

Response to Reviewer 2 Comments

Dear Reviewer,

Many thanks for your valuable and significant comments, which have greatly helped to improve this manuscript. We had carefully addressed and replied to the comments and suggestions in the revised manuscript. According to the comments, the modifications had been made and marked up using the "Track Changes" function of MS Word in the revised manuscript. Moreover, the revised manuscript had been edited by the English Editing of MDPI Author Services. The English editing certificate is attached to the last page of this file. The replies to the comments are addressed and listed as follows:

Point 1: Introduction:

- (1) Avoid common language like "etc."
- (2) "Backache has a great relationship with the degeneration of the spine." - This is unscientific.
- (3) Line 28-35 need to be rewritten completely. Also, the final sentences lack references.
- (4) line 54-66: Where does this lead the reader? Shorten or exclude.
- (5) line 67-86: Shorten substantially.
- (6) line 86-105: Shorten as well.
- (7) "We found that the segmentation results are not good and the segmentation errors often occur." This sentence cannot be serious.

Response 1:

- (1) The "etc." had been removed in the revised manuscript.
- (2) The sentence "Backache has a great relationship with the degeneration of the spine." had been removed and replaced by "Degeneration of intervertebral discs is one of the causes of back pain. Intervertebral disc degeneration, which often causes back pain, is a natural aging process characterized by changes in the appearance and chemical structure of intervertebral discs [2]".
- (3) The first paragraph (Line 28-35) had been rewritten completely. The reference had been added to the last sentence.
- (4) The third paragraph (Line 54-66) had been shortened and merged into the revised second paragraph (Line 44-50). These sentences emphasize the importance of an automatic segmentation and recognition method for specific intervertebral discs.
- (5) These two paragraphs (Line 67-86) had been shortened and rewritten into the revised fourth paragraph (Line 61-72).
- (6) The seventh paragraph (Line 87-105) had been shortened and rewritten into the revised fifth paragraph (Line 73-85).
- (7) The sentence "We found that the segmentation results are not good and the segmentation errors often occur." had been rewritten into "We found that the segmentation results were not good and the average IoU values were all lower than 72.3%." (Line 88-89).

Please refer to the Introduction of the revised manuscript (Line 27-95).

Point 2: Materials and Methods:

- (1) Did you at first calculate the needed number of samples for a sufficient effect size? How were statistics made?
- (2) The technical description is far too detailed for the readership of JCM and a lot of it should go into supplementary material.

Response 2:

- (1) Yes, we had explained the calculation of the required number of samples in the Section of Materials and Methods. Please refer to **Lines 97-102** in the revised manuscript.
- (2) Some technical descriptions had been moved to the supplementary materials. Please refer to the **Methods** of the revised manuscript and the **supplementary materials**.

Lines 97-102: According to the estimation of sample size for confidence interval estimates [19], if a 95% confidence interval, a standard deviation of 0.01, and a margin of error of 0.04% are used, the most conservative sample size would be about 2400. A total of 2982 de-identified spine lateral images obtained from August 2016 to July 2020 at Asia University Hospital, Taichung, Taiwan, were collected. This number exceeds the most conservative sample size required.

Point 3: Results:

- (1) Please summarize the results section into brief descriptions of your achievements. A lot of the figures can be summarized into larger ones. This way, the redundancy can be reduced.
- (2) Fig. 6-8: If you are proposing a figure with Excel, at least get rid of the major grid, adapt the font and size, the color and create a new legend.

Response 3:

- (1) The Results section had been summarized into brief descriptions in the last paragraph of the revised Results section (**Lines 252-258**). **Figure 7** had been summarized into a larger one.
- (2) **Figures 6-8** had been modified in the revised manuscript.

Lines 252-258: To sum up, the proposed method effectively achieved segmentation of specific intervertebral discs at L1/L2, L4/L5, and L5/S1. Its accuracy and average IoU values are better than U-Net, CNN-based, Attention U-Net, and the MultiResUNet models. During the training process, the loss in all five models was easy to drop and converge. In the validation process, the IoU of the proposed method approached 80% and was better than the other four models. In terms of time costs, the proposed method can adopt parallel processing, and ranks second among the five models.

