Evaluating Fairness for Cardiac Magnetic Resonance Image Segmentation

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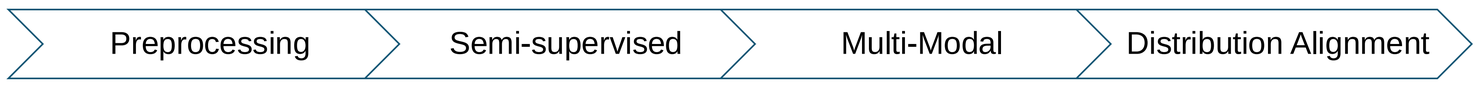
1 Motivation

- Fairness in semi-supervised cardiac magnetic resonance image segmentation has not been examined, which could potentially lead to systematic harm to patients.

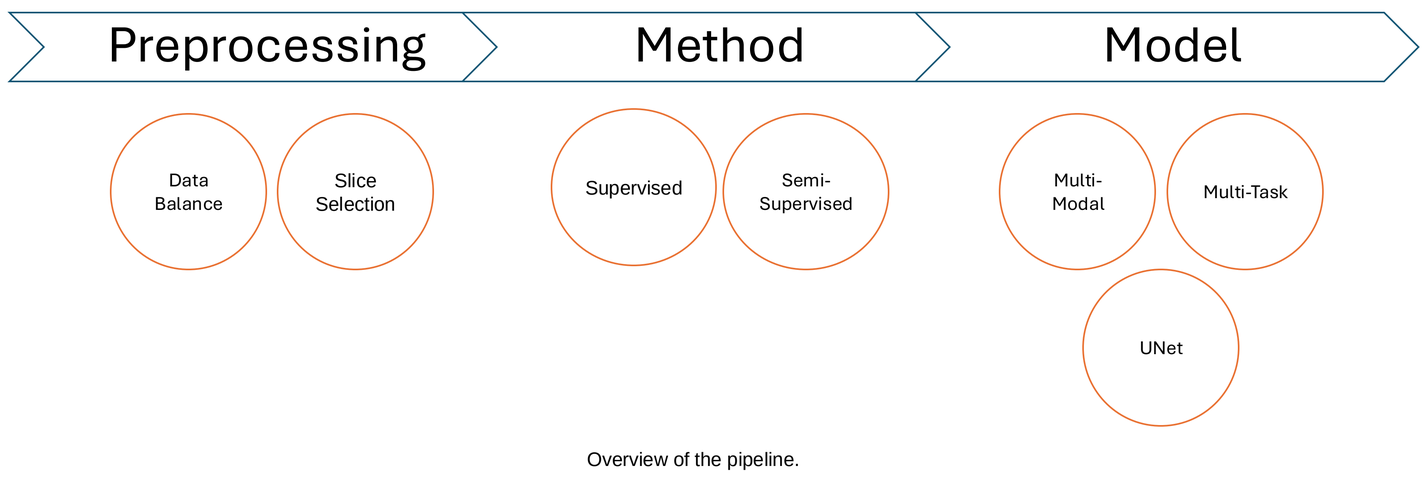
2 Objective

- Leverage semi-supervised learning, patient textual information and Distribution Alignment [3] to mitigate bias.



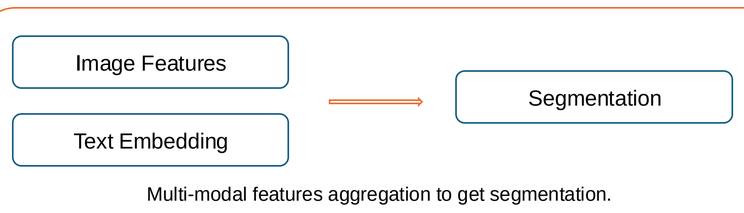
Overview of the pipeline.

3 Methodology

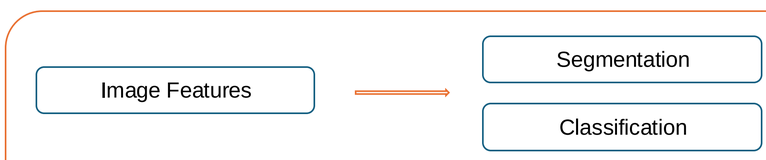


Overview of the pipeline.

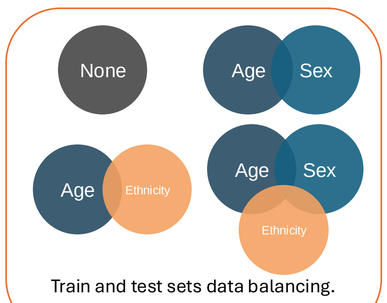
- We employ data balancing based on protected attributes to build different train and test sets.
- Our slice selection strategy includes using either all slices or only those with the lowest error scores.
- We use two training methods: fully-supervised and the semi-supervised pipeline from UniMatch [1].
- We tried three segmentation models: Unet [2], UNet Multi-Modal which uses image features and text embeddings from BERT [4], and UNet Multi-Task which learns both classification and segmentation.



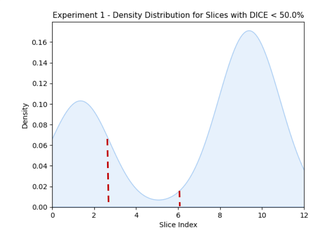
Multi-modal features aggregation to get segmentation.



Multi-Task model outputs segmentation and classification.



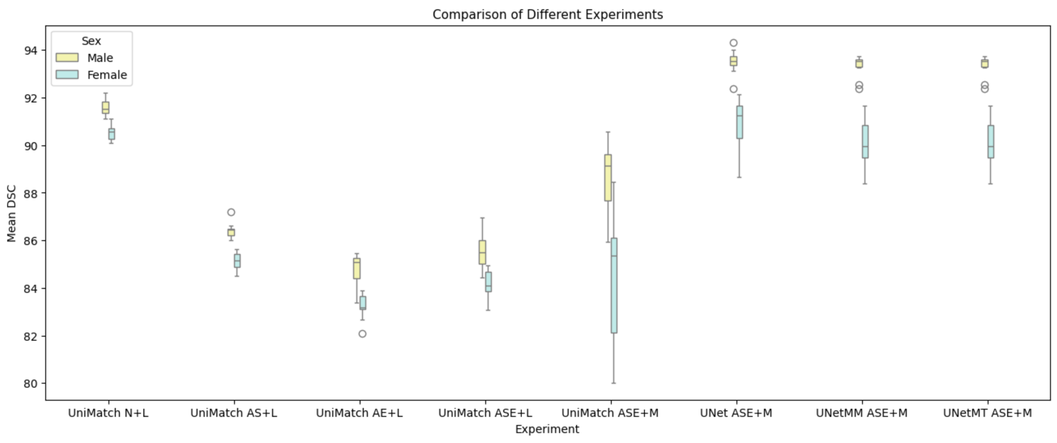
Train and test sets data balancing.



Slices choice with low error scores.

4 Results

- No technique could completely mitigate bias for all protected groups and intersectional groups.



Comparison of different experiments overall mean DSC.

- Lack of bias between groups does not preclude bias within intersectional groups.

- Incorporating ethnicity label into certain pipelines lowers overall performance and sometimes introduced disparities between more groups.

Effect of model choice on bias.

- We cannot definitively say that the cause of the bias is the encoding of sex or ethnicity features in the images.
- Using different test sets resulted in varied behavior when analyzing bias.

References

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