Chapter 25
Identification of Avascular Necrosis or Osteoporosis Using Deep Belief Convolutional Neural Networks

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ABSTRACT

Musculoskeletal impairment can be caused by Avascular Necrosis(AN). Younger people are more likely to develop it, thus early intervention and fast diagnosis are essential. The femoral bones are typically affected by this condition, which results in fractures that change the geometry of the bones. It is difficult to retrieve the AN-affected bone pictures because of the many places where the fractures are located. In this work, a useful method for retrieving AN pictures using deep belief CNN feature representation is proposed. Preprocessing is first applied to the raw dataset. In this stage, the median filter (MF) is used to reduce image noise and downsize the image. Using a deep belief convolutional neural network, features are represented (DB-CNN). The representations of the image feature data have now been converted to binary codes. Then, using the modified-hamming distance, the similarity measurement is calculated. The images are then retrieved with a focus on the similarity values. The test results demonstrated that the proposed approach is superior to the other methods now in use.

INTRODUCTION

1.2 million Australians experienced osteoporosis or AVN in 2012 (Bengio et al., 2012). The majority of them have osteoporosis, which results in fractures that cost millions of dollars to treat. Deep-seated discomfort that is present at rest, throughout exercise, and at night is experienced by the majority of

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patients with AVN of the humeral head (Anthimopoulos et al., 2016; Giveki et al., 2015; Zhang et al., 2016). AVN denotes the femoral head's bone tissue dying from a lack of blood flow. With regular weight bearing, this condition leads to a) micro fractures in the bone, b) collapse of the subchondral bone, and c) collapse of the overlying articular cartilage surface. Younger persons are more susceptible to AVN, therefore early intervention and fast diagnosis are essential. Typically, this condition affects the femoral bones, causing fractures that change the form of the bones. Figure 1 depicts AVN.

AVN has the ability to quickly collapse the articular surface. Furthermore, this necessitates a hip replacement (Lazik et al., 2015; Tsai et al., 2013). AVN fractures with even minor minimum stress are associated with greater rates of morbidity and mortality. Figure 2 demonstrates that, despite the fact that there are more therapeutic alternatives available to control osteoporosis, under treatment is incredibly common. Only 20% of people obtain care or have a checkup for the disease.

CBIR is a frequently used IR approach in a variety of computer vision applications, such as the medical field for obtaining historical patient information, e-commerce for determining the required products, information retrieval for taking images from a large database, etc. (Subash Kumar & Nagarajan, 2018). Medical CBIR retrieves images from vast imaging archives and has been used to assist in the diagnosis of numerous comparable cases (Banerjee et al., 2018). It is possible to diagnose related lesions from photos by using a medical image. This denotes a useful aid for doctors who encounter difficult-to-diagnose conditions that could result in incorrect diagnoses (Mera et al., 2015). ConvNets have also been increasingly used because of their usefulness in a variety of fields, including image retrieval. Deep Belief CNN Feature Representation is a useful technology proposed in this chapter for retrieving AVN images (DBCNN).

Retrieving AVN Images From DBCNN

Numerous investigations have suggested brand-new IR approaches. The study in (Ashraf et al., 2018) created an automated IR mechanism and proposed a brand-new content-focused picture capturing method that relied on color characteristics. Histogram, color, and DCT analyses were used since they were reliable and required minimal processing power. The performance was compared in terms of recall, precision, retrieval speed, and feature extortion. The comparison results showed that, compared to other CBIR typical schemes, the proposed plan outperformed them all in terms of average recall and precision values. In (Jin & Shan-W, 2017), a lower-level shape-feature-focused IR system was suggested.

In this method, the salient zone was determined by looking at the image's low-level characters, and the shape attributes of that area were used to determine how similar the salient zone was to other noteworthy zones. The shape features were determined by the major axis for the proposed shape features extortion framework, and the value of each feature was denoted by several scalars. For searching and obtaining photos from a huge database, CBIR makes use of image content features.

AVN picture retrieval becomes challenging due to variations in appearance. The input images in the dataset are first preprocessed by the suggested DBCNN. In the preprocessing stage, the image is scaled and image noise is removed using the Median Filter. When extracting features from images, Deep Belief ConvNets are utilized to convert the image feature representations to binary codes. Then, using Modified Hamming Distance, the similarity assessment is assessed (MHD). The photos are then retrieved with a focus on the similarity values. In Figure 3, the DBCNN architecture is shown.

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