Figure 6:

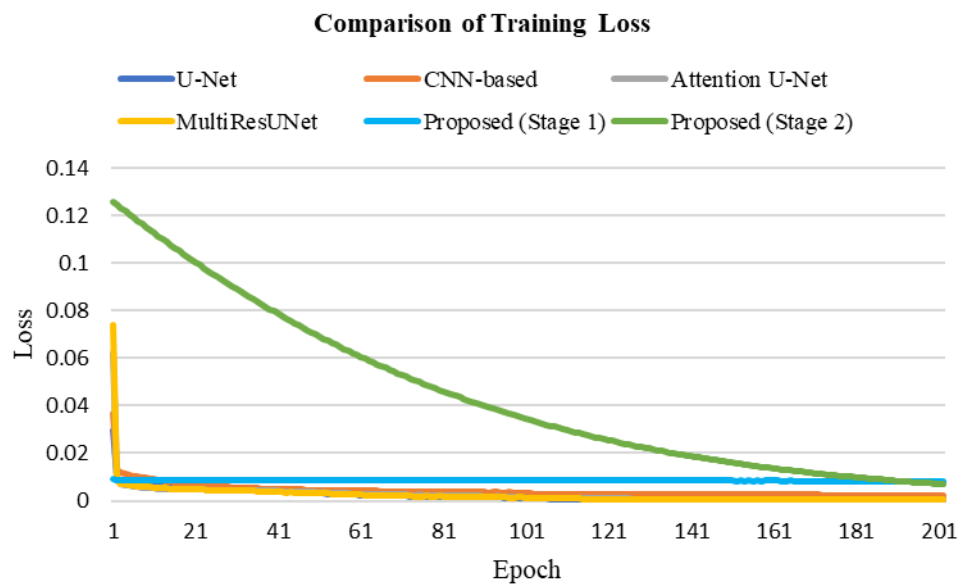


Figure 7:

