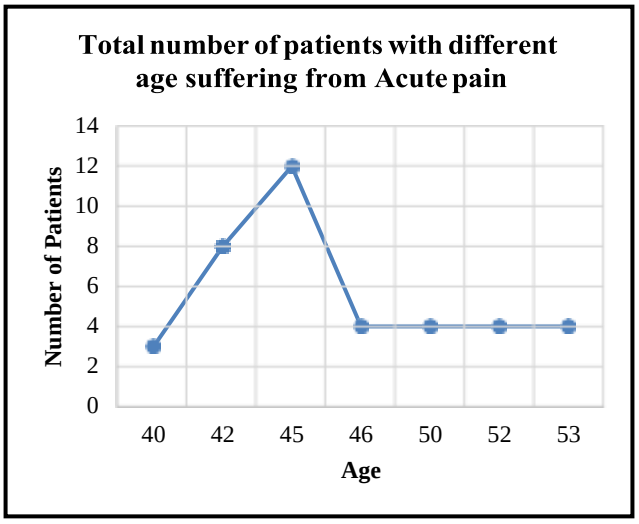



To Find the number of Patients who have Chronic Pain.
grunt>countCh = group chronicpain all;
grunt> countCh1 = foreach countCh generate COUNT(chronicpain);

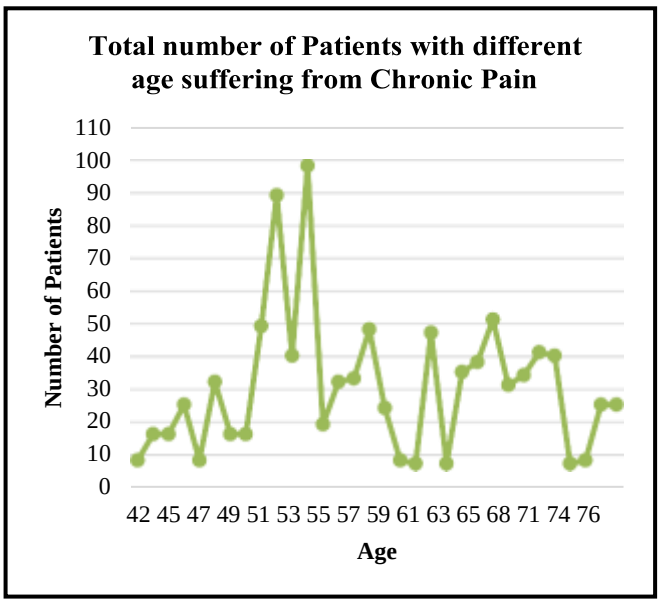



To Find the number of Patients of each age suffering from Acute Pain.
grunt> ac1 = foreach acutpain generate age;
grunt> agelist2 = group ac1 by age;
grunt> list2 = foreach agelist2 generate group,COUNT(ac1);

May – June 2020
ISSN: 0193-4120 Page No. 5789-5793




To Find the number of Patients of each age suffering from Chronic Pain.
grunt>ch = foreach chronicpain generate age;
grunt>agelist = group ch by age;
grunt> list = foreach agelist generate group,COUNT(ch);




## V. CONCLUSION

In this paper Apache Pig framework is used to analyse the mode of pain in Periarthritis shoulder, so that effective physiotherapy protocol as a primary care can be established to provide rehabilitation applications like mobilization, ultrasound ,strengthening and capsule Stretching exercises, wax therapy,hot packs, TENS to prevent disability, increase muscle strength, reduce muscle spasm, increase functional capacity by reducing the stiffness ,faster improvement in the ROM and provide pain reliefotherwise the problem duration and severity may increase and the patient may have to go for surgery.

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