# Automatic Analysis of Rheumatoid Arthritis Based on Statistical Features

Machine learning

**Aim:**

To recognise the clinical presentation of Rheumatoid Arthritis in image processing and effectively manage the medical, surgical and physical treatments.

# Abstract:


- Rheumatoid arthritis (RA) is the most common chronic disorder affecting joints (hand and leg ) disease worldwide .
- The image found in the skeletal system of this disease is often found non-productive due to noise in the image.
- Thus the role of image processing in RA lies, not in diagnosis, but in evaluation of structures affected by the disease .

# Outline

- Introduction
- Existing System
- Limitation
- Base Paper (Existing)
- Proposed Work
- Comparison
- Reference

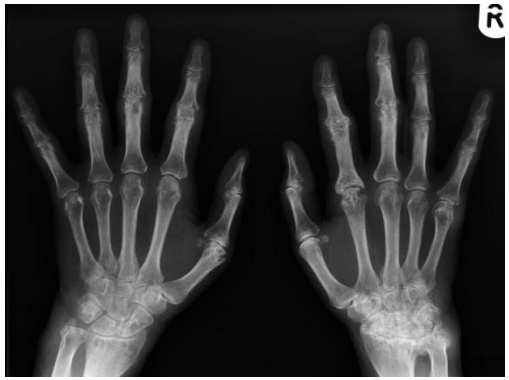
# Introduction

- RA is the most common chronic disorder affecting the joints. It affects approximately 1 to 2% of the Indian population, with 4 to 6% of people over the age of 50 .
- Rheumatoid arthritis (RA) causes pain, swelling, stiffness, and loss of function in the joints. The disease usually affects the joints, particularly in the wrist and the fingers.

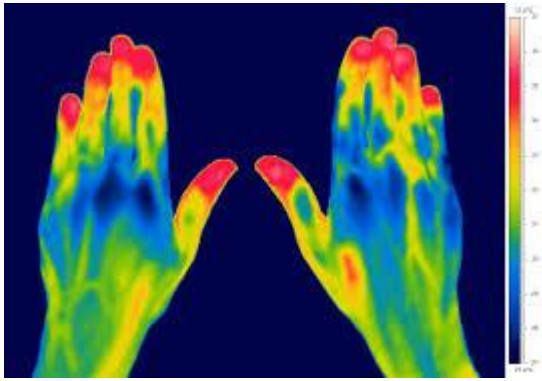
- Since there is no proven cure for RA yet, current treatments mainly focus on pain relief, inflammation reduction or stopping joint damage.
- Joint damage assessment in hand radiographs (X-Ray) is a frequently used method for monitoring the RA.

# Existing System

- RA results in pain of primary peripheral joints like fingers, wrist and feet.
- Various researchers has proposed methods like MRI, X-Ray, Radiography, Thermography for the detection of RA.

