Supplementary Material

1 Point Cloud Diffusion for Generation

The forward diffusion process can be modeled as a Markov chain.

$$q(x_i^{(1:T)}|x_i^{(0)}) = \prod_{t=1}^{T} q(x_i^{(t)}|x_i^{(t-1)}) \tag{1}$$

The training process is helping the model to learn the flow from original shape distribution to a noise distribution, and learn the noise predictor θ of each step.The generation of point clouds can be treated as the reverse of the diffusion process.

$$p_\theta(x^{(0:T)}|z) = p(x^{(T)}) \prod_{t=1}^{T} p_\theta(x^{(t-1)}|x^{(t)}, z), \tag{2}$$

$$p_\theta(x^{(t-1)}|x^{(t)}, z) = \mathcal{N}(x^{(t-1)}|\mu_\theta(x^{(t)}, t, z), \beta_t I), \tag{3}$$

where μ_θ is the estimated mean implemented by a neural network parameterized by θ. z is the latent encoding the target shape of the point cloud. The starting distribution $p(\mathbf{x}^{(T)})$ is set to a standard normal distribution $\mathcal{N}(0, \mathbf{I})$.

2 Synthesis Quality Metrics

The MMD-score measures the fidelity of generated samples, calculates the mean of the minimum matching distances between generated samples and real samples, used to evaluate the quality of the generative model. We define the distance D between image I_1 and image I_2 as

$$D(I_1, I_2) = \frac{1 - \cos(\theta)}{2} \tag{4}$$

where $\cos(\theta)$ represents the cosine similarity between the two images. The COV-score denotes the proportion of real samples that match at least one image in the generated images, for generated set S_g and the reference real set S_r, the COV-score is

$$\mathrm{COV}(S_g, S_r) = \frac{|\{\arg\min_{I_2 \in S_r} D(I_1, I_2) | I_1 \in S_g\}|}{|S_r|} \tag{5}$$

3 More Experimental Results

Table 1. SAMed segmentation performance of Optic Cup and Rim **(Sensitive attribute = Race)**

	Method	Overall ES-Dice↑	Overall Dice↑	Overall ES-IoU↑	Overall IoU↑	Asian Dice↑	Black Dice↑	White Dice↑	Asian IoU↑	Black IoU↑	White IoU↑
Cup	SAMed	0.8600	0.8671	0.7729	0.7813	0.8568	**0.8730**	0.8670	0.7688	**0.7905**	0.7808
	SAMed+ADV	0.8640	**0.8698**	**0.7769**	**0.7840**	0.8590	0.8705	0.8708	0.7709	0.7882	0.7846
	SAMed+GroupDRO	**0.8634**	0.8695	0.7767	0.7838	0.8583	0.8704	0.8706	0.7711	0.7886	**0.7842**
	SAMed+FairSeg	0.8617	0.8671	0.7741	0.7808	0.8587	0.8708	**0.8672**	0.7708	0.7882	0.7804
	Ours	0.8619	0.8660	0.7737	0.7796	**0.8606**	0.8702	0.8657	**0.7744**	0.7892	0.7782
Rim	SAMed	0.8000	0.8291	0.6919	0.7217	0.7890	0.7758	0.8444	0.6743	0.6587	0.7399
	SAMed+ADV	0.7935	0.8235	0.6835	0.7138	0.7801	0.7691	0.8395	0.6635	0.6498	0.7325
	SAMed+GroupDRO	0.8011	0.8302	0.6930	0.7230	0.7952	0.7748	**0.8454**	0.6822	0.6568	0.7410
	SAMed+FairSeg	0.8036	0.8323	0.6963	0.7260	0.7952	0.7789	0.8473	0.6825	0.6620	**0.7439**
	Ours	**0.8041**	**0.8311**	**0.6966**	**0.7242**	**0.7968**	**0.7808**	0.8452	**0.6840**	**0.6646**	0.7409

Table 2. SAMed segmentation performance of Optic Cup and Rim **(Sensitive attribute = Gender)**

