

View Author Feedback

Paper ID

1662

Paper Title

Solving Ambiguous Boundary: Leveraging CORAL-Correlation Aligning Semi-Supervised Medical Image Segmentation

AUTHOR FEEDBACK QUESTIONS

1. [Rebuttal paper only] Your rebuttal is addressed to the Reviewers, Area Chairs, and Program Chairs. Reviewers will be able to see your rebuttals and have the option to change their ratings based on the rebuttal. If your paper is accepted, the rebuttal will be made public alongside the reviewer and meta-reviewer comments. The goal of the rebuttal is to inform the Reviewers and Area Chairs of major misunderstandings, in your opinion, in the reviewers' assessment, or of incorrect statements in the reviews. An effective rebuttal focuses only on major critiques. It is not helpful to try to address every minor point in the reviews. By prioritizing and focusing on the major concerns, and by grouping multiple reviewer comments that generally pertain to the same issue into a few major categories, you are demonstrating to the Reviewers and Area Chairs that you understand the high level messages that were provided in the reviews. Please summarize or rephrase the criticism before you address it, and clarify to which comment(s) you are responding. While the room for rebuttal is limited, if properly utilized by condensing the response down to the essentials, this is an effective way to let the Reviewers and Area Chairs know that you understood the reviewer's concerns and have valid answers to the questions raised in the reviews, or to establish that certain reviewer comments were false or unsubstantiated. An effective rebuttal addresses reviewers' criticisms by explaining where in the paper you had provided the requisite information, perhaps further clarifying it. Do not provide or promise new / additional experimental results, as the final decision is to be made based on the submitted manuscript. Note that the fundamental content of the paper, including experiments, data, analysis, etc. should not be changed. Do not promise to expand your paper to address all the questions raised by the reviewers, as you will not be able to change your article substantially, and in all likelihood you don't have sufficient room to add to the paper. These promises are likely not to be taken seriously. A good rebuttal is polite; being confrontational does not bring any added value to the paper. However, if you feel you have received a review that was not courteous, or made false or unsubstantiated arguments that you can succinctly refute, you should point this out. Remember that your rebuttal will be made public, so do not write anything you would not want to appear in print. Please note that including an external URL/website that contains additional information/explanation of your paper is prohibited. That is, your rebuttal should be self-sufficient and within the limit of 4000 characters. External

links will be removed. (See "Rebuttal Guide"

<https://conferences.miccai.org/2024/en/PAPER-SUBMISSION-AND-REBUTTAL-GUIDELINES.html#rebuttalguide>) Please enter your rebuttal below (4000 chars max)

We appreciate the thoroughness with which you have examined our work. We will address each comment and make the necessary revisions.

Clarification on Solving Ambiguous Boundaries

Previous methods use cosine similarity as the consistency training objective [17,16,2].

Cosine similarity primarily emphasizes pixel-level predictions, often overlooking the global shape of the image. It should be noted that the boundaries are usually not isolated pixels, but continuous curves. Second-order statistics more effectively captures global structures and continuous curves. The CORAL algorithm prioritizes ensuring consistency in the shape of the global feature distribution, a strategy that aids in preserving the overall shape and structure of the image while mitigating the risk of local overfitting. The effectiveness of second-order statistical methods has also been proved from theoretical and other application perspectives in related works [25,26,27].

Reviewer 1

Comprehensive Review of Existing Methods

The latest advancement, including suggested references such as [28, 29], is included.

Typos and Symbol Consistency

Thank you for pointing out the incorrect use of symbols regarding CORR. The CORRmp and CORRap are corrected throughout the manuscript. We also expand the description of L_c for better clarity.

Ablation Study on DFP Module

We appreciate your suggestion regarding the ablation of the DFP module. The DFP module is an essential component for filtering out the high-quality features. We will design extensive experiments to demonstrate its effectiveness.

Reviewer 3

Clearer Description

Thank you for suggesting us to give a clear introduction and pointing out the typos. The introduction is well improved and the typos are fixed.

Clarification on Formulation and Temperature Setting

The formulation is described in section 2.1, which is a BCE Loss. We released our source code and all the parameters could be found. The temperature in our experiment is set at 0.1. Compared to previous models ([2], [16], [17]), there is no significant increase in computation cost during training.

Reviewer 4

Why Select CORAL

We appreciate the request for more details on CORAL. Previous methods using cosine similarity [2, 16, 17] primarily emphasize pixel-level predictions, often overlooking the global shape of the image. It should be noted that the boundaries in medical images are typically continuous curves rather than isolated pixels. Second-order statistics, as leveraged by CORAL, more effectively capture these global structures and continuous features. The CORAL algorithm ensures consistency in the global feature distribution shape, preserving the overall image structure while reducing local overfitting risks. This approach is theoretically proved and validated in related works [25, 26, 27].

Differences from CAML

While our approach shares some similarities with CAML, there are two major differences:

1. CAML uses cosine similarity to measure correlations between samples. In contrast, CORAL aligns second-order statistics (covariance matrices), capturing feature relationships for more robust domain adaptation.
2. Our DFP module updates anchor point embeddings by averaging old and new features, smoothly adapting to sample variations and reducing overfitting.

[25]Sheng et al. (2021). Second-order ResU-Net for automatic MRI brain tumor segmentation.

[26]Sun et al. (2021). Second-order encoding networks for semantic segmentation.

[27]Arya et al. (2017). A novel combination of second-order statistical features and segmentation using multi-layer superpixels for salient object detection.

[28]Wen, Lu, et al. "DCL-Net: Dual Contrastive Learning Network for Semi-Supervised Multi-Organ Segmentation." ICASSP 2024.

[29]Zhang, Zhenxi, et al. "Self-aware and cross-sample prototypical learning for semi-supervised medical image segmentation." MICCAI2023.

3. I hereby, on behalf of all co-authors, give permission to make this response public
Agreement accepted