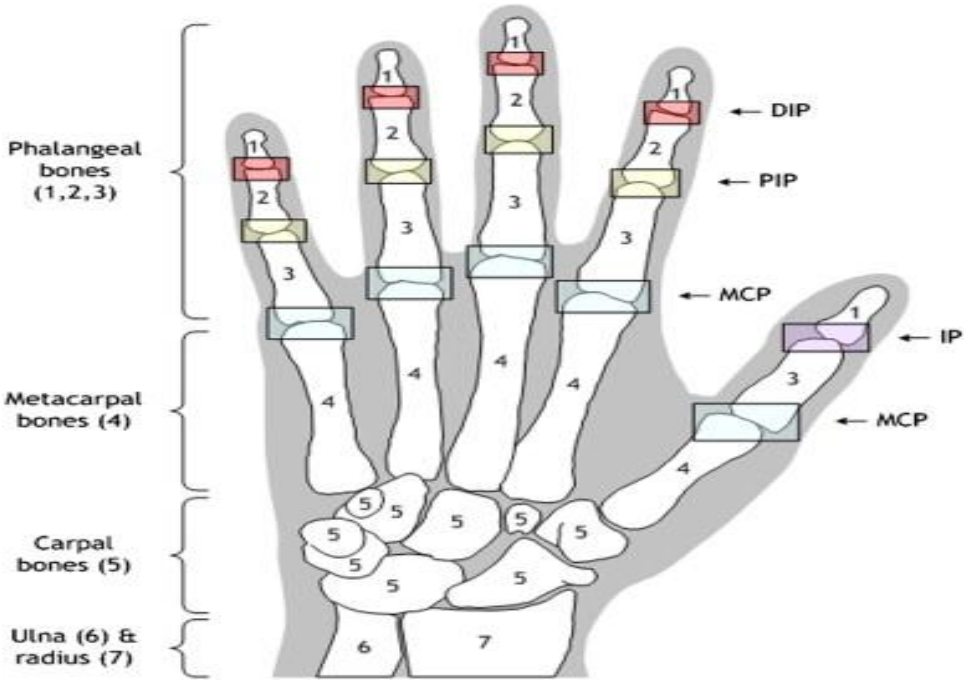


X-Ray



Thermography

- Hand radiograph analysis is  difficult for radiologist since there are 14 number of hand  joints.




- Where the RA happens to be in MCP (metacarpophalangeal ) joint.

- Manual JSW (Joint Space Width ) is also used for diagnosis of RA disease.


- Assessment of JSW in a diagnostic process requires the distribution of narrowed leg joints.

- RA first destroys the narrowed leg joints of the body like erosion may cause deformity in later stage of the disease.

# Limitations of Existing System

- Detection of RA in early stage repeatedly requires X-rays.
- No automatic tool for detecting and suggesting the treatment for RA.
- The treatment available only slow down progression of RA .

# The below data shows the different diagnosis and accurate result of a RA patient.

| Type of Input image | Algorithm | Accuracy |
|---|---|---|
| Hand X-Ray | Watershed | 50% |
| Hand X-Ray | JSW | 65% |
| Hand Knee X-Ray | Back propagation | 65% |
| Hand  Knee X-Ray | Perception | 71% |

# Base Paper

- Analysis of Rheumatoid Arthritis through Image Processing -2012
- Image and Segmentation of Hand in Evaluation of Rheumatoid Arthritis-2012
- Rheumatoid Arthritis Research -2013
- The validity of a Rheumatoid Arthritis medical records-based index of severity-2015

# Advantage

- Reduce joint inflammation
- Pain relief
- Fever
- Less side effects

# Disadvantage

- Time consuming
- Inaccurate
- Late diagnosis
- Manual Detection

# PROPOSED SYSTEM

- Recent improvements in hardware and software available for digital image processing have led to the quantitative assessment of radiological abnormalities in radiology.
- In this work we present
  - Image Acquisition
  - Enhancement
  - Restoration
  - Compression
  - Segmentation
  - Representation
  - Recognition