	Method	Overall ES-Dice↑	Overall Dice↑	Overall ES-IoU↑	Overall IoU↑	Male Dice↑	Female Dice↑	Male IoU↑	Female IoU↑
Cup	SAMed	0.8637	0.8671	0.7773	0.7813	0.8647	0.8703	0.7783	0.7855
	SAMed+ADV	0.8658	0.8667	0.7787	0.7803	0.8661	0.8675	0.7791	0.7820
	SAMed+GroupDRO	0.8670	0.8671	0.7803	0.7808	0.8672	0.8670	0.7804	0.7814
	SAMed+FairSeg	**0.8678**	**0.8702**	0.7807	0.7823	**0.8718**	**0.8756**	**0.7851**	0.7879
	Ours	0.8676	0.8698	**0.7809**	**0.7844**	0.8683	0.8718	0.7817	**0.7881**
Rim	SAMed	0.8251	0.8291	0.7175	0.7217	0.8319	0.8252	0.7252	0.7169
	SAMed+ADV	0.8263	0.8309	0.7188	0.7236	0.8342	0.8263	0.7276	0.7181
	SAMed+GroupDRO	0.8274	0.8320	0.7205	0.7253	0.8353	0.8274	0.7292	0.7198
	SAMed+FairSeg	**0.8289**	**0.8318**	**0.7227**	**0.7253**	**0.8338**	**0.8289**	**0.7274**	**0.7223**
	Ours	0.8221	0.8265	0.7132	0.7177	0.8297	0.8221	0.7214	0.7125

Table 3. SAMed segmentation performance of Optic Cup and Rim **(Sensitive attribute = Language)**

	Method	Overall ES-Dice↑	Overall Dice↑	Overall ES-IoU↑	Overall IoU↑	English Dice↑	Spanish Dice↑	Others Dice↑	English IoU↑	Spanish IoU↑	Others IoU↑
Cup	SAMed	0.8490	0.8671	0.7603	0.7813	0.8652	0.9077	0.8838	0.7791	0.8338	0.8001
	SAMed+ADV	0.8485	0.8686	0.7586	0.7830	0.8668	**0.9131**	0.8820	0.7808	**0.8432**	0.7982
	SAMed+GroupDRO	0.8530	**0.8702**	0.7640	**0.7847**	**0.8684**	0.9085	**0.8849**	**0.7825**	0.8360	**0.8019**
	SAMed+FairSeg	0.8527	0.8684	**0.7646**	0.7826	0.8670	0.9034	0.8794	0.7810	0.8268	0.7937
	Ours	**0.8518**	0.8676	0.7624	0.7810	0.8659	0.9029	0.8815	0.7789	0.8271	0.7968
Rim	SAMed	0.8070	0.8291	0.7006	0.7217	0.8305	**0.8534**	0.7989	0.7234	**0.7468**	0.6871
	SAMed+ADV	0.8087	0.8295	0.7019	0.7217	0.8307	0.8528	0.8015	0.7231	0.7463	0.6900
	SAMed+GroupDRO	**0.8136**	0.8311	**0.7075**	0.7239	0.8322	0.8493	**0.8065**	0.7253	0.7411	**0.6954**
	SAMed+FairSeg	0.8100	**0.8313**	0.7038	**0.7244**	**0.8328**	0.8511	0.7992	**0.7263**	0.7436	0.6865
	Ours	0.8036	0.8245	0.6944	0.7145	0.8258	0.8472	0.7955	0.7160	0.7377	0.6805

Table 4. SAMed segmentation performance of Optic Cup and Rim **(Sensitive attribute = Ethnicity)**

	Method	Overall ES-Dice↑	Overall Dice↑	Overall ES-IoU↑	Overall IoU↑	Hispanic Dice↑	Non-Hispanic Dice↑	Hispanic IoU↑	Non-Hispanic IoU↑
Cup	SAMed	0.8519	0.8671	0.7645	0.7813	0.8653	**0.8904**	0.7790	**0.8100**
	SAMed+ADV	0.8544	0.8678	0.7657	0.7814	0.8661	0.8883	0.7791	0.8080
	SAMed+GroupDRO	0.8594	**0.8698**	0.7718	0.7840	0.8682	0.8855	0.7819	0.8044
	SAMed+FairSeg	0.8611	0.8685	**0.7753**	**0.7845**	0.8704	0.8824	0.7904	0.8070
	Ours	**0.8625**	0.8664	0.7730	0.7793	**0.8714**	0.8650	**0.7889**	0.7775
Rim	SAMed	0.8221	0.8291	0.7164	0.7217	0.8277	0.8397	0.7203	0.7307
	SAMed+ADV	0.8260	0.8323	0.7206	**0.7257**	0.8308	**0.8416**	0.7241	**0.7342**
	SAMed+GroupDRO	0.8237	0.8299	0.7178	0.7224	0.8284	0.8390	0.7208	0.7298
	SAMed+FairSeg	**0.8296**	**0.8331**	**0.7215**	0.7242	**0.8349**	0.8408	**0.7278**	0.7329
	Ours	0.8186	0.8234	0.7112	0.7136	0.8306	0.8222	0.7171	0.7124