OCT Super-Resolution for Data Standardization using AI: A MACUSTAR report

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Purpose

- There is often **large variability in image quality and resolution** in optical coherence tomography scans (OCTs) from multicenter studies.
- This impairs intra- and inter-study **consistency** of biomarker quantification.
- Aim: Validate a super-resolution approach based on artificial intelligence (AI) to enhance OCTs **to high-quality standards** by increasing the density of the scan pattern.

Results

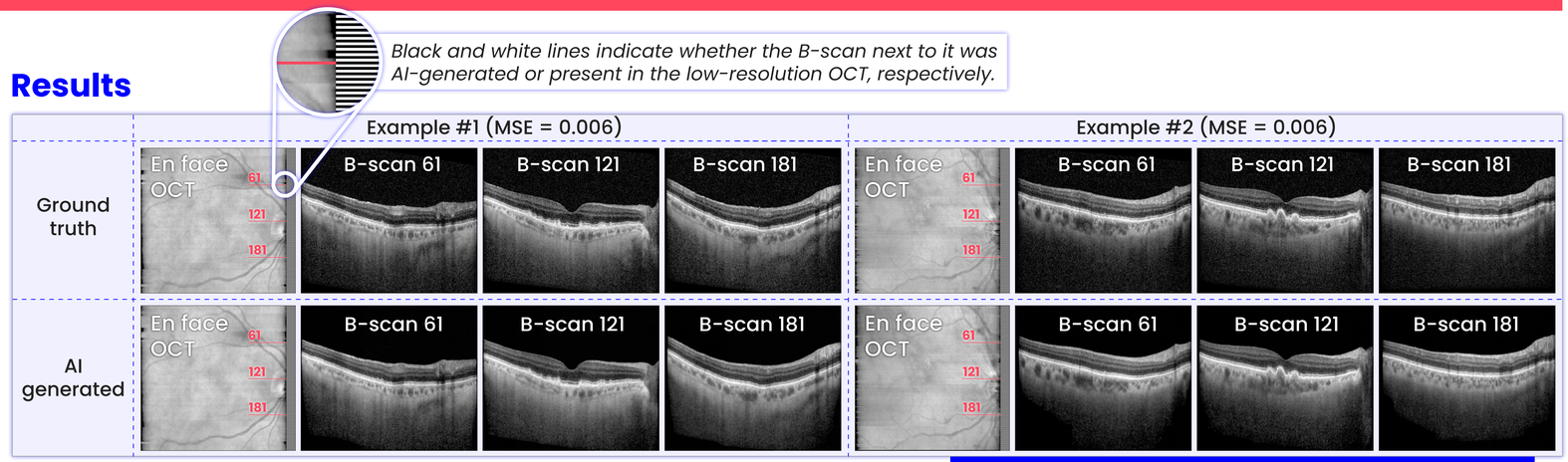
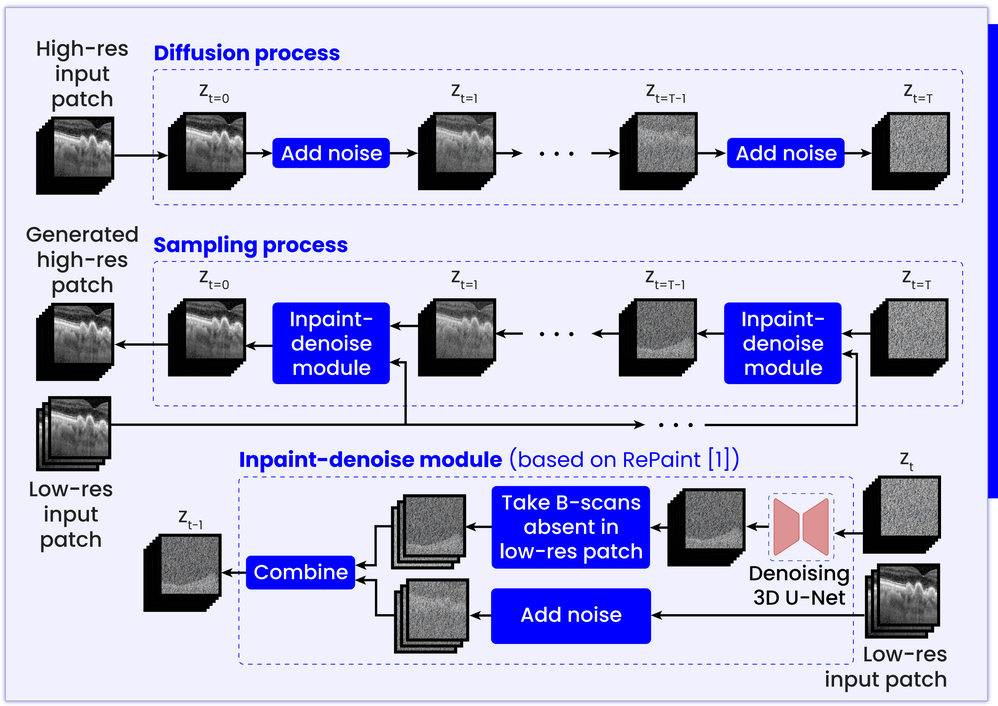


Fig. 1: Qualitative results.

	Validation set
MSE (mean squared error)	0.006 ± 0.004
SSIM (structural similarity index measure)	0.599 ± 0.100

Table II: Performance metrics, displayed as mean ± std. dev.

Methods



- Train patch size: 128×128×16 pixels.
- Sampling patch size: 496×496×16 pixels.
- 50% patch overlap while sampling.
- Using RePaint [1] jumping schedule.
- We currently upsample from 120 to 241 B-scans.
- Dataset: The MACUSTAR cohort, a European multicenter study.
- 241 B-scans per OCT volume.

		Training	Validation
Patients	**Total**	181	26
	No AMD	37	3
	Early AMD	21	2
	Intermediate AMD	98	18
	Late AMD	24	3
	Unknown AMD stage	1	0
OCT volumes	**Total**	743	26

Table I: Dataset and split statistics.

Conclusions

- We showed the **feasibility** of the proposed approach to generate **super-resolution OCTs**.
- This is one of the required steps to standardize high-quality OCTs within multicenter studies.
- In extensions of this approach, **coherence** between the OCT and other modalities, such as **en face imaging and other metadata**, could be introduced, allowing the AI model to make better informed generative decisions.

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References
[1] Lugmayr, A., Danelljan, M., Romero, A., Yu, F., Timofte, R., & Van Gool, L. (2022). Repaint: Inpainting using denoising diffusion probabilistic models. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition* (pp. 11461-11471).

Commercial Relationships Disclosure
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