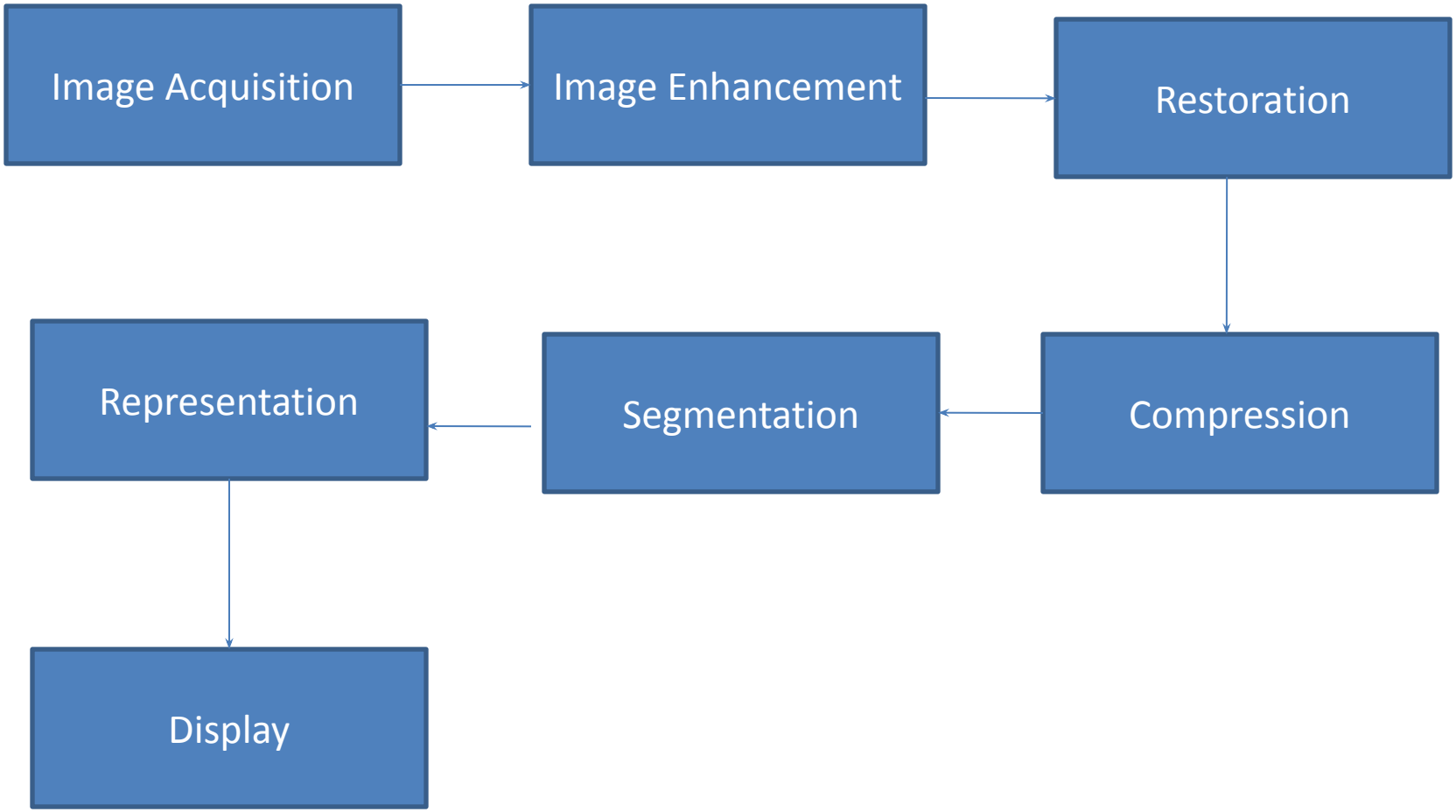
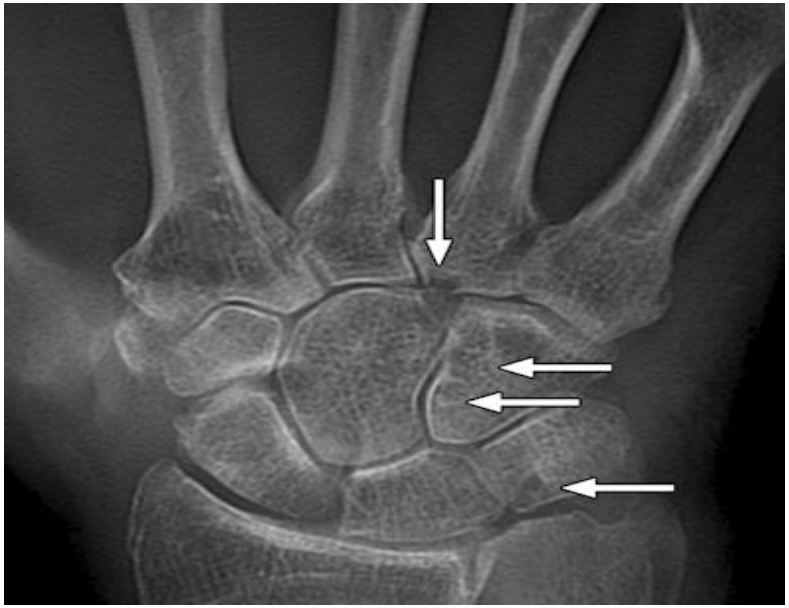


