Osteoarthritis classification of radiographic images using the Xception model

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***Abstract***

In this paper, we present a method to improve the classification accuracy of osteoarthritis after deformation in radiographic images using the existing Xception model. The proposed model modifies the exit flow of the existing Xception model to generate a larger amount of parameters, then stacks more and filters the exit flow for effective feature extraction. This suggests that the accuracy can be further improved through the improvement of the convolutional neural network model for the degenerative arthritis classification problem. We then compare the accuracy between the layer-by-layer deep network and the lightweight model, suggesting that the Xception model is effective for that domain.

**Keywords:** Knee osteoarthritis, Deep Learning, Model Lightweight, Convolutional Neural Network

1. Introduction

The human body is made up of numerous joints that allow us to move voluntarily. Articular cartilage, the most important tissue that maintains the normal functioning of joints, is located between these joints to prevent direct bone collisions [1].

It is urgent to secure scientific and logical basis for the diagnosis and treatment of osteoarthritis [2], so in this paper, a lightweight model was used to shorten the reasoning time and reduce the learning and learning cost in a limited environment. We found a model suitable for the domain through experiments, and we propose a model with improved classification accuracy of osteoarthritis using Xception.

2. Related work

As a result of the study applied to the deep model, there was no noticeable improvement in accuracy, and the accuracy of the parameter-related study exceeded about 70% and there was no performance improvement, so the method of applying data augmentation and optimization is as follows. There have been studies that improve accuracy by reducing training costs through model networks [3, 4].

In this paper, we tried to find an effective lightweight model to reduce parameters and learning time.

3. Suggested method

The Xception model using the depth-wise separable convolution technique showed the highest performance in spatial feature extraction for the gradual reduction of joint spacing and the thickening of the shadow of the bone under the cartilage. As a result of the analysis, it was determined that accurate prediction was impossible because information loss occurred in the process of abrupt reduction of features. As a method of extracting high-density features, we built a deep convolutional network to control the number of parameters that are reduced at the end of training. The feature map has been gradually reduced through filters.

4. Experiment

To evaluate the performance of the proposed Xception model, we entered DPhi's "Data Sprint #35: Osteoarthritis Knee X-ray" contest [6] and used the criteria provided in the contest for predictive accuracy of the test dataset. We also used the knee osteoarthritis dataset [5] provided by Kaggle's "Knee Osteoarthritis Dataset with KL Grading – 2018" as validation data.

5. Conclusions

This paper proposes to alter the outlet flow of the Xception model to classify osteoarthritis. Although the proposed model uses about 2.5 times more parameters than other comparative models, the accuracy is about 79.62%, which is superior to other models. I think that this has been achieved, and it is expected that in future studies, it will be possible to analyze the improved model through mathematical calculations and further improve the network. will analyze

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