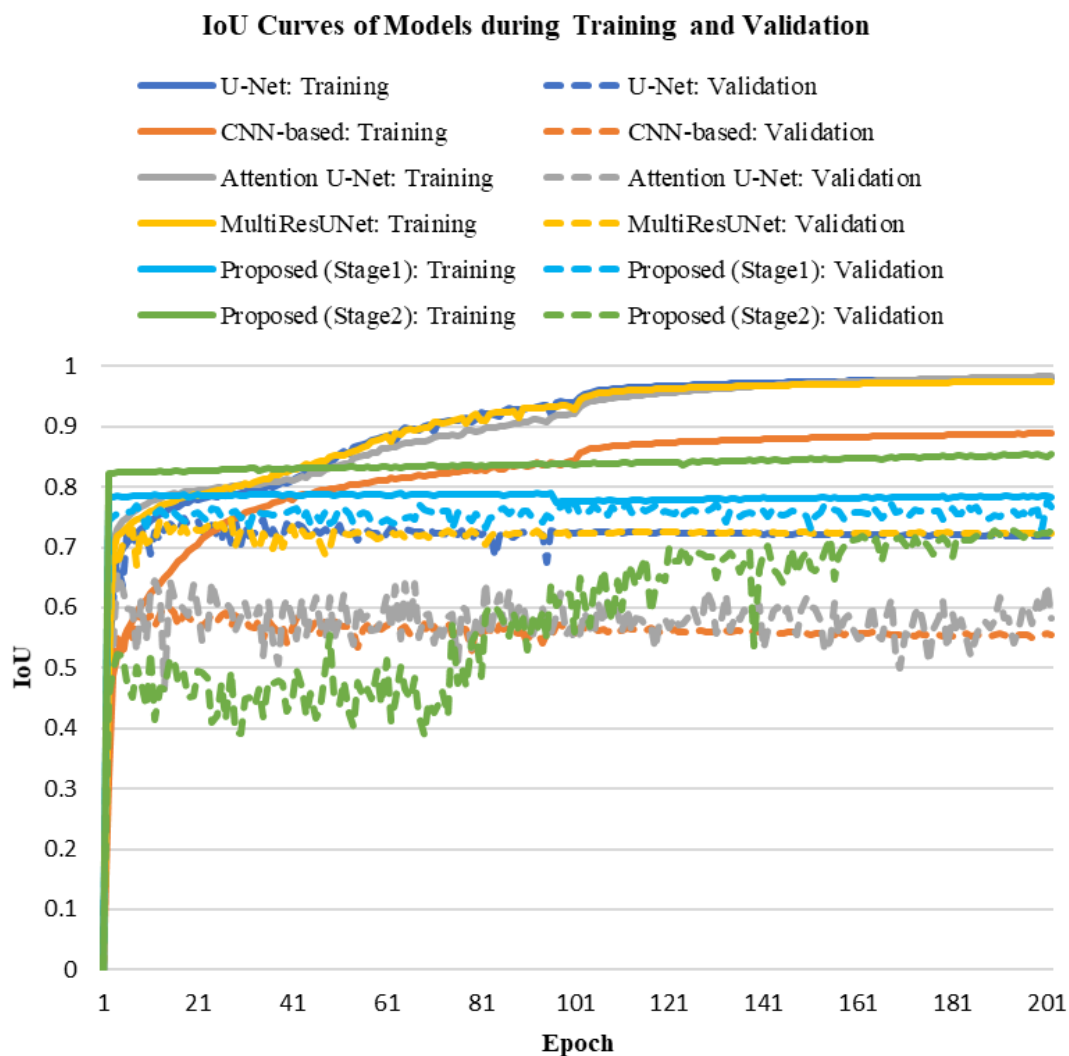
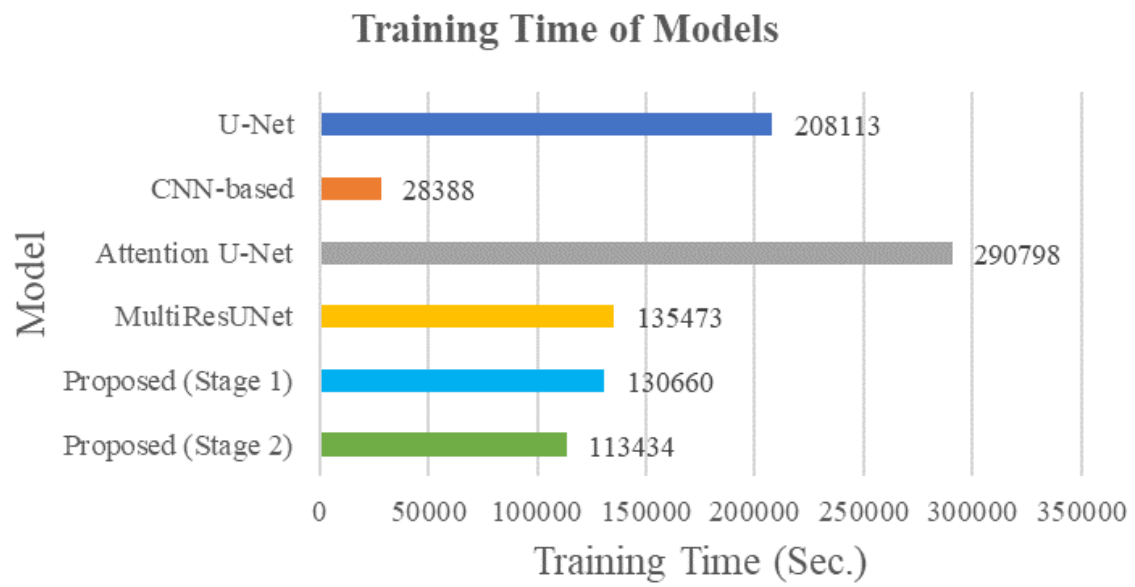


Figure 8:



The English Editing Certificate



We certify that the following article

**Automatic segmentation of specific intervertebral discs through a two-stage
MultiResUNet model**

Yu-Kai Cheng, Chih-Lung Lin, Yi-Chi Huang, Jui-Chi Chen, Tzu-Peng Lan, Zhen-You Lian, Cheng-Hung Chuang

has undergone English language editing by MDPI. The text has been checked for correct use of grammar and common technical terms, and edited to a level suitable for reporting research in a scholarly journal.

MDPI uses experienced, native English speaking editors. Full details of the editing service can be found at

► <https://www.mdpi.com/authors/english>.



Basel, Switzerland
October 2021