Image Acquisition
Image Enhancement
Restoration
Compression
Segmentation
Representation
Display

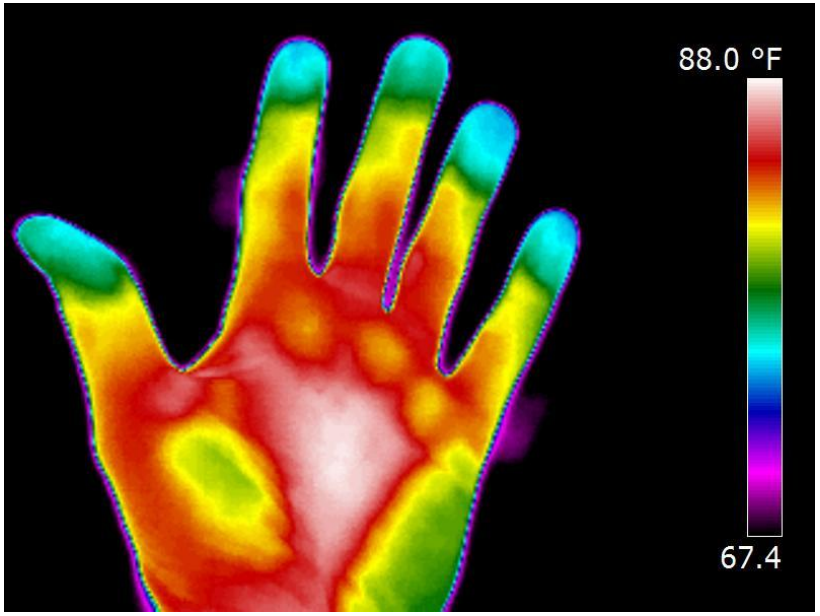
- The proposed model is a fully automatic, quantitative assessment tool for RA diagnosis.
- Will increase accuracy, reproducibility and speed of image interpretation.
- This model integrates the status of multiple joints, thereby reducing time as well as inter and intra-reader variations.
- The key points is the exact joint location is traced by local linear mapping  algorithm.
- The automated analysis helps to reduce need of skilled personnel.

# Comparison of Existing and Proposed System

| Features | Existing System | Proposed System |
|---|---|---|
| Accuracy | 70% | 90% |
| Diagnosis | Manual | Automatic |
| Efficiency | 70% | 90% |
| Noise | 90% | 10% |
| Speed (Study) | 3-4 Min | 15 m/s |
| Time | 25 Min | 10 Min |
| Application | X-Ray, MRI | Computerized Axial Tomography (CAT), Thermal Images |



CAT Scan




Thermal Scan

# HARDWARE REQUIREMENTS

- Processor - Intel
- Speed - 1.1 GHz
- RAM - 256 MB(min)
- Hard Disk - 20 GB
- Monitor - SVGA

# SOFTWARE REQUIREMENTS

- Tool - MATLAB R2012
- Operating system- Windows Xp, 7

# Reference


- A. pfei, D.renz G. lehmann, A.malich, g.Wolf, J.Bottcher, “The usefulness of computer aided joint space analysis in assessment of Rheumatoid Arthritis “, July 2013.
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- Andrzej Bieleckia,“ Hand radiographs preprocessing, image representation in the finger regions and joint spacewidth measurements for image interpretation”, 2008.
- Sasan Mahmoodi, Bayan Sharif, Graeme Chester, John Owen, Richard Lee “Skeletal Growth Estimation Using radiographic image processing and analysis”, Dec.2000.