A Simple but Strong Baseline for Head and Neck OARs Segmentation

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Abstract

In this technical report, we address the task of semantic segmentation for head and neck Organs-at-Risk (OARs). We employed the nnUNet framework and conducted experiments on the SegRap2023 challenge dataset. Through exploration of various parameter settings, we found that the NoMirroring data augmentation strategy and larger patch size achieved significant improvements in segmentation performance at OARs. Our findings provide a simple yet effective baseline approach for head and neck OARs segmentation.

Introduction

Radiotherapy is one of the most important cancer treatments for killing cancer cells with external beam radiation. Treatment planning is vital for radiotherapy, which sets up the radiation dose distribution for tumors and ordinary organs. The goal of planning is to ensure the cancer cells receive enough radiation and to prevent normal cells in organs-at-risk (OARs) from being damaged too much. For instance, optical nerves and chiasma in the head cannot receive too much radiation. Otherwise, the patient risks losing his/her vision. Gross Target Volume (GTV) is the position and extent of gross tumor imaged by CT scans, i.e., what can be seen. A critical step in radiation treatment planning is to delineate the boundaries of GTV and tens of OARs. However, manual delineation slice-by-slice in CT scans is tedious and time-consuming for radiation oncologists. Automatic delineation of GTV and OARs would substantially reduce the treatment planning time and therefore improve the efficiency of radiotherapy.SegRap2023, a dataset of CT scans of patients with nasopharyngeal carcinoma (NPC), where the segmentation targets will include OARs.The dataset will consist of CT scans from 200 patients (120, 20, and 60 patients for training, validation and testing, respectively), each with two CT scans (a no-contrast CT and a contrast-enhanced CT) with pixel-level annotations of GTVnx, GTVnd, and 45 OARs. This study will contribute to the ongoing exploration of Head and Neck in medical image segmentation. We hope that our findings will provide valuable insights into the potential of these techniques, particularly in the context of head and neck OARs segmentation.

EXPERIMENTS RESULTS

Table 1. Results of different nnUNet settings on our defined validation dataset

Network architecture	Spacing	Patch size	Mirror	Fold-0 DSC	Online Score
nnUNet (default)	3.0, 0.54, 0.54	28, 256, 224	Yes	0.7001	-
nnUNet	3.0, 0.54, 0.54	28, 256, 224	No	0.8323	0.8961
nnUNet	3.0, 0.54, 0.54	48, 256, 256	No	-	0.8996

In this section, we present the quantitative results of our experiments with different setting of the nnUNet model. We will follow the settings of nnUNet and divide the dataset (120 CT-pairs) into 5 folds, with fold-0 (24 CT-pairs) used for validation.The results are summarized in the Table.\ref{tab:res_arch}. We observed that increasing the patch size slightly affects the segmentation performance of critical organs in the head and neck region. However, the NoMirror operation is crucial for accurate segmentation in this area and greatly influences the model's performance.
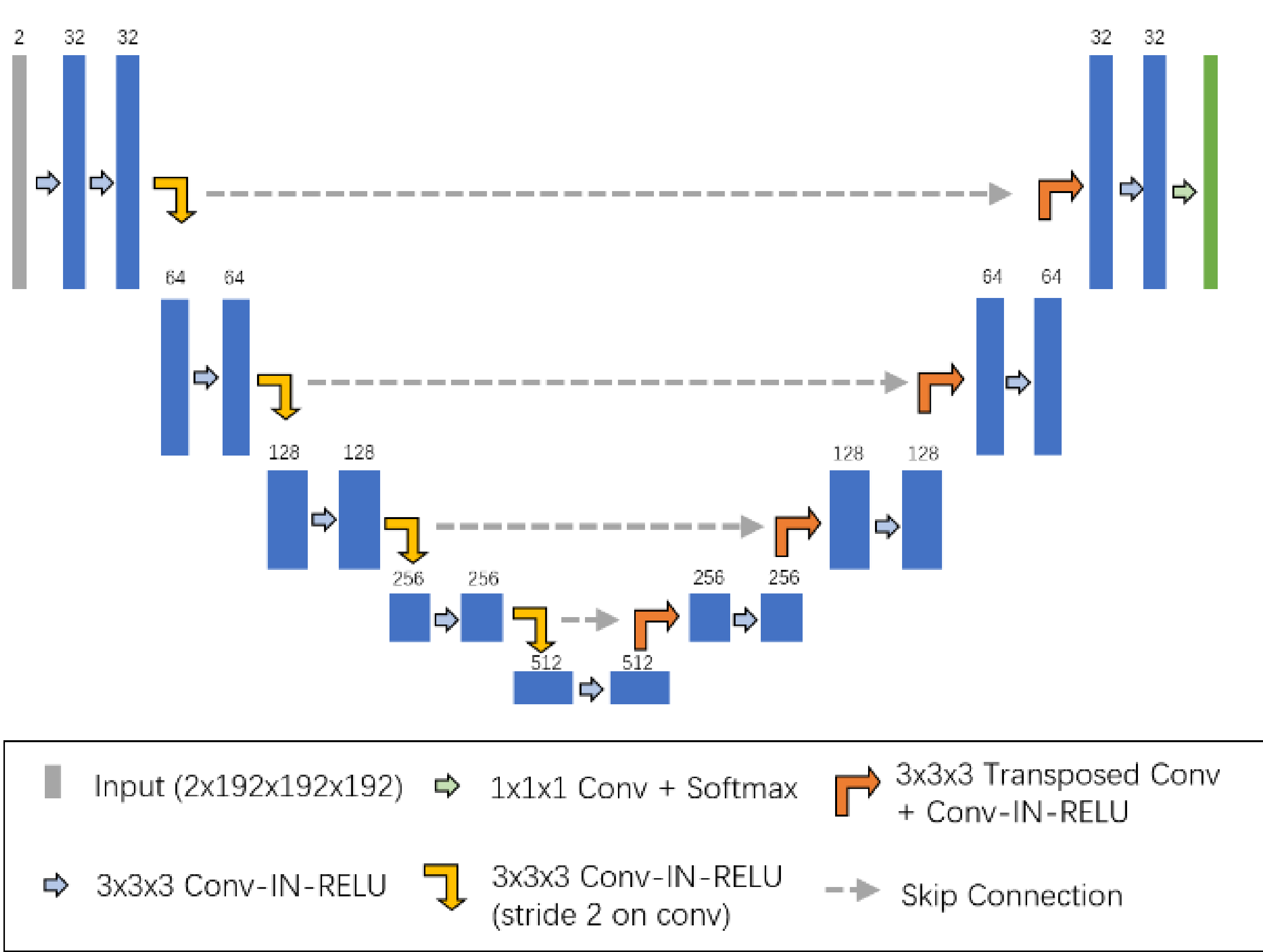
METHODOLOGY

Illustration of the nnUNet we used. The number of feature channels is denoted on the top of the box. The arrows denote different operations.

CONCLUSION

The findings from this tech report illuminate the potential of nnUNet in the field of medical image segmentation, particularly in Head and Neck organs-at-risk segmentation. Regarding the segmentation of organs-at-risk in the head and neck region, we have verified the potential of nnUNet in this field. Additionally, the utilization of a larger patch size and the NoMirror setting can greatly enhances the segmentation performance. We hope that this finding can contribute to improving the segmentation of organs-at-risk in the head and neck region within the community.

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