

Dian Pratiwi, ST MTI

**Artificial Intelligence
Research Collection**

(Concept, Design and Applications)

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Application

Author:

Dian Pratiwi, ST MTI

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Demikian ucapan yang bisa saya sampaikan. Semoga buku ini dapat bermanfaat bagi pembaca.

Salam

(Penulis)

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A

An Application of Backpropagation Artificial Neural Network Method for Measuring The Severity of Osteoarthritis

(Dian Pratiwi, Diaz D. Santika, and Bens Pardamean)

Abstract:

The examination of Osteoarthritis disease through X-ray by rheumatology can be classified into four grade of severity. This paper discusses about the application of artificial neural network backpropagation method for measuring the severity of the disease, where the observed X-ray range from wrist to fingers. The main procedures of system in this paper is divided into three, which are image processing, feature extraction, and artificial neural network process. First, an X-ray image digital (200x150 pixels and greyscale) will be thresholded, then extracted features based on probabilistic values of the color intensity of seven bit quantization result, and statistical textures. That feature values then will be normalizing to interval [0.1, 0.9], and then the result would be processing on backpropagation artificial neural network system as input to determine the severity of disease from an X-ray had input before it. From testing with learning rate 0.3, momentum 0.4, hidden units five pieces and about 132 feature vectors, this system had had a level of accuracy of 100% for learning data, 80% for learning and non-learning data, and 66.6% for non-learning data

Index Terms—Backpropagation, Feature Extraction, Normalization, Osteoarthritis

INTRODUCTION

The disease known as osteoarthritis or calcification generally occurs in areas around joints such as cartilage and joints of the fingers, knees, and spine that causes symptoms of fatigue, inflammation, pain and swell.

ng that accompanied reddish color. These symptoms are used as an initial analysis by rheumatologist. However, in ensuring conditions of osteoarthritis not simply on the basis of the symptoms that arise. Because of many cases showed that advanced stage osteoarthritis are not or only slightly showing symptoms, and vice versa. Therefore, further tests such as X-rays, Magnetic Resonance Imaging (MRI), or Computed Tomography Imaging (CT Scan) is recommended to do in order to give more accurate results. In this paper, we discuss a classification technique based on Artificial Neural Network (ANN) is applied by the author in order to help predict or measure the severity of the osteoarthritis disease through X-ray image from the fourth grade. The fourth grade have a different description of the osteoarthritis condition and only can be diagnosed by rheumatologist, radiologist, or orthopedist through a series of medical examinations. Some images are used by orthopedist or rheumatologist in determining the severity of osteoarthritis disease from X-ray

photograph is to see whether or not cysts, swelling, formation of new bone that is not flat and spiky (osteophyte), subchondral sclerosis, and reducing cartilage mass [1]. The description of these condition then made it as a reference in assisting rheumatologist ensure osteoarthritis disease from the X-ray image set. Every characteristic and feature of osteoarthritis that appear on X-ray image will be processed and extracted based on the brightness (intensity) and texture, which then will be processed to generate

predictions in software-based artificial neural network backpropagation method.

1. Goal

The goal in this paper, ie:

- a) Obtaining a correct prediction results in a measure the severity of osteoarthritis disease of each X-ray image
- b) Generate one way to classify the level of osteoarthritis disease is by applying the method of backpropagation artificial neural network.

2. Benefits

The benefits in this paper are:

- a) Helps rheumatologist in ensuring the severity of osteoarthritis from patient's condition, so that treatment can be given with no undertreatment or overtreatment
- b) Can be used as a basis of preliminary design or develop a system of measuring the severity of other diseases, which can be applied in subsequent studies.

SAMPLE AND PROCEDURE

A. Sampel Data

The data used in this study is a set of X-ray images derived from patients with osteoarthritis with a variety of conditions. This condition can be divided into four grades of severity with a different picture, namely [1] :

a. Grade 1 (Doubtful) :

- Distal interphalangeal joints : Normal joint except for one minimal osteophyte.
- Proximal interphalangeal joints : Minimal osteophytosis at one point and possible cyst
- First carpometacarpal joint : Minimal osteophytosis and possible cyst formation

b. Grade 2 (Minimal) :

- Distal interphalangeal joints : Definite osteophytes at two points with minimal subchondral sclerosis and doubtful subchondral cysts, but good joint space and no deformity.
- Proximal interphalangeal joints : Definite osteophytes at two points and possible narrowing of joint space at one point.
- First carpometacarpal joint : Definite osteophytes and possible cysts.

c. Grade 3 (Moderate) :

- Distal interphalangeal joints : Moderate osteophytes, some deformity of bone ends and narrowing of joint space.
- Proximal interphalangeal joints : Moderate osteophytes at many points, deformity of bone ends.
- First carpometacarpal joint : Moderate osteophytes, narrowing of joint space, and subchondral sclerosis and deformity of bone ends

d. Grade 4 (Severe) :

- Distal interphalangeal joints : Large osteophytes and deformity of bone ends with loss of joint space, sclerosis, and cysts.
- Proximal interphalangeal joints : Large osteophytes, marked narrowing of joint space, subchondral sclerosis, and slight deformity.
- First carpometacarpal joint : Large osteophytes, severe sclerosis, and narrowing of joint space.



Fig. 1. X-ray image of hands. (a) X-ray image of nonosteoarthritis; (b) X-ray image of osteoarthritis [2]

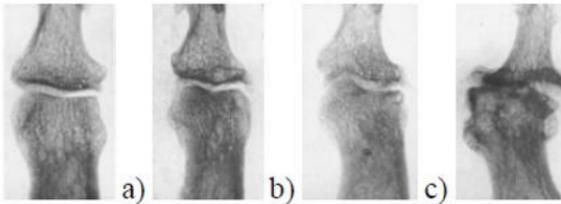


Fig. 2 [1]. X-ray image of Osteoarthritis in the various grades of The Distal Interphalangeal joints; (a) Grade 1, (b) Grade2, (c) Grade 3, (d) Grade 4

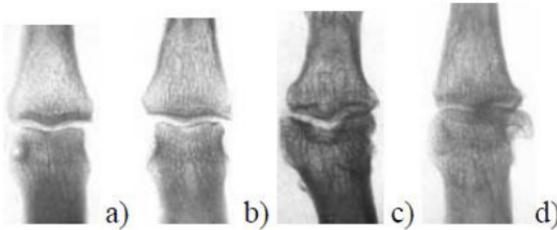


Fig. 3 [1]. X-ray image of Osteoarthritis in the various grades of The Proximal Interphalangeal joints ; (a) Grade 1, (b) Grade 2, (c) Grade 3, (d) Grade 4

