Classification of degenerative arthritis using Xception model in radiographic images

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***Abstract***

This paper presents a method for improving the accuracy of degenerative arthritis classification in radiographic images using the existing Xception model after deformation. The proposed model modifies the exit flow of the existing Xception model to generate a larger amount of parameters and then applies the filter of the exit flow by stacking more for effective feature extraction. This presents the possibility of further increasing accuracy through improvements in convolutional neural network models for problems with degenerative arthritis classification. We then present that the Xception model is effective for that domain through the accuracy comparison between deep networks and lightweight models by Layer.

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

1. Introduction

The human body is composed of numerous joints that allow us to move willingly. Articular cartilage, which is the most vital tissue for maintaining normal joint function, sits between these joints to prevent the bones from directly colliding [1].

It is also urgent to secure scientific and logical evidence for the diagnosis and treatment of degenerative arthritis [2], so this paper requires less reasoning time and used a lightweight model to reduce learning and learning costs in a limited environment. We found a model suitable for the domain through experimentation, and propose a model using Xception that shows improved accuracy in classifying degenerative arthritis.

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 parameter-related studies exceeded about 70%, so there was no performance improvement, so the method of applying data augmentation and optimization of the model network There have been studies to improve accuracy by reducing learning costs through [3, 4]

In this paper, we tried to find an effective lightweight model to reduce parameters and learning time, and Xception showed the highest accuracy among lightweight models, so we conducted a study based on that model.

3. Suggested method

The Xception model using the depth-wise separable convolution technique showed the highest performance in extracting spatial features for the gradual reduction of joint spacing and the hardening phenomenon where the shadows of the bones under the cartilage thicken. As a result of the analysis, it was thought that information loss occurred in the course of a sudden decrease in features and that it was not possible to make a correct prediction. As a method to extract higher-density features, a convolution network is deeply built to control the number of parameters that are reduced in the process of ending learning. The feature map was gradually reduced through the filter.

4. Experiment

For the proposed Xception model performance evaluation, we participated in the DPhi's "Data Sprint #35: Osteoarthritis Knee X-ray" competition [6] and used the criteria provided in the competition for the prediction accuracy of the test dataset. Additionally, the knee arthritis dataset [5] provided by Kaggle's "Knee Osteoarthritis Dataset with KL Grading – 2018" was used as verification data.

5. Conclusions

This paper proposes to change the exit flow of the Xception model to classify osteoarthritis grades. Although the proposed model uses about 2.5 times as many parameters as other comparative models, the accuracy is about 79.62%, which shows higher performance than other models. I think that this has been accomplished, and future research seems to enable analysis through mathematical calculations of the improved model and further network improvement. will analyze it.

6. Acknowledgement

This study was conducted as a result of the Gyeonggi-do Regional Cooperation Research Center (GRRC) project supported by Gyeonggi-do

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